

Report 4:

Exploring the Relationship Between Community Resilience & Irrigated Agriculture in the MDB: Social and Economic Impacts of Reduced Irrigation Water



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This report has been prepared for



Cotton Catchment Communities **CRC**

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Executive Summary

Overview of Research Questions and Methodology

This report builds on and applies the first three stages of the study, *Exploring the Relationship Between Community Resilience & Irrigated Agriculture in the MDB*,¹ to address the following research questions:

- What are likely to be the social and economic impacts of changes in agricultural production due to permanent reductions in irrigation water for different types of communities at different geographic scales?
- What factors are likely to mitigate or exacerbate impacts arising from a permanent reduction in irrigation water?
- How might communities be assisted to respond to such changes?

In order to answer these questions, we have examined these impacts at different scales, including the national; Basin; local or regional; and enterprise level through quantitative and qualitative methods. These include:

- Modelling of impacts of permanent reductions in irrigation water on employment, population and socio-economic indicators of community resilience and wellbeing, applying the findings of earlier stages of the study;
- Extensive consultation and two field visits to the eight selected case study LGAs of Bourke NSW, Balonne Qld and Moree Plains NSW, and the aggregate SLA of Dalby-Wambo in the Northern Basin; and the LGAs of Murray Bridge SA, Mildura Vic, Griffith NSW and Campaspe Vic in the Southern Basin;
- A cost benefit analysis to understand the likely magnitude of the major costs and benefits of increased environmental flows with a commensurate reduction in the use of water for irrigated agriculture.

Findings

Cost, Benefits and Mitigating Factors

In the **calculation of costs**, the major cost of reduced water for irrigation is likely to be the loss of productivity as measured directly by lost 'jobs'.² Cost estimates of job losses are likely to be somewhat high due to the use of national averages at the local level, and the assumption of no

¹ JSA (2010) Report 1: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Scoping Paper*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri; JSA (2010) Report 2: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Understanding Agricultural Employment*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri; and JSA (2010) Report 3: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Irrigated Agriculture and Socio-Economic Indicators*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri.

² Consistent with previous cost benefit analysis on social programs and policy interventions (see for example, Stubbs, J. & Storer, J. (1996) *Cost Benefit Analysis of the Neighbourhood Improvement Program*, NSW Department of Housing.

other use for stranded or decommissioned infrastructure. At the same time, this is likely to be more than offset by an underestimation of actual job losses, as a result of census undercounting, inability to identify all agricultural jobs or seasonal and casual jobs, the use of a conservative average agricultural multiplier, the drought effects in the modelled year of 2005-06, and potential cumulative and threshold effects from water reduction. Substitution has been accounted for through calculating employment from the likely next best use of agricultural land. For these reasons, the employment and related population and productivity losses should be regarded as lower-bound estimates. Many other costs identified in the case study communities have not been quantified, but noted in a qualitative sense, and are likely to be minor in comparison with lost employment.

The major **benefit** of increased environmental flows is likely to be maintenance of biodiversity and ecological integrity of key environmental assets, and this has been valued as the cost of associated lost agricultural output. This is effectively the price the community will pay to gain this benefit. Other benefits such as increased tourism have been considered and appear to be relatively minor. Benefits such as reduced channel salinity, for example, could be delivered more efficiently through managed solutions, and there is evidence that the *Basin Salinity Management Strategy* implemented since 2000 has been quite effective in this regard.

Opportunities for **Mitigation of costs** have also been considered through the case study communities, including more liberal water trade, gains in system and on-farm efficiencies, allowing for the likely next best land use, opportunities for economic diversification and community leadership. In each of these cases, we find that there are likely to be limited opportunity for mitigation.

- **Ability to trade water** allocations during the low allocation years of the drought has been a significant benefit to many businesses and some communities, though the community impacts to an extent depend on whether the area has been a net importer or exporter of water. Limited future mitigation from permanent trade in water is possible, but it is likely to be highly constrained through issues related to water security, connectivity, future supply and cost of irrigation water, and the practicalities of delivery and transmission, with particularly limited opportunities in the Northern Basin.
- The **next best use of agricultural land** always results in a loss of jobs due to significant differentials between irrigated agriculture and dryland uses, with the gap between existing and next best use determining the extent of the impact.
- Remaining **efficiency gains** are unlikely to offset projected loss of jobs, and such gains would require significant capital investment and are unlikely to be cost effective. Additionally, the difficulties of the recent drought years and current uncertainties related to water policy make further capital investment problematic. Moreover, there was evidence in all case study areas of significant efficiency gains in response to variability of irrigation water, the severity of the recent drought, and as part of good business practice. Attempts at diversification have met with varying degrees of success at the enterprise level, and have been least effective in the low-reliability environment of the Northern Basin.

- Despite evidence of strong **leadership** by civic, business and community leaders in most case study areas in responding to current water challenges and attempting to attract increased industry, a lack of economic diversity is evident in most areas, and it would generally be difficult to offset projected losses in agricultural employment in smaller, more remote and/or agriculturally dependent towns. Those most likely to offset such losses are areas close to a major urban centre, and/or with a significant alternative productive use such as extractive industries.

In many ways, the unprecedented population and employment loss experienced by Moree Plains, Bourke and Balonne Shires during the 2001-06 drought years provides a 'real time simulation' for what may happen in irrigation communities across the Basin if there were to be significant permanent reductions in irrigation water. Though many areas of SA and Victoria were more protected until 2006-07 in the highly regulated systems of the Southern Basin, general security areas of NSW have also experienced early drought effects. Moreover, a permanent reduction in irrigation water will constrain post-drought recovery in these areas.

Differential Impacts

Overview

There will be a **significant difference in social and economic impacts** when considered at different geographic scales. The greatest impacts are likely to be experienced at the local or regional level, with some communities disproportionately affected due to their size, degree of remoteness, proportion of disadvantaged Aboriginal residents, proximity to another major urban centre or alternative economic resource, and their degree of reliance on irrigated agriculture.

Factors that may assist communities to be more or less resilient in the face of projected changes were also considered for each case study area, and include existing socio-economic indicators, and potential mitigating factors noted above.

National and Basin-Level Impacts

At the **national level**, we have assumed that water reductions are evenly distributed across all irrigators, and modelled these at the 10%, 25% and 50% level with the following conservative estimates of job losses and cost of lost productivity.

Table 0.1: Estimated job losses and cost of lost productivity from permanent reductions in irrigation water

Level of Reduction	10%	25%	50%
Loss of Jobs	6,000 jobs	14,000 jobs	28,000 jobs
Annual Cost	\$0.6 billion	\$1.4 billion	\$2.7 billion
Capitalised Cost	\$8.3 billion	\$19.4 billion	\$38.9 billion

Loss of productivity at the 50% level of water reduction is the same at the Basin and national level in absolute terms, but the proportional impact is minor at the national scale. The above job

loss equates to 4.1% of jobs at Basin level (not including the ACT), but translates to 0.3% of jobs or 3 months of GDP growth at a national scale. At the national scale, this is assumed to be a 'real' and permanent reduction in GDP arising from either replacement of agricultural produce by imports or the loss of export income. While the jobs may be recovered through growth in other sectors, Australia will always be slightly worse off than it would otherwise have been.

Further effects of scaling are evident when costs are considered on a per household basis at the national and basin level, and on selected case study communities, as shown below, again using modelling for a 50% reduction in irrigation water. It is noted that these estimates are linear, and can be reduced pro rata for smaller reductions.

Table 0.2: Effects of scaling on household costs

Scale	Annual Cost per Household	Capitalised Cost per Household
National	\$380	\$5,400
MDB	\$4,500	\$65,000
Bourke LGA	\$8,800	\$125,000
Mildura LGA	\$16,000	\$230,000

Clearly there are marked differences in the distribution of costs and benefits for different communities and at different geographic scales. Important social equity considerations also emerge, where some of the most disadvantaged and least resilient communities like Bourke Shire will disproportionately bear the costs of outcomes, while the majority of benefits would be experienced at the national level.

By another view, if lost productivity was offset by the benefit to the community of environmental flows, the benefit/cost ratio at the national level would be '1', but in a community like Mildura it would be only 0.02 (at that level the costs are 42 times the benefits). This may help to explain the concerns raised by most of the case study communities.

Local-Level Impacts

The eight areas selected as case studies are used for indicative purposes, and examined mainly for what they may contribute to our understanding of the likely impacts and mitigating factors in other communities with similar characteristics, of which there are 149 LGAs, SLAs and combined areas (excluding the ACT). Other communities could also apply the 'resilience report card' that has been developed for this purpose (see detailed case study reports at Appendices 1 to 8).

At the local level, **a loss of employment and population was predicted for all case study areas.** Averaged across the eight case study areas, a 50% reduction in water availability predicted job losses of around 9.0%; and a 10% reduction in water availability predicted job losses of around 2.0%. Impacts are quite variable, reflecting the degree to which a community is dependent on irrigated agriculture, with job losses as high as 18.9% predicted in some areas from a 50% reduction in water availability. These estimates are probably low for regional centres, as jobs in

such areas are likely to reflect a wider area, outside the scale of our modelling. Similarly, a 50% reduction in water availability predicted population losses of around 11.4%; and a 10% reduction in water availability predicted job losses of around 2.5%. Again impacts are quite variable, with population losses as high as 25.2% predicted in some areas from a 50% reduction in water availability.

Impacts on key **socio-economic indicators** related to community resilience and wellbeing were also modelled, with more varied impacts predicted, though in no case study area did indicators become generally more favourable with a loss of irrigation water. A majority of case study areas were predicted to experience adverse impacts on socio-economic indicators as a result of population and employment loss, rather than the change in agricultural mix *per se*.³ These included projections of an older population and work force, increased concentration of disadvantage, increased concentration of disadvantaged Aboriginal people, threshold effects on key services, and contraction of the local economy. Improvement in some indicators was also noted with reduced population, including increased volunteering and decreased crime rates.

In the **Northern Basin**, all case study areas apart from Dalby-Wambo were predicted to experience significant adverse socio-economic impacts with less irrigation water. The impacts on small economies that are relatively remote, have large Aboriginal populations and very limited economic alternatives are likely to be considerable. In addition, irrigated agriculture has been part of the long-term resilience of areas like Bourke, Balonne and Moree. Dalby-Wambo has advantages related to lesser remoteness, and opportunities related to the mining and energy sector, which are likely to mitigate the impact of reductions in irrigation water, though there are community concerns regarding impacts on ground water resources and agricultural land in the Darling Downs as a result of the extraction of coal seam gas.

There are limited options for mitigation of adverse impacts. Water trade is likely to be of limited future benefit in the less connected and regulated systems of the Northern Basin, and there are reported to be limited efficiency gains remaining to be accessed without significant capital investment. Diversification into higher value crops like horticulture has generally had limited or no success in these Northern Basin case study areas due to low water security and the high cost and risk of investment, though areas like Moree have had somewhat more success in this regard. The current mix of annual irrigated crops like cotton and irrigated cereal is almost certainly an outcome of the nature of the river systems in the Northern Basin, the year to year uncertainty around water allocations and the commensurate returns required in high risk scenarios. Each of these factors indicates that, even with impressive leadership and co-ordination observed during field visits, communities like Bourke, Moree and Balonne will be vulnerable to a permanent reduction in irrigation water. Their high Aboriginal populations and risk of an increasingly residualised population are also noted.

The **Southern Basin** case study areas of Griffith and Mildura are predicted to have large employment and population losses, related to their remoteness and high degree of reliance on irrigated agriculture, though Mildura has the advantage of size and amenity, which may offset

³ See findings in Report 3: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Irrigated Agriculture and Socio-Economic Indicators*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri.

impacts to some degree. They are also predicted to experience adverse impacts on key socio-economic indicators. Campaspe, though less remote, is also predicted to have large employment and population losses. Murray Bridge and Campaspe are predicted to experience very limited impacts on indicators of community resilience and wellbeing, largely due to their more advantaged locations. They are less remote than other communities assessed, though impacts in Murray Bridge may be worse than forecast, as it is the most disadvantaged of the case study areas and likely to experience cumulative impacts from reductions in water availability in smaller communities in its large, agriculturally dependant hinterland.

The ability to trade water in a more liberalised market has been important to the resilience of individual businesses, agricultural sectors and of some communities during low allocation years in the Southern Basin, though government-led interventions to achieve industry restructuring such as the Small Block Exit Grant have had unintended consequences, including exacerbation of social impacts and constraints to sustainable industry restructuring occurring to varying degrees in older irrigation districts where this program has typically been applied. Future trade in water is more feasible in the more regulated and connected systems of the Southern Basin, though there are likely to be significant future constraints depending on the quantum and location of reduced irrigation water, as noted above. Future impacts at the community level are likely to depend on whether communities are net importers or exporters of water, and positive and negative impacts will be differentially distributed. The ability to offset permanent loss of irrigation water through system and on-farm efficiencies are reported to be quite minimal, with much already reported to be achieved. Importantly, the next best use with less irrigation water would generally lead to significant loss of employment, and may not be feasible in any case.

There was a common view across the Basin that agriculture has been resilient over the long-term, and that significant post-drought recovery is possible and already evident after good rainfall in parts of the Northern Basin. It is also reported that much of the land that has been lost in the Southern Basin could come back into production with the right growing and market conditions. For this reason it is important that short-term impacts be distinguished from longer-term impacts of a permanent reduction in irrigation water. Post-drought recovery is likely to be constrained by permanent reductions in irrigation water under the Basin Plan, other regulatory provisions, permanent out of area trade and in the longer term, climate change.

Finally, strong leadership is evident in communities most likely to be affected by loss of permanent irrigation water, but the extent to which it can assist with community and industry adjustment without significant restructuring resources and support, and in the absence of viable economic alternatives, appears problematic.

Enterprise-Level Impacts

The likely result of reductions in water availability at the enterprise level will be generally, and on average, a cost to farmers and associated value-added processing, warehousing and distribution, and other related industries. The cost will be seen in two ways, either through reduced profitability through an increase in operating costs and/or a reduction in income; or through loss

of savings and invested capital through bankruptcy or sale of their farm and/or capital investments at a loss.

There are a number of possible mitigations. If farmers are reimbursed for lost water and the compensation properly represented the value of the water, then the effect on the farmer will be effectively neutral as the farmer would be able to use the compensation to buy replacement water, however if the supply of water is now limited, it will not be possible for all farmers to buy replacement water. It is likely however that investment in irrigation infrastructure will be lost if the farmer is unable to purchase replacement water, with this cost unlikely to be compensated by government. In further support of this conclusion, it was often reported in consultations with growers and industry groups that the proceeds from permanent sale of water were used to retire debt (where that debt represented borrowings to fund capital investment in land, plant and machinery), rather than to invest in new enterprises within their local area.

In the absence of compensation, the ability to trade in water will mitigate the impact to some extent, allowing some farmers to stay in business with reduced profits by buying in water, and, where some farmers can sell water to a more efficient use, there may be an opportunity for a small proportion of farmers to make windfall profits.

Policy Implications

Although there are likely to be important environmental benefits from decreased irrigation water, particularly related to the maintenance of biodiversity and ecologic integrity of key assets, a full understanding of the relative costs and benefits of providing that water, consideration of equity and relative efficiencies, and a transparent decision-making process appear essential given our findings of the likely significant adverse social and economic impacts at the local level.

Questions regarding the nature of processes used to achieve environmental improvements also arise from case study communities, including the evident value of bottom-up or more participatory approaches to improved water efficiency and water sharing arrangements, decreased salinity and improved land management. Continued support for policy measures that increase the engagement of communities in developing solutions to broad environmental objectives, through for example regional NRM co-ordination bodies, would appear to be warranted. Collaborative gains are reported to be at risk due to community perceptions of a more top-down and less flexible approach that may accompany the forthcoming Basin Plan and related policy initiatives. The effectiveness and efficiency of market versus government-led interventions to achieve structural adjustment also arise, for example, in relation to programs like the Small Block Exit Grant and infrastructure upgrade programs which appear to have had unintended consequences for communities and industry, both socially and in terms of constraining more sustainable industry restructuring.

A projected increase in the proportion of disadvantaged Aboriginal residents in communities that already have very disadvantaged profiles is of particular concern, and has led civic leaders in areas like Bourke to express concern about the need for and cost of 'Northern Territory-style interventions' if post-drought recovery is constrained and further population is lost. Appropriate government support of such communities is vital, and again the environmental benefits from a

further reduction in irrigation water would need to be clearly and transparently articulated and costed to demonstrate that they warrant such high social costs.

Finally, it is clear that impacts in communities that are highly reliant upon irrigated agriculture, more remote, have few economic alternatives and/or where there are existing high levels of disadvantage will need special consideration for the provision of significant community and industry structural adjustment resources if they are to adjust to a future with less irrigation water. Most importantly, that future will be quite different to the present, and communities are unlikely to remain in their current form.

1 Background to the Study

1.1 Overview

This paper reports on the findings from Stage 4 of the study, *Exploring the Relationship Between Community Wellbeing and Resilience and Cotton Production in the Murray Darling Basin (MDB)*. This is a four-stage project that aims to describe and predict the social and economic impacts on communities at different geographic scales arising from changes in the availability of water related to Federal Government policy, and to inform the development of appropriate mitigations. Appendices 1 to 8 provide detailed case studies on eight selected areas.

To date, the study has been reported in three previous reports, which should be read in conjunction with this report.

Report 1 is a **Scoping Paper**, which sets out the rationale for the study, the social, economic, environmental and policy context, and the conceptual framework for the study;

Report 2 **quantifies the impact of cotton production on employment** across the MDB compared with other agricultural uses of land and irrigation water. As well as identifying the employment associated with cotton production, this enables the development of a tool that can be used to predict changes in employment at a local and national level as agricultural uses of land and water vary as a result of changes in water availability arising from changes in water policy and climate change. It will be a useful tool in modelling changes associated with the forthcoming *Murray-Darling Basin Plan*, which will set sustainable diversion limits for water, and in understanding the likely impacts of related federal initiatives under *Water for the Future*. Apart from the immediate impact on levels of employment, there will be a secondary effect as the mix of employment changes. That changing mix of employment may have impacts on socio-economic indicators, with such secondary effects explored in the next stage of the study;

Report 3 **quantifies the impact of cotton production on ‘proxy’ indicators of community wellbeing and resilience** across the MDB, compared with other agricultural uses, including labour force age and participation rate, unemployment, diversity of industry base, household income, quantum of population and employment change, key crime and health indicators, degree of socio-economic polarisation, median age, SEIFA Indices of Socio-Economic Disadvantage, Economic Resources and Education and Occupation, school participation and post-school qualifications, and social capital indicators related to attachment to place and community participation. The impact of changes in the employment base related to water availability are examined controlling for other factors such as Indigenous population, median age, and degree of urbanisation (remoteness and population size). This enables the development of a tool that can be used to predict changes in key indicators of wellbeing and resilience as employment mix varies over time with changing agriculture in response to changing water availability;

Report 4 (**this report**) uses the results from previous stages and other relevant data to **quantify and describe the likely social and economic impacts** on irrigated agricultural (including cotton producing) communities in the MDB arising from changes in availability of water for irrigation. This includes a cost benefit analysis (or identification of whole of community costs and benefits)

at different geographic scales and case studies conducted in eight communities with irrigated agriculture industries. This stage of the study also seeks to engage communities and other key stakeholders in the MDB in order to ground-truth findings, share knowledge from the study, and identify more qualitative impacts and past adaptation strategies. It also aims to identify appropriate mitigation to respond to adverse impacts predicted, including from the viewpoint of stakeholders at different geographic scales.

An important part of this stage is the development of a longer-term community engagement and impact assessment strategy. This will provide for ongoing feedback and review on how changes to water availability arising from policy and other factors are impacting on local, catchment and Basin-wide communities. Together with regular updates in quantitative assessment, it is proposed that such ongoing input from local communities will provide ‘on the ground’ involvement from local stakeholders in identifying relevant impacts and contributing to the development of appropriate mitigations as changes occur. Such monitoring is also critical in enabling stakeholders to provide ongoing input to policies as they are rolled out and reviewed.

1.2 The Conceptual Framework for Stage 4 (this report)

1.2.1 Introduction

Given findings from the literature and the first three reports of this study, it is likely that the social and economic impacts related to changes in water availability will be experienced differently at different geographic scales (eg. farm, local community, region, MDB, national), and by different groups within a community (e.g. farmers, Aboriginal people, businesses). Key factors will include the existing wellbeing and resilience of these communities, and other mitigating factors such as access to the water market and alternative economic opportunities.

In order to understand the differential impacts upon areas and groups, we have carried out a cost-benefit analysis to determine impacts at the MDB and national levels; and prepared eight case studies to explore the likely impacts at the farm, regional and local community levels. These documents comprise the fourth and final report for this study.

1.2.2 Cost Benefit Analysis

One of the most important tasks of public policy analysis is to address questions of relative efficiency.⁴ In a market situation, efficient allocative decisions are presumed to be arrived at by the summation of the actions of individuals across the market place. However in many areas pertaining to public policy, a market place does not exist. Common areas of market failure include externalities and public goods. Externalities occur when an individual uses a resource to obtain an advantage, but costs of that use are incurred by others external to the user. A common

⁴ Friedman L, (2002) *The Microeconomics of Public Policy Analysis*, p. 169.

example is pollution or environmental degradation arising from an industrial use. Public goods will not be supplied by a market, because the good is not excludable, not rival or both. A well known example is a lighthouse, where firstly, it is not possible to charge users for using the lighthouse as once it is in place anyone can use it, and secondly there is no rivalry in that it makes no difference if one person or a thousand people use it, there is no diminution in the output of the lighthouse.

In these circumstances, relative efficiency is tested by the compensation principle. Essentially, the principle involves considering whether it is possible for the winners from a change to compensate the losers and still come out ahead, noting however that, in the case of cost benefit analysis, the compensations are not in fact made.⁵ If the winners can compensate the losers and still come out ahead, then the proposal is considered efficient.

1.2.3 Framework for the Study

This report seeks to identify and quantify the social impacts and the economic costs and benefits associated with changing water availability within the MDB. Because of the size and complexity of the MDB, and lack of readily available detail in many areas around the costs and outcomes of alternative uses of water, this is necessarily a scoping exercise. Nevertheless, relativities can be established, and options can be differentiated where cost differences are substantial.

The estimate of relative efficiency will vary with the scale of analysis. For example, if the winners were found in cities and the losers within a country town, then at the scale of the town there would be no winners to theoretically compensate the losers, but at the scale of the state or country, winners in the cities could theoretically compensate losers in the country town. At the scale of the town, the decision would be inefficient, but at the scale of the state, the decision could be efficient. Similarly if pollution was exported to another country, at the national level the transaction may be efficient, but at the global level it may be inefficient.

The analysis has been carried out at four scales, with varying levels of detail. The scales selected are the farm or enterprise level, the local (SLA) level, the Murray Darling Basin level and the national level.

⁵ Friedman Op. cit. p. 169.

2 Summary of Key Findings from Stage 4 (this stage)

2.1 Overview

The remainder of this report seeks to identify and where possible quantify the social impacts and economic costs and benefits associated with changing water availability within the MDB. It could provide a useful tool in modelling the social impacts and efficiency of changes in water allocation associated with the forthcoming *Murray-Darling Basin Plan*, which will set sustainable diversion limits (SDLs) for water; and will improve our understanding of the likely impacts of related federal initiatives under *Water for the Future*.

An overview of the main research questions for Stage 4 of the study is first provided. This is followed by a summary of key results and a statement of the methodology used in the current stage of the research. More detailed data and discussion then follows.

2.2 Research Questions for Stage 4 of the Study

2.2.1 Overview

This stage of the study seeks to address eight key research questions:

1. Will changing availability of water result in net social and economic benefits at the enterprise level and what is the likely quantum of costs and benefits?
2. What mitigations may result in maximising net benefit at the enterprise level?
3. Will changing availability of water result in net social and economic benefits at the local level and what is the likely quantum of costs and benefits?
4. What mitigations may result in maximising net benefit at the local level?
5. Will changing availability of water result in net social and economic benefits at the MDB level and what is the likely quantum of costs and benefits?
6. What mitigations may result in maximising net benefit at the MDB level?
7. Will changing availability of water result in net social and economic benefits at the national level and what is the likely quantum of costs and benefits?
8. What mitigations may result in maximising net benefit at the national level?

Each of these questions is answered briefly in turn below, and explored in detail in the body of the report.

2.2.2 Research Questions 1 and 2

Research Questions 1 and 2 ask: *Will changing availability of water result in net social and economic benefits at the enterprise level and what is the likely quantum of costs and benefits? and*

What mitigations may result in maximising net benefit at the enterprise level?

The likely result of reductions in water availability at the enterprise level will be generally, and on average, a cost to farmers and associated value-added processing, warehousing and distribution, and other related industries. The cost will be seen in two ways, either through reduced profitability through an increase in operating costs and/or a reduction in income; or through loss of savings and invested capital through bankruptcy or sale of their farm and/or capital investments at a loss.

There are a number of possible mitigations. If farmers are reimbursed for lost water and the compensation properly represented the value of the water, then the effect on the farmer will be effectively neutral as the farmer would be able to use the compensation to buy replacement water, however if the supply of water is now limited, it will not be possible for all farmers to buy replacement water. It is likely however that investment in irrigation infrastructure will be lost if the farmer is unable to purchase replacement water, with this cost unlikely to be compensated by government. In further support of this conclusion, it was often reported in consultations with growers and industry groups that the proceeds from permanent sale of water were used to retire debt (where that debt represented borrowings to fund capital investment in land, plant and machinery), rather than to invest in new enterprises within their local area.

In the absence of compensation, the ability to trade in water will mitigate the impact to some extent, allowing some farmers to stay in business with reduced profits by buying in water, and, where some farmers can sell water to a more efficient use, there may be an opportunity for a small proportion of farmers to make windfall profits.

2.2.3 Research Questions 3 and 4

Research Questions 3 and 4 ask: *Will changing availability of water result in net social and economic benefits at the local level and what is the likely quantum of costs and benefits? and*

What mitigations may result in maximising net benefit at the local level?

There are likely to be very different impacts at different geographic scales from permanent reductions to irrigation water related to government policy, liberalisation of water trade and long-term climate change and those impacts will be experienced differentially in communities depending on context. Given the uncertainty surrounding the size and distribution of water reductions, for example, under the forthcoming Basin Plan, modelling on the socio-economic impacts of these changes has been conducted for water reduction scenarios at the local level in eight diverse communities. Case study communities were selected on a range of relevant criteria including the relative importance of irrigated agriculture. In the Northern Basin, these communities are the local government areas (LGAs) of Bourke, Balonne and Moree Plains, and

the aggregate SLA of Dalby-Wambo. In the Southern Basin, the LGAs of Murray Bridge, Mildura, Griffith and Campaspe were selected.

At the local level, a loss of employment and population was predicted for all case study areas at 10%, 25% and 50% irrigation water reduction levels, with varying levels of severity. The likely result of reductions in water availability at the local level, such as a local government area, will be generally, and on average, a net cost to the community, through loss of production as evidenced by lost jobs. Averaged across the eight case study areas considered in this study, a 50% reduction in water availability predicted job losses of around 9.0%; and a 10% reduction in water availability predicted job losses of around 2.0%. Impacts are quite variable, reflecting the degree to which a community is dependent on irrigated agriculture, with job losses as high as 18.9% predicted in some areas from a 50% reduction in water availability. These estimates are probably low for regional centres, as jobs in such areas are likely to reflect a wider area, outside the scale of our modelling. Similarly, averaged across the eight case study areas considered in this study, a 50% reduction in water availability predicted population losses of around 11.4%; and a 10% reduction in water availability predicted job losses of around 2.5%. Again impacts are quite variable, with population losses as high as 25.2% predicted in some areas from a 50% reduction in water availability.

Impacts on key socio-economic indicators related to community resilience and wellbeing were also modelled, with more varied impacts predicted, from little change in areas like Dalby-Wambo and Campaspe, to considerable adverse impacts in all other areas of the Northern Basin. In no case study area did indicators become generally more favourable with a loss of irrigation water.

Determinants of differential impacts from previous stages of this study were found to include changes in employment and population, degree of remoteness,⁶ degree of urbanisation (population size), proportion of Aboriginal residents particularly remote populations,⁷ and age of the population.⁸ Degree of economic diversity and opportunities to diversify were also relevant factors though these are largely a function of other factors like remoteness, proximity to a large urban centre or to other economic resources like extractive industries, and to a large extent not within the control of a local community, though strong community leadership is also important in determining how a community responds. The importance of these variables was largely confirmed in this stage of the research, though other factors were also found to be important in mitigating or exacerbating projected impacts, including:

- The nature of the ‘next best’ land use without irrigation water, so as to understand the quantum of likely employment substitution;
- Ability to ‘recover’ from drought and past responses to stressors;

⁶ As set out in *Statistical Geography: Volume 1 Australian Standard Geographical Classification (ASGC), 2006 (cat. no. 1216.0)*.

⁷ It is noted that, although ‘Indigenous people’ is a proxy indicator, it is not being Aboriginal *per se* that signifies disadvantage but a range of attributes that are more likely to found among Aboriginal people, such as low income, educational and employment status, being sole parent, lower likelihood of home ownership, etc

⁸ JSA (2010) Report 2: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Understanding Agricultural Employment*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri; and JSA (2010) Report 3: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Irrigated Agriculture and Socio-Economic Indicators*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri.

- Potential benefits from open trade in water;
- Ability to make further efficiency gains, which would indicate the extent to which reductions in irrigation water could be absorbed within current business structures;
- Access to other economic opportunities such as mining and extractive industries, or access to major markets such as capital cities that could facilitate business relocation;
- Other natural attributes such as scenic beauty, strategic location, environmental conditions; and
- Leadership, networking and co-ordination to facilitate community responses to significant stressors, in this case, potentially reduction in irrigation water.

Each of these factors was also explored in two field visits to each case study community, interviews with other key informants and through desktop research.

In the **Northern Basin**, all case study areas apart from Dalby-Wambo were predicted to experience significant adverse socio-economic impacts with less irrigation water. Though the quantum of job losses may be quite low in a basin or national context, the impacts on small economies that are relatively remote and have large Aboriginal populations are likely to be considerable. It is likely that irrigated agriculture has been part of the long-term resilience of areas like Bourke and Balonne, and its decline would hasten trends to urbanisation (seen as population loss in smaller and remoter areas) and a more residualised population among those who remain. Impacts on Moree Plains are also likely to be significant, though it has benefits from its larger size and more robust dryland farming base. Dalby-Wambo is predicted to have lesser impacts, due largely to its proximity to larger urban centres, opportunities from mining and energy resources, and less disadvantaged profile. There are also more significant concerns among those consulted about the potential impacts on artesian water and prime agricultural land of the Darling Downs from the expansion of coal seam gas. Unlike other areas, these concerns largely overshadowed concerns regarding the forthcoming Basin Plan.

There are limited options for mitigation of adverse impacts. Some areas may be able to offset job losses by enterprises buying in water from other areas, but any such offset of job losses in one area will mean that another area will be worse off than without trading, as they will lose water and hence jobs. It is often claimed that additional environmental water will lead to increased jobs through tourism or other outcomes, or increased production from reduced salinity or 'healthier' ecosystems, but there is little evidence to support such assertions.

Generally across the MDB, local areas are heavily reliant on agriculture, with few options for diversification. The main opportunity for diversification lies in different crops or stock options in response to droughts, changing prices, technological change and the like. Reductions in the availability of irrigation water will reduce overall agricultural output, with a commensurate loss of jobs, decrease in the size of the economy and probable loss of population.

Water trade is likely to be of limited future benefit in the less connected and regulated systems of the Northern Basin, and there are reported to be limited efficiency gains remaining without significant capital investment. Such investment is likely to be problematic due to current uncertainty about water, reductions already experienced from different regulatory requirements,

and the severe and protracted drought since 2000-01 in the Northern Basin, which has meant less profitability and in some cases bankruptcy for an increasing number of businesses. Diversification into higher value crops like horticulture has generally had limited or no success in these Northern Basin case study areas due to low water security and the high cost and risk of investment, though higher rainfall in Moree has supported a little more diversity in this regard. The current mix of annual irrigated crops like cotton and irrigated cereal are almost certainly an outcome of the nature of the river systems in the Northern Basin, the year to year uncertainty around water allocations and the commensurate returns required in high risk scenarios, just as high levels of water security have supported very different irrigated agricultural production in the Southern Basin. Each of these factors indicates that, even with impressive leadership and co-ordination observed during field visits, communities like Bourke, Moree and Balonne will be vulnerable to a permanent reduction in irrigation water.

Importantly, there was a common view that agriculture has been resilient over the long-term, and that significant post-drought recovery is possible and already evident after good rainfall in parts of the Northern Basin. For this reason it is important that short-term impacts be distinguished from longer-term impacts of a permanent reduction in irrigation water. Post-drought recovery is likely to be constrained by permanent reductions in irrigation water under the Basin Plan, other regulatory provisions or permanent out of area trade. There are also concerns that water already taken from irrigation through the Federal Government 'buyback' is having such an effect, though there is likely to be a lag in flow-ons to other local businesses.

In many ways, the unprecedented population and employment loss experienced by Moree Plains, Bourke and Balonne Shires during the 2001-06 drought years provides a 'real time simulation' for what may happen in the **Southern Basin** if it were to sustain significant reductions in irrigation water. Unlike the Northern Basin, the SA and Victorian areas of the Southern Basin were, to a large extent, cushioned from the worst of the drought until 2006-07 due to a predominance of high security licenses in the highly regulated Murray River system, which has enabled high value horticulture and viticulture. Areas like Griffith in the Murrumbidgee and the NSW Murray have been more exposed, due to higher reliance upon low security water and greater variation in allocations, though permanent plantings were generally protected through high security water. At the same time, impacts in Campaspe have been more severe than in other Victorian and SA areas, with areas irrigated from the Campaspe river experiencing significant cuts from 2004-05. The effects in areas of Campaspe irrigated from the Murray and Goulburn rivers were cushioned until 2006-07.

Serious impacts have been felt since 2006-07, when three years of historically low flows on top of a severe drought depleted upstream storages at Hume and Dartmouth dams, and led to the first low water allocations for many of these areas 'in living memory'. The area below Lock 1 (in which Murray Bridge is located), was particularly hard hit, as low river and lake levels made it impossible for irrigators to access allocations without incurring significant cost, for example, to extend irrigation intakes. This was exacerbated by fluctuations in commodities prices in various horticultural sectors.

In terms of modelling of projected impacts from reduced irrigation water, the Southern Basin case study areas of Griffith and Mildura are predicted to have large employment and population

losses. An area like Griffith, which is smaller, less urbanised, less economically diverse and with less strategic advantages from location appears to be particularly exposed to a loss of irrigation water, and effectively exists *because* of irrigation and policy decisions in the past. Surrounding LGAs like Coleambally and Deniliquin are very exposed due to the predominance of general security water, evident in the severe impacts on crops like rice and related processing in the latter years of the drought. Impacts in these areas are likely to flow on to Griffith as well, though this is not quantified. Mildura is much larger, and has the advantages and amenity of a large regional service centre on the Murray River with high levels of water security. Nonetheless, Mildura's remoteness and degree of reliance on irrigated agriculture are also problematic. Both of these areas are predicted to experience a general decline in indicators of community resilience and wellbeing related to population and employment loss, and Mildura's existing indicators signal some vulnerability in relation to disadvantage and human capital that may affect its ability to flexibly adapt to structural economic change. Murray Bridge and Campaspe are predicted to experience very limited impacts on indicators of community resilience and wellbeing, largely due to their more advantaged locations, though Campaspe's reliance on irrigated agriculture predicts relatively high job loss. They are less remote than other communities assessed. However, Murray Bridge is the most disadvantaged of the case study areas and likely to experience cumulative impacts from reductions in water availability in smaller communities in its large, agriculturally dependant hinterland, where more substantial employment impacts are forecast. Employment and population loss is projected to be quite high in Campaspe, and the dairy industry has suffered significant losses during the recent years of the drought. It has an older age structure, lacks economic diversity and appears to have been growing at the expense of its hinterland, so that it may be unwise to be too complacent about an area like Campaspe.

In terms of factors that may mitigate or exacerbate projected socio-economic impacts, the ability to trade water in a more liberalised market has been important to the resilience of individual businesses, agricultural sectors and of some communities during low allocation years in the Southern Basin. However, government-led interventions to achieve industry restructuring such as the Small Block Exit Grant have been more problematic, arguably exacerbating social impacts on small communities and constraining more sustainable structural adjustment that has been occurring more gradually in many of these communities. Future trade in water is far more feasible in many of these areas due to greater connectivity in the regulated systems of the Southern Basin and relatively high value produce, though future impacts at the community level are likely to depend on whether communities are net importers or exporters of water, and positive and negative impacts will be differentially distributed. The ability to offset permanent loss of irrigation water through system and on-farm efficiency gains are reported to be quite minimal, with much reported to have been achieved in recent decades including through participatory NRM programs, and more rapid restructuring occurring in recent low allocation years in some communities. Importantly, the next best use with less irrigation water would generally lead to significant loss of employment, and may not be feasible in any case, for example where the total amount and fragmentation of land used for horticulture would not provide for viable dryland uses.

In terms of opportunities for post-drought recovery, it is reported that much of the land that has been lost could come back into production with the right growing and market conditions, and

again evidence of long-term resilience of agriculture to changing conditions in terms of product mix and farming practices was often provided. Permanent reductions in water would again constrain recovery to the extent to which this is possible. Finally, strong leadership is evident in communities most likely to be affected by loss of permanent irrigation water, like Mildura and Griffith, and in LGAs like Murray Bridge where small communities and some industry sectors have suffered significantly during the drought. Such leadership is vital, but the extent to which it can assist with community and industry adjustment without significant restructuring resources and support, and in the absence of viable alternatives, again appears problematic.

Moreover, though there are likely to be important environmental benefits from increased irrigation water, particularly related to the ecologic integrity of key assets, a full understanding of the relative costs and benefits of providing that water, consideration of equity and relative efficiencies, and a transparent decision-making process appear essential given our findings of the likely significant adverse social and economic impacts at the local level. Questions regarding the nature of processes used to achieve environmental improvements also arise from these case studies, including the evident value of bottom-up or more participatory approaches to improved water efficiency and improved land management versus more top-down or less flexible approaches to these important issues. The effectiveness and efficiency of market versus government-led interventions to achieve structural adjustment also arise, for example, in relation to programs like the Small Block Exit Grant and infrastructure upgrade programs which appear to have had unintended consequences for communities and industry. Finally, it is clear that impacts in communities that are highly reliant upon irrigated agriculture, more remote, have few economic alternatives and/or where there are existing high levels of disadvantage will need special consideration for the provision of significant community and industry structural adjustment resources if they are to adjust to a future with less irrigation water. Most importantly, that future will be quite different to the present, and communities are unlikely to remain in their current form.

2.2.4 Research Questions 5 and 6

Research Questions 5 and 6 ask: *Will changing availability of water result in net social and economic benefits at the MDB level and what is the likely quantum of costs and benefits? and*

What mitigations may result in maximising net benefit at the MDB level?

The effect of reductions in water availability at the MDB level will be a loss of production measured as a loss of jobs. If reductions in water availability were taken evenly across the basin, a 10% reduction in water availability is predicted to result in the loss of 6,000 jobs, a 25% reduction in water availability is predicted to result in the loss of 14,000 jobs and a 50% reduction in water availability is predicted to result in the loss of 28,000 jobs. The estimates of job losses are equivalent to annual costs of \$581 million, \$1,356 million and \$2,726 million respectively; and capitalised costs of \$8.3 billion, \$19.4 billion and \$38.9 billion respectively for the various levels of change in water availability.

The most effective mitigation is likely to come from trading of water between uses. For example, one GL of water employs around 2.3 people if used for cotton, and around 38.0 people if used for

vegetables. However there are restrictions on the ability to trade. Less labour intensive uses, such as cotton and rice production, are typically associated with unregulated streams or low security water, whereas more labour intensive uses require high security water. There is limited connectivity within the basin, with many river systems ending in swamps and only connecting to the Darling, and hence the Murray, in major flood events. Typically transmission losses within the MDB average 48%, meaning that, on average, it could cost 2 Gl of water to transport 1 Gl of water from one area to another in the basin. Detailed hydrological modelling is outside the scope of this study, however consultation undertaken suggests that there are limited opportunities for trade within the basin to offset reductions in water availability because of lack of connectivity and transmission losses. There is some opportunity for water to be transferred from irrigated dairy in tributaries of the upper Murray to other uses in the mid and lower Murray, and for water to be transferred from broadacre crop and pasture growing in the Murrumbidgee to other uses in the Murrumbidgee and lower Murray, but such offsets are difficult to model, depending on the relative profitability of different enterprises and the relative levels of water security required.

An alternative mitigation is for diversification at the enterprise level, with farmers adopting more labour intensive uses where such approaches are profitable. Such an approach has been unsuccessful in the Northern Basin due to insufficient water security. Again modelling is difficult and detailed hydrological modelling is outside the scope of this study. As a minimum, water security is set by connectivity, capacity of on farm storage and the capacity of up river storages; and it could well be that the job losses associated with setting extraction levels low enough to provide adequate water security will never be made up by the additional employment from more labour intensive uses as a result of increased water security.

Where reductions in water availability are a result of policy decisions to deliver water to the environment, basin wide impacts will be exacerbated depending on the sites chosen to receive environmental water. This is because of lack of connectivity and transmission losses. As discussed below, a recent study from the Wentworth Group of Scientists called for the majority of environmental water to be taken from the Murrumbidgee and Murray Rivers. In that case, a 40% reduction in water availability to irrigators is predicted to result in the loss of at least 41,000 jobs in irrigation areas in the MDB.

2.2.5 Research Questions 7 and 8

Research Questions 5 and 6 ask: *Will changing availability of water result in net social and economic benefits at the national level and what is the likely quantum of costs and benefits? and*

What mitigations may result in maximising net benefit at the national level?

The effects of reductions in water availability in the MDB at the national level will be a loss of production, measured as a loss of jobs, and with those job losses quantified above. The costs will be experienced differentially. At the national level, the annual cost of a 50% reduction in water availability is about \$380 per household, compared with \$4,500 per household at the MDB level, a cost of \$8,800 per household in Bourke LGA and a cost of \$16,000 per household in Mildura LGA. The capitalised cost per household is \$5,400 nationally, \$65,000 across the MDB, \$125,000 in Bourke LGA and \$230,000 in Mildura LGA.

Where reductions in water availability are a result of increased environmental flows, the primary benefit will be the maintenance of ecosystems and biodiversity, with that benefit determined by the value placed on the outcome by the community, and measured according to the opportunity cost in lost employment. Generally, achieving outcomes by increasing flows or by dilution do not appear to be cost effective by comparison with managed interventions, noting however that such approaches are in tension with notions of ‘natural’ associated with environmental paradigms. As is common in matters of public policy and infrastructure provision, impacts will be felt differentially, with the majority of adverse impacts felt in the MDB and particularly in regional and local areas dependent on irrigated agriculture, and with the positive impacts felt at a national level, for example people living in coastal cities who may place a high value on particular environmental outcomes.

Because agriculture is a primary industry, and driven by the availability of natural resources in addition to capital and labour, job losses are likely to represent a real loss of wealth and production at the national level. If levels of unemployment at the national level were below the natural rate of unemployment, then such effects could be mitigated by those rendered unemployed by reductions in water availability finding productive work elsewhere and not displacing others from the workforce. However if unemployment at the national level is above the natural rate of unemployment, then any people rendered unemployed by reductions in water availability are likely to find work by displacing other less skilled people from the workforce. It is likely that unemployment in Australia (apart from a brief period in mid 2008) is consistently above the natural rate unemployment as evidenced by low levels of inflation, and probably reflecting active government policies of encouraging inward migration to Australia. Other opportunities for mitigation arise from agricultural diversification and water trade, but, as discussed elsewhere, such opportunities are limited.

If reductions in water availability came about from the diversion of water from irrigation to environmental flows, then there may be benefits arising from the increased environmental flows. The benefits are likely to be experienced at the national level, whereas the commensurate costs are likely to be experienced at a local and regional level.

A number of possible benefits are assessed in this report. These include maintenance of ecosystems and biodiversity, restructuring as a result of water buyback, recreation and tourism, improved water quality (eutrophication and salinity), certainty for users and infrastructure costs associated with rising water tables.

There are alternative methods of achieving these benefits. At the most simplistic level, benefits may be able to be achieved through dilution by increasing environmental flows, or as a result of increased flows. However there are two other options that need to be considered. The first is the do nothing case and an assessment of the cost of that approach. The second is to consider alternative methods that may deliver the benefit in a way that has a much lower overall cost to the community. Typically, approaches based on dilution and increased flows are estimated to have costs between 10 and 1,000 times the cost of managed interventions in achieving similar outcomes, suggesting that such approaches should be thoroughly investigated by government. However, as stated above, managed interventions are in tension with notions of ‘natural’.

The possible benefits of increased environmental flows are discussed below.

Restructuring as a result of the water buyback

This is likely to be at best cost neutral at the national level as any benefit from restructuring or additional capital investment is offset by a cost to taxpayers and to the wider community. Where restructuring or capital investment does not provide appropriate levels of return, there is likely to be a net cost to the wider community. Where appropriate levels of return are available, it is likely that such outcomes would be already provided by the market and would not require subsidy.

Certainty for users

It is not clear in what way this may be perceived as a benefit. It would only be a benefit in an environment where farmers are totally risk averse, and hence would not use water if any level of uncertainty existed. In fact this is not the case, and farmers regularly make investment decisions in an environment of uncertainty with respect to weather and commodity prices. At the same time, it should be noted that high security water is more valuable than low security water.

Reduction in infrastructure costs associated with rising water tables

This has not been assessed. On a preliminary review, and based on the writer's experience in infrastructure provision and maintenance, the costs appear to be tenuous and overstated.

Recreation and Tourism

Claimed economic benefits of recreation and tourism are typically assessed as the value placed on tourism by the individual tourist and take this value as the total benefit of a particular tourist activity. In fact there are many opportunities for tourism in Australia, meaning that consumption of one type of tourism can be easily substituted for another. Hence, the benefit can only be the marginal benefit to users in moving from one type of tourism or recreation to another, such as the costs of additional travel and the like. We are of the view that the recreation and tourism benefit arising from increased environmental flows is at best zero, as substitutes appear to be relatively available. The purported benefits of recreation and tourism are better represented as the value placed by the community on maintenance of ecosystems and biodiversity.

Improved water quality

Reductions in water quality as a result of salination and eutrophication will have economic costs associated with reduced agricultural output and increased costs in the provision of drinking water and water for industrial use. There is a secondary benefit arising from favourable outcomes in terms of ecosystems and biodiversity.

We have not found any reporting of eutrophication in the MDB, with the primary water quality concern appearing to be salinity, and to a lesser degree, algal blooms. We have considered salinity in some detail, with a focus on levels at Morgan, and understand that similar conclusions can be drawn around algal blooms.

Somewhat surprisingly to us, there does not appear to be any current quantifiable concern with river channel salinity levels at Morgan. This seems to be an outcome of the Basin Salinity Management Strategy (BSMS) implemented around 2000, which appears to have been highly successful. The benchmark for acceptable levels of salinity in the Murray River adopted in the Water Act is a less than 5% chance of exceedance of 800 EC⁹ at Morgan. Prior to the adoption of the BSMS, that criterion was predicted to be exceeded in 2010. However using data over the last ten years, exceedance of the criterion is predicted in 2050 assuming constant proportional standard deviation and in 2080 assuming constant standard deviation.

With regard to the two likely economic impacts of reduced water quality; reduced agricultural output and increased costs in the provision of drinking water as a result of increased salinity, threshold levels at which adverse impacts will arise are quite high, suggesting that the 800 EC target is conservative with an inbuilt safety factor. Reductions in agricultural output of 10% for sensitive crops are expected at levels between 1,000 and 2,000 EC, suggesting that any reduction of agricultural output as a result of increasing salinity is not expected to be experienced for many years. For many crops, such as grapes and cotton, reductions in output of 10% are expected at levels around 3-4,000 EC. With regard to drinking water, the Australian Drinking Water Guideline for Total Dissolved Solids is equivalent to 900 EC, and an upper limit for drinking water quality is equivalent to 1,800 EC.

We have looked at the comparative costs and benefits of various methods of reducing salinity.

The cost of reducing salinity by one EC unit through dilution (increased environmental flows) has been estimated at between \$2.6 million and \$48.1 million per year due to lost agricultural output. By comparison, salt diversion schemes are estimated to cost around \$0.3 million annually per one EC unit reduction in salinity, between one tenth and one one hundredth of the cost of dilution.

With regard to water supply, the options in order of increasing cost are:

- Additional salt diversion and management and desalination (at a factor of 1);
- Construction of Pipelines from storages in the upper Murray (at a factor of 3); and
- Dilution through increased environmental flows (at a factor of 10-100).

In summary, and by comparison with targeted management interventions, dilution is a very expensive method of addressing salinity. The current suite of management techniques in the MDB has been highly successful in reducing levels of salinity, being between 1% and 10% of the cost of the alternative of dilution through increased environmental flows.

High levels of salinity are found in lakes and pools within the MDB when low flows combine with high levels of evaporation. We are of the view that such salinity concerns are best considered in terms of maintenance of ecosystems and biodiversity. This is discussed below.

⁹ A measure of Total Dissolved Solids by measuring electrical conductivity. The units of measurement are not stated.

Maintenance of ecosystems and biodiversity

There is no market to estimate the value to the community of ecosystems and biodiversity. While an environmental paradigm, and the Water Act 2007, would form a view that the value of ecosystems and biodiversity is infinite, we have taken the approach that the maintenance of ecosystems and biodiversity is a form of public good and that the cost of such outcomes should be assessed in terms of the willingness of the community to pay the price. We take the approach recommended by the Productivity Commission in its recent Inquiry and have sought to determine the opportunity cost of achieving particular environmental outcomes in the MDB, taking that opportunity cost as the price paid in lost agricultural production and measured in loss of jobs.

We have costed two recent proposals to achieve particular environmental outcomes in the MDB based on an increase in environmental flows at the expense of irrigation. Kingsford et al estimate the requirement for increased environmental water for the lower lakes at around 790 Gt per year. The Wentworth Group of Scientists estimate increased environmental flows of 4,400 Gt per year with the majority of that water coming from reductions in irrigation in the Murray and Murrumbidgee Rivers.

The Kingsford et al proposal is estimated to cost between 4,000 and 30,000 jobs, with the **higher estimate more likely** because of lack of connectivity and transmission losses within the basin. Water security is also important, as the demand is likely to be higher in dry years when low security water is less likely to be available.¹⁰ This is equivalent to between \$350 and \$2,900 million per year in lost productivity or, in net present value, between \$5 billion and \$41 billion. The lower lakes are currently under severe ecological stress and are being maintained in “a holding pattern” in anticipation of increasing flows as the drought breaks, by a range of management interventions costing around \$20-30 million per year, between one tenth and one one-hundredth of the cost of providing the additional flows proposed by Kingsford et al. Clearly the community is prepared to pay the cost of management options. The outcome of the Basin Plan will show to what extent the community is prepared to pay the price of increased environmental flows.

The proposal by the Wentworth Group of Scientists is estimated to cost around 41,000 jobs, valued at around \$4.0 billion per annum, or in net present value, \$57 billion, equivalent to \$8,000 for each household in Australia. The effect of such a proposal on areas dependent on irrigated agriculture such as the Murrumbidgee irrigation area, and dairy areas in the Murray will be devastating, with the cuts proposed equivalent to taking all water from rice, other broadacre irrigated cropping and dairy production and half the water used for horticulture (vegetables, grapes and fruit growing) in the Murray Darling Basin in 2005-06.

However, considered at a national level, such costs are likely to be relatively small, being equivalent to a loss of 0.4 % of jobs at the national level or equivalent to three months loss of GDP growth. Again, normative assessment as to whether the outcomes are worth the price paid will only be evident with the outcomes of the Basin Plan.

¹⁰ The lower estimate is based on all the water coming from cotton growing areas in the upper MDB catchment and rice growing areas in the Murrumbidgee. Both these uses are based on low security water.

3 Detailed Findings and Discussion

This section seeks to identify and quantify the costs and benefits associated with changing water availability within the MDB at four different scales, the enterprise level, the SLA level, the MDB level and the national level.

Because of the size and complexity of the MDB, and lack of readily available detail in many areas around the costs and outcomes of alternative uses of water, this is necessarily a scoping exercise. Nevertheless, relativities can be established, and options can be differentiated where cost differences are substantial.

3.1 The Enterprise Level

The following discussion of costs and benefits of changing water availability at the enterprise scale is qualitative, drawing on interviews with farmers and other key informants across the basin. The costs and benefits will depend to a large degree on the characteristics of the individual enterprise. Similarly, the response of the enterprise to changing water availability may depend on a range of external factors.

At the enterprise level, there are two costs associated with reduced water availability. The first is reduced profitability, through an increase in operating costs or reduction in income. The second is loss of savings and invested capital through bankruptcy or sale of the enterprise, or its components such as land and water, at a loss. The quantum and nature of impacts will depend on a range of factors, including levels of debt, commodity prices, the ability to access water markets, and public subsidies.

The immediate result of a reduction in water availability will be a loss of production, and hence income, leading to reduced profitability and with the quantum dependent on the level of fixed costs. Additionally, if water is sourced elsewhere, variable costs will increase. The effects will be variable depending on the circumstance of the farmer. For someone farming an annual crop such as cotton or some vegetables, a smaller or alternative crop may be planted depending on the available water, or no crop may be planted and remaining water may be sold to another user. There may be a change to more productive uses, such as from cotton to fruit growing, but productive uses based on perennial crops will be associated with a need for greater water security and this may not be available. Additionally, a capital investment will be required to meet costs of establishment.

For those with permanent crops, such as grape vines and fruit trees, some less productive vines or trees may be let die to reduce water demand however this will lead to reduced income. If water availability increases in the future, additional significant capital investment will be required to make use of the additional water, with vines and trees taking 5-7 years to become productive. Additional water may be purchased in to ensure the survival of trees and vines and to continue production. This will depend on assessment of a number of factors, including the price of the commodity, access to water markets, the price of water, the availability of water and the likely duration of the reduction in water. For example, if commodity prices were high enough to justify

buying in water, then this may be a long-term solution, but if prices were lower resulting in keeping trees alive at a loss, eventually savings would be exhausted and it would no longer be possible for the farmer to purchase water.

Dairy farmers may sell their water and purchase in feed for their cattle, again depending on the relative costs. Similarly, the degree to which this would be a long-term solution depends on whether the farmer is drawing down savings or increasing borrowings.

Other farmers may invest in capital to use their remaining water more efficiently, such as moving to pipes and drip irrigation from channels and furrows, however again this is capital intensive and will require significant investment.

Some farmers may pursue other options, such as an alternative use for their land, including sale as a 'lifestyle block' or for residential development and depending on planning restrictions; dryland farming options; or they may sell their water to others, maintain their home and seek alternative employment.

Consolidation is a common response, with the size of enterprises increasing through purchase of other irrigators and with greater levels of capital investment warranted through economies of scale. Diversification is also encountered, with, for example, a dairy farmer purchasing a dry land farm as an alternative source of feed for stock. These responses will again depend on profitability and savings or on the ability of the farmer to access borrowings.

Other enterprises affected by changes in water availability include food processing and irrigation districts. Food processors may need to go further afield to source products as farms in their traditional area cease or reduce production or they may close down. Loss of members from irrigation schemes may result in fewer irrigators to fund existing infrastructure, however this will be offset by ongoing payment of fees or the payment of exit fees by farms ceasing irrigation.

In summary, the effect of changing water availability will be generally, and on average, a net cost to farmers. This cost will be incurred through decreased income or increased costs or both. The existence of water markets will mitigate the impact to some extent, allowing some farmers to stay in business but with reduced profits. In some cases, some farmers may be better off, particularly where they had been using the water for a less efficient use and the price of water is set by more efficient uses. That is, they may make more profit from selling water than from using it for farming. Farmers with low levels of borrowings or with savings are more likely to benefit.

Where the reduction in water availability is a result of government policy, the impacts may be mitigated by compensation or purchase of water, depending on the price offered. Even though the compensation price may be less than the value of the water to the farmer, if the compensation price reflects the market price of water, the farmer would be in a neutral position insofar as the compensation allowed them to buy in water. This would not be possible across all enterprises, as the quantity of water available will be reduced, and demand by all farmers will drive the price of water up. Conversely, if the compensation price was more than the value of the water to the farmer and the farmer could stay in business, the farmer would make a windfall profit, however the same profit would be available if the farmer sold their water on the open market. However where a farmer does not buy in water, the value of irrigation infrastructure is likely to be lost, as the return on that infrastructure comes from the proceeds of a crop, and irrigation water is only

one of the inputs to that crop. In further support of this conclusion, it was often reported in consultations with growers and industry groups that the proceeds from permanent sale of water were used to retire debt (where that debt was the outcome of borrowings to fund capital investment in land, plant and machinery), rather than to invest in new enterprises within their local area. Compensation for lost water will only partially compensate the total cost to farmers, as without water, it is likely that land, plant and machinery will be significantly reduced in value. The true cost to farmers, and hence the compensation required, will be the current price of the enterprise as a going concern, less the value of the total enterprise with a reduced water allocation. Consultations in areas such as Merbein suggest the differential may be significant, with land and plant effectively valueless without water.

Regardless, the effect of reduced irrigation water will be that more marginal farmers and enterprises will cease business, either through voluntarily retiring from farming or through bankruptcy. Importantly, those marginal farmers will not necessarily be the least efficient farmers. An efficient farmer with a high debt level may well be worse off financially by comparison with an inefficient farmer with no debt level. Decisions will also depend on available options. A younger farmer may seek employment elsewhere, however an older farmer may have fewer options and continue farming with reduced profitability until retirement.

3.2 The local Level

3.2.1 Overview

The primary driver for long-term reductions in water availability for irrigation communities in the Murray Darling Basin will be government policy, including the purchase of water entitlements under *Water for the Future* and the setting of new Sustainable Diversion Limits (SDLs) under the forthcoming *Basin Plan*. Climate change is also projected to have an impact on reduced water availability by 2030. Permanent out of area trade is also likely to affect communities quite differently, depending on whether they are a net importer or exporter of water, and conditions under which it is traded.

Whilst there are likely to be benefits from increased water for the environment, reduced water for irrigation is likely to result in a range of social and economic impacts on agriculturally dependant communities across the Basin. It is important in this regard to distinguish between **short-term stressors** such as rainfall variation and fluctuating commodities prices, to which agricultural communities have been adapting over many years, and more permanent impacts from **long-term stressors**, in this case policy- and climate change-driven permanent reduction of water for irrigation.

In the face of possible permanent reductions in water availability and the associated impacts, this part of the study aims to answer the question, ‘how resilient are communities likely to be to permanent changes to irrigation water?’

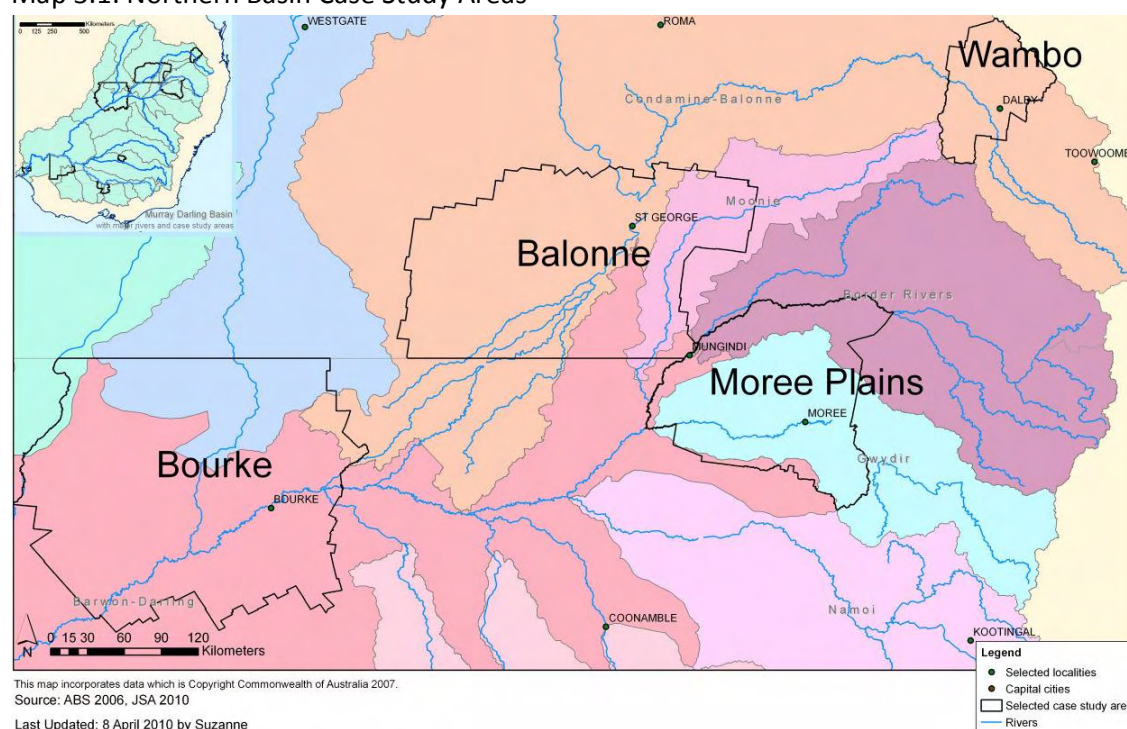
To explore the likely social and economic impacts and degree of resilience to more permanent changes in water at different geographic scales, JSA has developed a ‘resilience report card’, and

applied this to eight case studies across the Murray Darling Basin in different types of irrigated agricultural communities. The eight case study areas were selected in order to represent different states, different CSIRO Sustainable Yields Regions, cotton and non-cotton producing areas, a diversity of irrigated agricultural uses and diversity across three key attributes including population size, remoteness and Indigenous population. They were also selected to represent a 'top 10' in different irrigated agricultural produce. A case study selection matrix is provided at Appendix 10.

Selected case study areas in the Northern Basin are Dalby-Wambo, Queensland; Balonne, Queensland; Moree Plains, NSW; and Bourke, NSW. These case study areas, typically equivalent to an LGA, are augmented by an overview of the regional context, or of smaller communities within these areas, to illustrate some of the impacts that are likely at different scales.

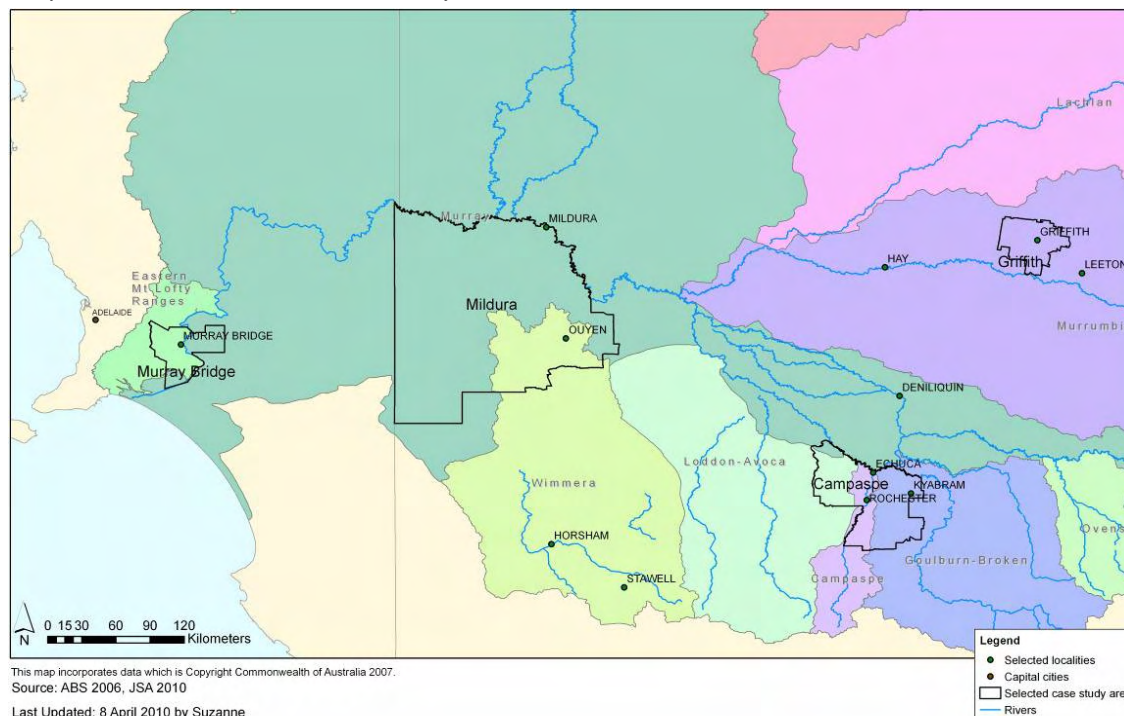
The following map shows these case study communities in the context of the Northern Basin.

Map 3.1: Northern Basin Case Study Areas



Selected case study areas in the Southern Basin are Griffith, NSW; Campaspe, Victoria; Mildura, Victoria; and Murray Bridge, South Australia. The following map shows these areas in the context of the Southern Basin.

Map 3.2: Southern Basin Case Study Areas



Although we have only been able to focus on eight areas, it is hoped that the case studies will provide information for communities within the Basin facing similar challenges, and draw out those characteristics of communities that are likely to mitigate or exacerbate the impacts of permanent reductions in irrigation water.

This section first provides an overview of the framework for assessing likely socio-economic impacts at the local level (the ‘resilience report card’), a rationale for the approach used and other methodological considerations. It then provides an overview of key findings for case study areas against main elements of the framework. This is followed by a brief summary on each of the case studies, supported by detailed reports on each at **Appendices 1 to 8**.

3.2.2 The Resilience Report Card’: Rationale and Methodology

Overview

A ‘resilience report card’ was developed and applied to each case study community in order to understand how resilient or vulnerable a community is likely to be in the face of permanent reductions in irrigation water. Key factors were derived from the literature, research conducted in earlier stages of this study,¹¹ and consultations with case study communities from January to June 2010. The resilience report card’ includes:

¹¹

- Projected changes in employment, population, and indicators of community wellbeing modelled for 10%, 25% and 50% cuts in irrigation water on the 2005-06 growing season;
- Factors found to have a statistically significant relationship to wellbeing and resilience, which largely supported findings from previous studies;
- The current status of the case study community in terms of existing socio-economic indicators of resilience compared with the MDB and national averages; and
- Factors which are likely to mitigate or worsen projected impacts identified during field research, explored during two field visits to each community and consultations with a range of stakeholders.

An overview of the approach used in relation to each of these is provided below, and in detail for each case study area in **Appendices 1 to 8** of this report.

3.2.3 Applying the ‘Resilience Report Card’

This section provides an overview of comparative data and findings on each of the components of the resilience report card set out above.

Projected Impacts on Population, Employment and Other Socio-Economic Indicators

The effects of a permanent reduction to irrigation water on each of the case study areas from permanent reductions in the availability of irrigation water that may occur through reductions in SDLs under the forthcoming *Basin Plan*, trade of permanent water out of area or climate change has been modelled using data from Research Strategies 1 and 2 of this study.¹² The extent to which additional reductions in entitlements or allocations may occur under the Basin Plan is at the time of writing unknown. As such, we have modelled 10%, 25% and 50% cuts in irrigation water from that used in the 2005-06 growing season.

Employment and population loss predicted is likely to be an under-estimate due to Census undercounting related to coding and self-reporting issues, the inability to identify all agricultural jobs in our analysis, and the use of an ‘average’ multiplier for agriculture, with irrigated agriculture anecdotally associated with higher flow-on effects.

A more conservative assessment is also likely as an LGA-based case study approach cannot adequately estimate cumulative impacts, for example, where a case study area services a wider hinterland in value-added processing, warehousing, distribution and the like, or where there are

¹² JSA (2010) Report 1: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Scoping Paper*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri; JSA (2010) Report 2: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Understanding Agricultural Employment*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri; and JSA (2010) Report 3: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Irrigated Agriculture and Socio-Economic Indicators*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri.

threshold effects, for example, where population loss means the population is insufficient to support certain services, or where water reductions means an agricultural use is not viable. Such relationships are not necessarily linear. Smaller towns and LGAs in the hinterland of the case study may also be seriously affected, particularly where these communities are smaller, more remote and more agriculturally dependent.

Cumulative impacts and those that may be experienced at different scales have been noted in the case studies where possible, and a smaller community and/or regional perspective is provided in various case studies to provide examples of how these may affect different types of areas.

The following graphs show the different impacts on employment and population for each of the case study areas from our modelling of 10%, 25% and 50% reductions in irrigation water. The size of the impact modelled is related to the size of the economy and population base, the degree of reliance upon irrigated agriculture, and the nature of the next best land use assumed. As noted above, these are likely to be lower bound estimates, and probably a significant underestimation in some cases.

The situation is somewhat more complex than these figures indicate, and these graphs should be read in conjunction with case study summaries below. Despite the fact that employment and population loss in Bourke and Balonne Shires are projected to be quite small in quantum, for example, the impacts on a very small, agriculturally dependent community are likely to be large, and could provide a tipping point for a community with the socio-economic characteristics of Bourke. By comparison, the quantum of losses for Dalby-Wambo case study area are also projected to be quite small, however the impacts are projected to be relatively minor because of the size of the local economy. Moree Plains is projected to experience mid-range loss of jobs and residents, and is somewhat cushioned by the robustness of its dryland agricultural base. Nonetheless, it is not a large economy, and cumulative impacts on services and industry would be expected as population falls below relevant thresholds.

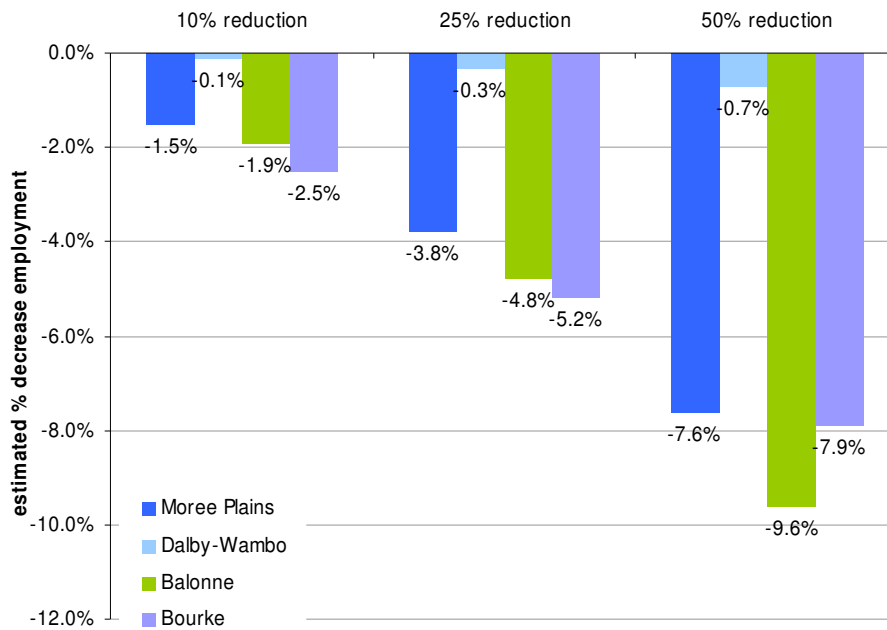


Figure 3.1: Estimated reduction in employment with different reductions in water availability across Northern Basin Case Study areas.

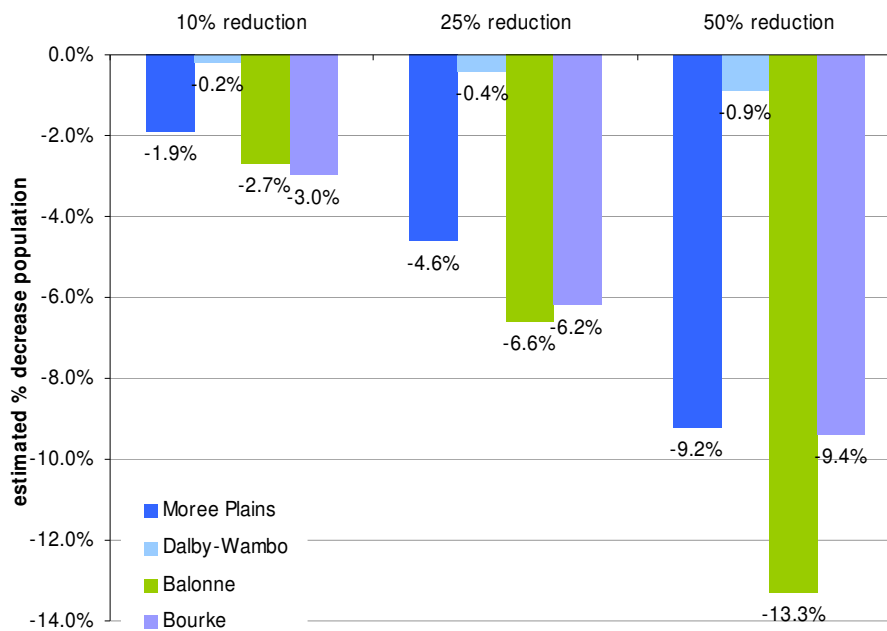


Figure 3.2: Estimated reduction in population with different reductions in water availability across Northern Basin Case Study areas.

Projected population and employment loss for Rural City of Murray Bridge in the Southern Basin are also quite small in quantum, but its hinterland is large and heavily reliant upon agriculture, so that the impact of such employment loss is likely to be understated when viewed in the regional context of the Murraylands.

The remaining three Southern Basin case study areas are projected to have larger losses in jobs and people. Mildura and Griffith are particularly exposed as areas highly reliant upon irrigated agriculture, which has in a sense provided the rationale for their existence. Mildura is a much larger economy and a major regional service centre, so that it may be cushioned from such loss, though there are risks for its resilience if it drops below the 50,000 population threshold found to make an area more independent from the fortunes of its agricultural base. However, its remoteness and cumulative impacts from its large, agriculturally dependent hinterland are also risks. Griffith is very exposed to significant social impacts in the event of employment and population loss. It is highly reliant on irrigated agriculture, is remote and does not have the size and other advantages of a service centre like Mildura. Campaspe is also projected to experience a relatively large loss of jobs and population with reduced irrigation water due to its high reliance on irrigated agriculture and has substantial value-added processing from quite a wide hinterland, though it has a range of mitigating factors from its more favourable location.

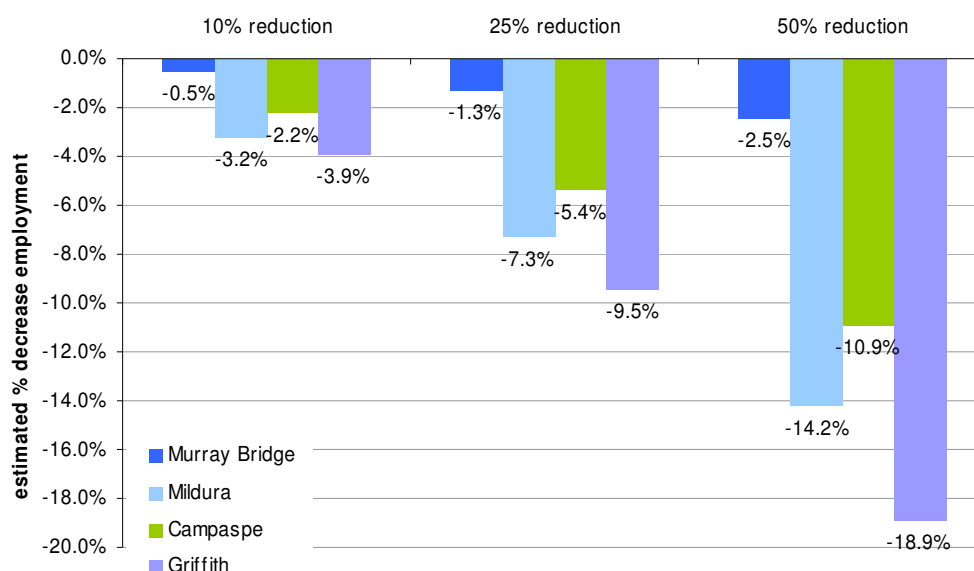


Figure 3.3: Estimated reduction in employment with different reductions in water availability across Southern Basin Case Study areas.

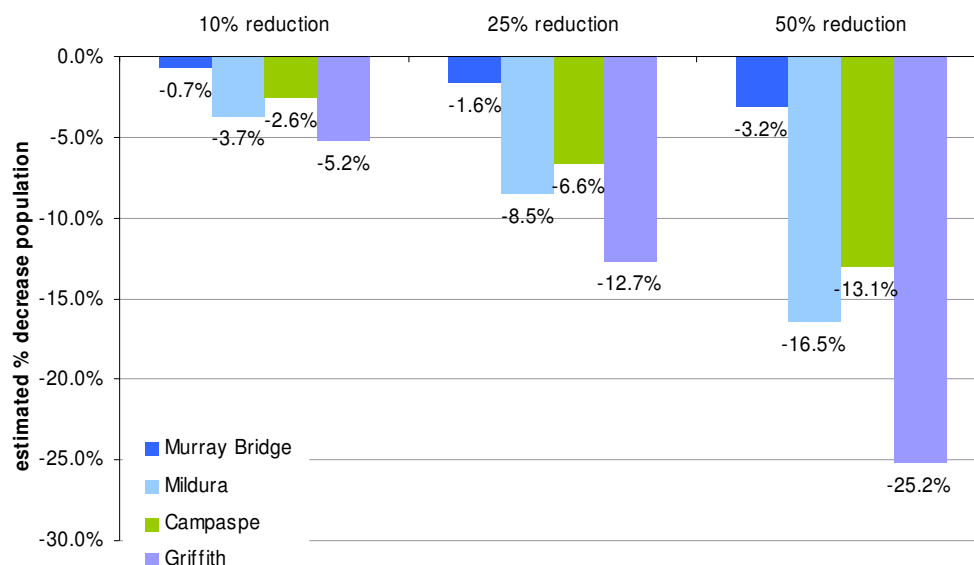


Figure 3.4: Estimated reduction in population with different reductions in water availability across Southern Basin Case Study areas.

A more nuanced understanding is thus required than these figures provide, and the reader is referred to the individual case study summaries below, and reports in Appendices 1 to 8, for a more detailed assessment.

Factors Affecting Wellbeing and Resilience

A number of factors were found to predict changes in indicators of wellbeing and resilience in earlier stages of this study,¹³ including changes in employment and population. These included degree of remoteness,¹⁴ degree of urbanisation (population size), proportion of Indigenous people particularly remote populations,¹⁵ and age of the population.¹⁶ Degree of economic diversity and opportunities to diversify were also relevant factors identified in the literature,¹⁷ though our findings indicate that these factors are largely a function of other factors like remoteness,

¹³ JSA (2010) Report 2: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Understanding Agricultural Employment*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri; and JSA (2010) Report 3: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Irrigated Agriculture and Socio-Economic Indicators*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri.

¹⁴ As set out in *Statistical Geography: Volume 1 Australian Standard Geographical Classification (ASGC), 2006 (cat. no. 1216.0)*.

¹⁵ It is noted that, although 'Indigenous people' is a proxy indicator, it is not being Aboriginal *per se* that signifies disadvantage but a range of attributes that are more likely to found among Aboriginal people, such as low income, educational and employment status, being sole parent, lower likelihood of home ownership, etc

¹⁶ JSA (2010) Report 2: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Understanding Agricultural Employment*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri; and JSA (2010) Report 3: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Irrigated Agriculture and Socio-Economic Indicators*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri.

¹⁷ JSA (2010) Report 1: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Scoping Paper*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri.

proximity to a large urban centre or to other economic resources like extractive industries, and to a large extent not within the control of a local community, though strong community leadership from local government, regional development agencies and the like can assist in capturing investment opportunities.

This section provides a comparison of the eight case study areas against the MDB average for areas and Australia for each of the indicators found to be statistically significant predictors of changes in indicators of community resilience and wellbeing, including of employment and population change. The following graphs shows a high level of diversity across the eight areas, as well as some clear similarities and differences between the Northern and Southern Basin case study areas.

In general, the Southern Basin case study areas have much larger populations than those in the Northern Basin, with Mildura the largest at around 50,000 people in 2006, and Bourke the smallest at just over 3,000 people. The importance of population thresholds was noted in Report 3 of this study, with areas like Bourke and Balonne at less than 5,000 people very vulnerable to changes in their economic base due to their disproportionate reliance upon agriculture and those over 50,000 generally far more independent from their agricultural base. The less remote location and proximity to major regional centres in Victoria are likely to account for Campaspe's size and continued growth. Moree at around 14,000 has the status of a district-level service centre, but it would not want to lose much more population, and threshold effects are already being reported in terms of loss of services to larger regional centres like Gunnedah and Armidale.

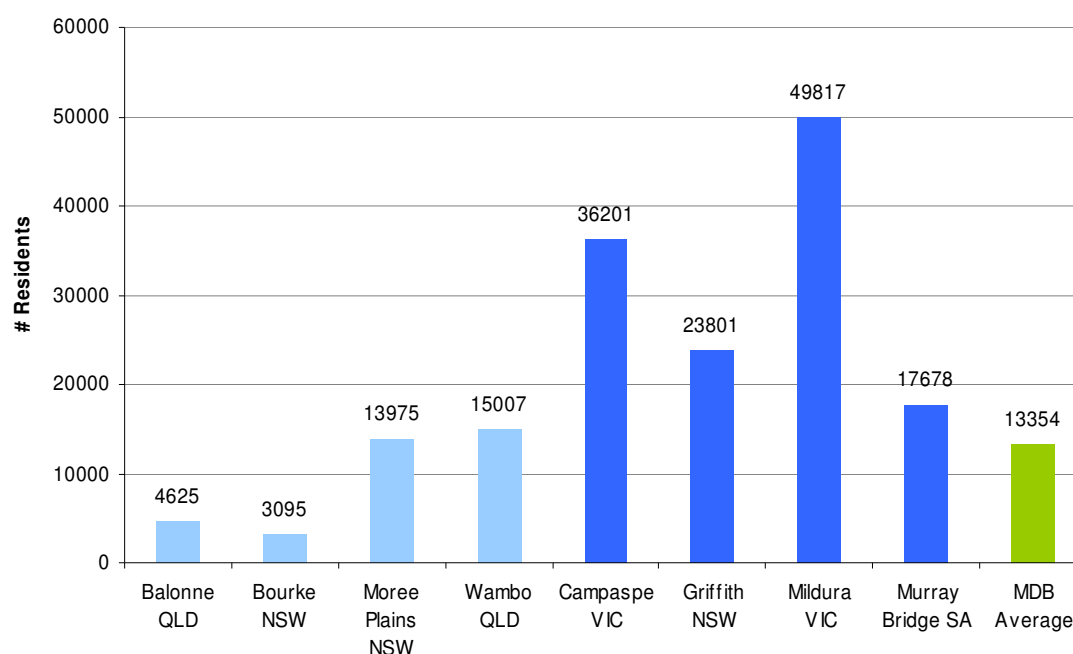


Figure 3.5: Total Resident Population, 2006

Source: ABS (2006) Census of Population and Housing, JSA (2009)

In general, the Northern Basin case study areas are much more remote than those in the Southern Basin, particularly Balonne and Bourke, though Mildura and Griffith are almost as remote as Moree Plains. Their differences in size, despite degree of remoteness, is in part related to the nature of the river system, degree of regulation, and level of water security that has enabled the growth of larger centres in remote areas of the Southern Basin.

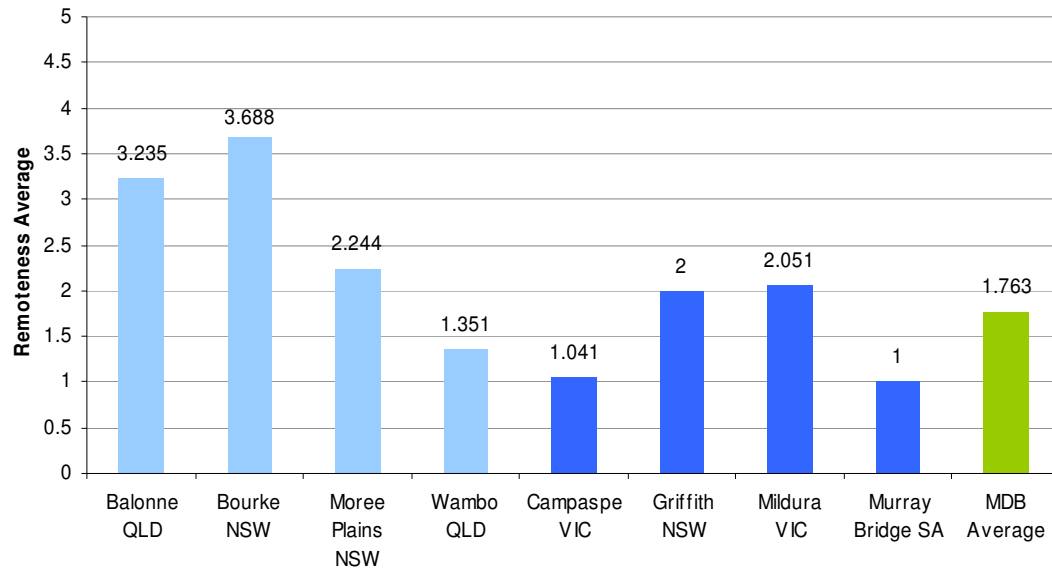


Figure 3.6: Remoteness Average

Source: ABS (2006) Census of Population and Housing, Special Order. JSA (2009)

There are stark differences between the proportion of Aboriginal people in most Northern and Southern case study areas, as shown in the following graph. Bourke, Balonne and Moree all have very high proportions of Aboriginal people, whose presence was found to be related to much higher levels of disadvantage, poor health, education and employment indicators. When combined with their remoteness and size, Bourke and Balonne Shires would be expected to be very vulnerable communities to any loss of employment and population through an increase in the Aboriginal proportion of their population.

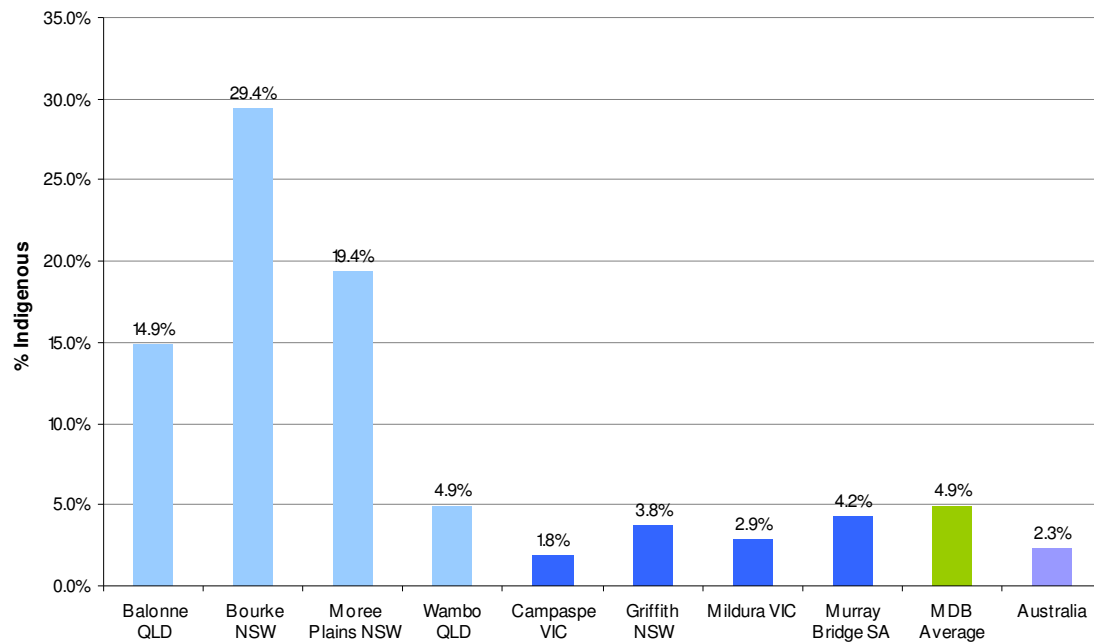


Figure 3.7: % Indigenous Population

Source: ABS (2006) Census of Population and Housing, JSA (2009)

Northern case study areas generally have considerably younger median age values than the Southern case study areas, with younger median age normally associated with more positive socio-economic status and resilience. However, in the case of Bourke, Balonne and Moree Shires this is more likely to be associated with a very young and disadvantaged Aboriginal population. Less remote, high amenity areas of the Southern Basin areas like Campaspe show the effects of retention of older people and its attraction as a ‘tree change’ area for retirees. Griffith’s younger age profile is reported to be due to cultural factors and retention of younger people in family businesses and, like Mildura, there have been a good number of entry-level jobs in horticulture, value-added processing and the like. Dalby-Wambo’s proximity to Toowoomba and the coast and to rapidly expanding energy and mining opportunities also has a young workforce and a high turnover of residents.

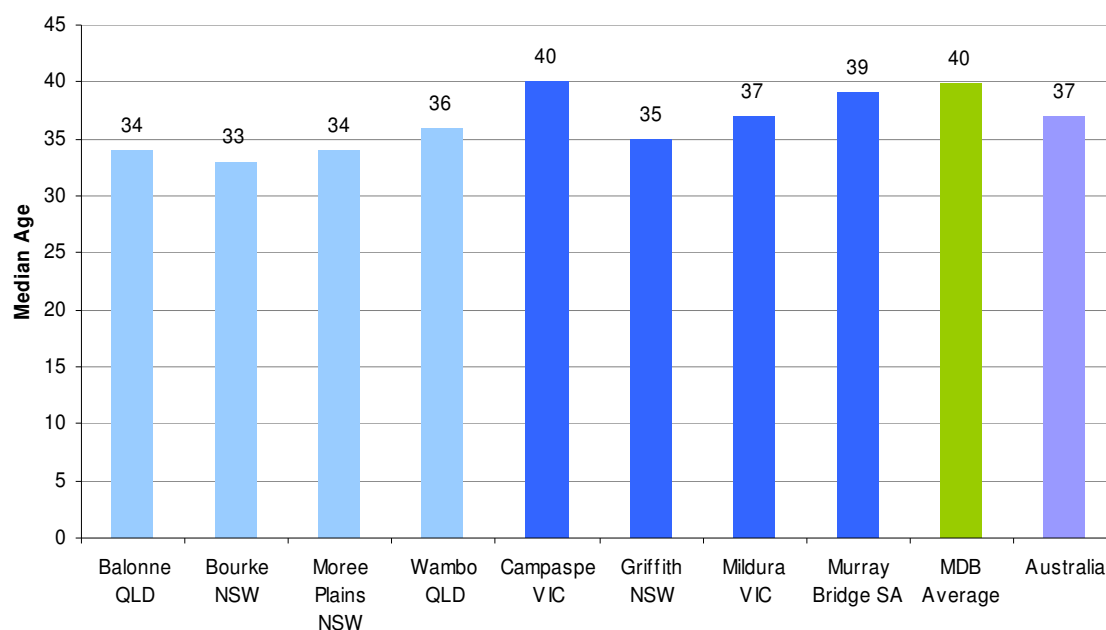


Figure 3.8: Median Age

Source: ABS (2006) Census of Population and Housing, JSA (2009)

Degree of reliance upon irrigated agriculture and relative level of economic diversity are also key factors in how resilient a community is likely to be in the face of reduced water for irrigation. As noted above, such diversity is to a large extent the result of circumstances over which a community has limited control, including its remoteness from metropolitan markets, proximity to mineral or energy resources, and scenic beauty, though our case studies indicate that strong community leadership can help to promote any advantages the area may have in seeking alternative economic opportunities.

The following table, summarised from the case study reports at Appendices 1 to 8, provides an overview of our assessment as to whether an area's economic diversity is likely to contribute to resilience with less irrigation water. Factors considered were reliance upon agriculture and particularly irrigated agriculture, likely flow-ons including factors relevant to the local and regional context, the extent to which the area compares with MDB and national industry sector values, including alternative productive sectors, and other factors from consultation.

Apart from Dalby-Wambo, with locational and extractive-industry related advantages, case study areas of the Northern Basin lack economic diversity, and appear unlikely to have significant diversification opportunities in the future, largely due to remoteness and absence of alternatives like extractive industries. Murray Bridge has strong advantages related to its proximity to Adelaide, though its hinterland is highly agriculturally dependent, but the other Southern Basin case study areas are more problematic. Griffith is probably the most exposed area among Southern case study areas due to its location, and neither it nor Campaspe shows economic maturity in most industry sectors. Mildura is more diverse, and has advantages from its regional centre status, but the degree to which productive sectors not related to irrigated agriculture will

develop to offset projected job loss appears somewhat problematic, again due to remoteness as well as the importance of irrigated agriculture to its large hinterland.

Table 3.1: Economic Diversity and Contribution to Resilience

Case Study Area	Is economic diversity likely to contribute to resilience with less water?	Summary from Case Study Reports
Dalby-Wambo	√?	Reasonably diverse economic base, opportunities in manufacturing, mining and energy sectors, and benefits of being a district service centre. Remains relatively dependent upon agriculture and value-added processing and services to agriculture.
Balonne	X	Highly reliant on agriculture and directly related activities, with around 85% of jobs related to agriculture. Irrigated agriculture accounts for at least 50% of direct employment and flow-ons
Moree Plains	X?	Highly reliant upon agriculture and related industries, though dryland cropping and grazing is a robust sector. Some benefits from being a district service centre, including higher % of public sector and retail jobs, but this also makes Moree vulnerable to ongoing centralisation of public services and jobs. In a sense, it is not 'remote enough'.
Bourke	X?	Very reliant on agriculture and flow-ons, though Bourke also has a relatively high % of public and community sector employment related to its large welfare sector and role as a remote service centre, and its remoteness could work in its favour in terms of retention of key services. However, it has very few opportunities for diversification in other non-agricultural sectors, and irrigated agriculture can be seen as a key diversification strategy that has mitigated long-term population loss to some extent.
Murray Bridge	✓?	Lower than MDB average of jobs in agriculture, but services a large, agriculturally dependent hinterland. Murray Bridge has a more diversified economy than the MDB average as a regional service centre, though it is considerably less diverse than the national economy. Continued economic growth depends on SA govt growth policy, retaining and attracting new businesses, and flow-on impacts from any water reductions in the hinterland.
Mildura	?	Much higher reliance on agriculture, value-added processing, warehousing and distribution, with at least one-third of employment in or related to irrigated agriculture in terms of flow-ons. Likely to be higher due to anecdotally higher multipliers from horticulture, and servicing a large irrigated agricultural hinterland. Lower than average employment in alternative productive industry sectors not related to agriculture. However, employment in the service sector, including health and education, and in retail is relatively high due to Mildura's importance as a regional centre. A significant increase in alternative industry sectors would be required to offset loss of jobs in irrigation, which may be problematic due to remoteness.

Case Study Area	Is economic diversity likely to contribute to resilience with less water?	Summary from Case Study Reports
Griffith	X	Lower than MDB and national averages for economic diversity across most industry sectors. Remains highly reliant on irrigated agriculture and related industries and flow-ons. Decline in agriculture would need to be offset by new or expanded industries, which appears unlikely given locational disadvantages.
Campaspe	X?	Lower than MDB and national averages for economic diversity, though population threshold reported to be increasing regional-level retail and services. Remains highly reliant on agriculture and related industries. Decline in agriculture would need to be offset by new or expanded industries. Tourism is perceived to be strong but employment in key sectors such as accommodation, food and recreation are average or below average. Therefore, visitation does not necessarily seem to be translating into jobs.

Current Status of Community Resilience Indicators and Projected Change

It is also necessary to understand the current status of case study communities with regard to key socio-economic of indicators of community resilience in order to examine how robust or how vulnerable a community is likely to be to projected changes in employment and population arising from less irrigation water. The 'resilience report card' therefore also provides an assessment of the extent to which the current socio-economic status of each case study community compares with MDB and national benchmarks.

The following proxy indicators or resilience were derived from key literature from earlier stages of this study. Their selection was also influenced by the need to be readily available for the relevant period, and comparable at selected geographies. They include:

- Proxy Indicators of Community Wellbeing:
 - SEIFA Disadvantage (includes indicators related to people's access to material and social resources, and their ability to participate in society)
 - SEIFA Economic Resources (including income, housing expenditure and assets of households)
 - Median Household Income
 - Disability Support Pensions
 - Premature Death
 - Profound or severe disability
 - Crime rates related to domestic and non-domestic assault and aggregate property crime (available for NSW only);
- Economic growth and adaptability:

- Change in Total Employment 2001-06
- Labour force participation 15+ years
- Labour force participation 65+ years
- Post-school qualification (skills base)
- School participation at 16 years
- SEIFA Index of Education and Occupation (includes relevant Census variables on the general level of education and occupation-related skills and status of a community)
- GINI co-efficient of household income distribution/polarisation
- Youth unemployment rate
- General unemployment rate
- Amenity:
 - Population Growth
 - In-migration
- Social capital:
 - Volunteering rate

It is noted that there are more qualitative aspects to these indicators. These were also explored through field visits and consultations with a range of stakeholders in each case study community, as discussed below.

Overview

Differences in variables such as industry mix, median age, remoteness, population and indigenous population would be expected to translate to particular outcomes for selected indicators of community resilience. However, the situation is more complex when looking at selected proxy indicators, as discussed in detail in the case study reports. A comparison between the case study areas, and between the Northern and Southern Basin, is instructive in this regard.

Changes in population and employment in the 2001-06 inter-censal period are first discussed. This is followed by an overview of relevant proxy socio-economic indicators. Again, note that more detail is provided in Appendices 1 to 8.

Employment and Population Change 2001-06

The following graphs show employment and population changes in the case study areas from 2001-06 compared with the MDB and national averages.

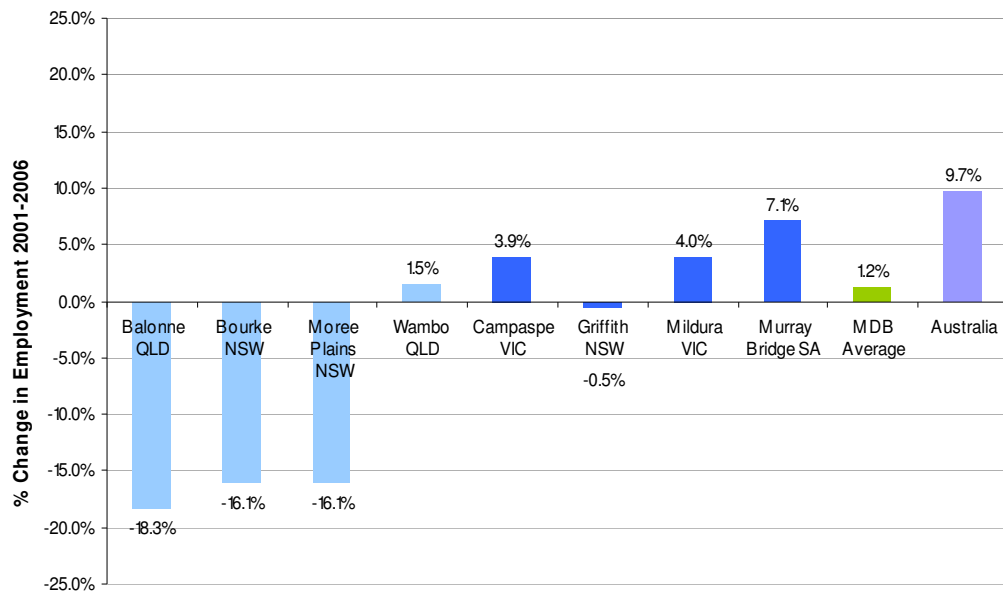


Figure 3.9: % Change in Employment 2001-2006

Source: ABS (2006) Census of Population and Housing, JSA (2009)

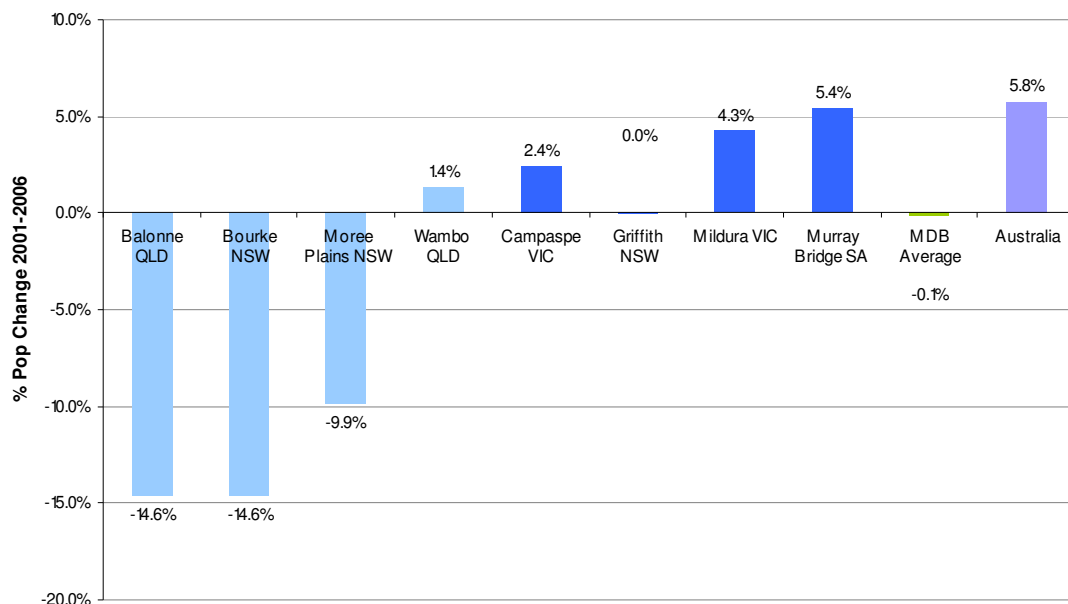


Figure 3.10: % Population Change 2001-2006

Source: ABS (2006) Census of Population and Housing, JSA (2009)

There is, in general, a stark contrast between the case study areas of the Northern Basin and the Southern Basin regarding population and employment change in the 2001-06 inter-censal period. Apart from Dalby-Wambo, with its less remote location, higher degree of urbanisation and diverse economic opportunities from mining, energy and manufacturing, which experienced small growth (1.4%), the case study areas of the **Northern Basin** have sustained major population

losses from 2001 to 2006, particularly in the more remote, smaller and more agriculturally dependent areas of Balonne and Bourke (around 15% each). Moree also sustained heavy population loss during the extended drought period (10%) after having a relatively stable population base in the previous inter-censal period. Though the impact of the drought and low water allocations from 2001 to 2006 are clearly evident in Moree as well, it is less remote, much larger and more urbanised, which is likely to have contributed to the less severe impacts.

In contrast, the SA and Victorian case study areas in the **Southern Basin** have experienced population growth during this period though, apart from Murray Bridge, this was generally well below the national average. The attractiveness of Echuca (in Campaspe) and Mildura as larger regional centres with a large intensive agricultural hinterland and a 'tree change' influence is apparent. This was particularly evident in Mildura. Although twice as remote as Campaspe, it had double the population increase, with in-migration reported among families and older people, and greater retention of its younger people in its diverse service sector and University outreach campus. As noted above, it had almost reached the 50,000 threshold in 2006 where agriculture begins to be less determinative of future resilience, though its relative lack of industry diversification means that it is still vulnerable to changes in water availability, particularly from cumulative impacts from its wide hinterland. Campaspe has also grown, though this is likely to be mainly due to absorption of population from its immediate and wider hinterland, and some counter-urbanisation trends from those wanting to live in a more rural setting. Murray Bridge's somewhat higher growth is largely due to an absorption of people from more remote rural areas, as well as the cheaper housing and entry level jobs attractive to less well off people from Adelaide, less than an hour away. Despite its lower level of Aboriginal population, it is the most disadvantaged of all the case studies across a number of key socio-economic indicators. Griffith, in NSW, went against the Southern Basin growth trend, experiencing a small decline in population from 2001 to 2006. Griffith was smaller, and thus somewhat more reliant upon irrigated agriculture including from a wide hinterland, and generally more remote than the other case Southern case study areas, which may in part account for its different growth trajectory.

As well as these broader trends of remoteness, size and degree of urbanisation, the impacts of water availability and security are clearly evident in the differences in the trajectories of the Northern and Southern Basin case studies. Bourke, Balonne and Moree in particular have experienced significant reductions in water availability under significantly reduced allocations due to protracted drought, generally much lower levels of water security in a far less regulated river system, and administrative changes in the amount of water available. Moreover, the variability of rainfall and lower levels of security are evident in population fluctuations over time, though other forces like technological change are also clearly at work. The Dalby-Wambo area has been more cushioned from these drought effects through its location and natural attributes that provide for greater economic diversity.

Unlike the Northern Basin, the SA and Victorian areas of the Southern Basin were, to a large extent, cushioned from the worst of the drought from 2001-06. Most of their irrigation water is high security in the highly regulated Murray River system, which has enabled permanent plantings and high value vegetable production. Areas like Campaspe and Mildura operated at near 100% water allocations during the drought years of 1997/98 to 2005/06, and so were buffered from drought effects evident in the Northern Basin. Though other factors such as size

and remoteness are also at play, the extreme differences between the different parts of the Basin during the 2001-06 periods are influenced to a significant extent by water availability and related administrative factors. Griffith in the NSW Murrumbidgee system, and rice-growing areas like Coleambally and Deniliquin in its hinterland, were more exposed to the early part of the drought, which is evident in the fact that it was the only Southern case study area not to grow, though the fact that much of its employment is in horticulture and other produce with high security licences probably account for the maintenance of its population compared with more remote Northern Basin case study areas.

Serious impacts have been felt since 2006/07, when three years of historically low flows depleted upstream storages at Hume and Dartmouth dams leading to the first low allocation years seen in some areas. The area below Lock 1, in which Murray Bridge is located, was particularly hard hit, as low river and lake levels made it impossible for irrigators to access allocations without incurring significant cost, for example to extend pump intakes. This was exacerbated by fluctuations in commodities prices in various horticultural sectors.

Though anecdotal reports of recent job loss have been received in a number of the case study areas, and particularly in smaller more agriculturally dependent communities, there is likely to be a lag time in terms of flow-ons to other sectors and to population loss, as discussed in the Bourke case study, and the extent of impacts will not fully be understood until at least the next population count in the 2011 Census.

It is therefore instructive to look at the Northern Basin, which has in many ways been running a 'real time simulation' of the social and economic impacts of significantly reduced water from a severe prolonged drought, and to a lesser extent, changed administrative arrangements in some areas. Though powerful forces are also at play in the different areas, as discussed in earlier reports, the population and employment impacts in the Northern Basin are likely to be experienced to some extent in the Southern Basin in the long-term with permanent reductions in water.

The level of impacts will depend upon key factors like remoteness, size, Aboriginal population, age and diversity, outlined above. They will also be influenced by the existing level of resilience or vulnerability in terms of existing socio-economic indicators, and the extent to which other factors may exacerbate or mitigate projected impacts. These two matters are discussed in turn below.

Summary of Existing Socio-Economic Indicators of Resilience

The following table provides a brief summary of the current status of the eight case study communities in terms of key indicators of resilience including levels of disadvantage, income, underlying measures of human capital like employment and educational status, health, social capital and crime (for NSW). Such indicators provide only 'proxy measures' of current resilience, and discussions about what they may mean in the local context were held on field visits to each of the areas to provide a more nuanced understanding. Employment and population change from 2001-06, discussed above, are also relevant considerations. Detailed rationale is

provided in case study reports at Appendices 1 to 8, and relevant graphs are provided in Appendix 9.

Table 3.2: Summary of Socio-economic Indicators of Community Resilience

Case Study Area	Community Status Re Indicators (1)	Summary from Case Study Reports
Dalby-Wambo	Fair	Benefits from location and access to more diverse economic opportunities evident in good performance against SEIFA Index of Disadvantage and of Economic Resources, low levels of unemployment and steady employment and population growth; but vulnerability evident in relatively low education and occupation index, low skills base, low school participation rate, and mixed health indicators.
Balonne	Fair	Better indicators than other remote Northern areas, including very low unemployment, high SEIFA Index of Education and Occupation, much higher median income and labour force participation, and long-term population growth. Less favourable indicators probably related to large Aboriginal population, though better health and disability indicators than similar areas, and 2.5 times national volunteering rate indicates a high level of engagement including of Aboriginal residents.
Moree Plains	Poor	Despite being larger than Balonne, has worse indicators of vulnerability in terms of high disadvantage, low education and occupation SEIFA Index, low skills base, low level of school participation at 16 years, mixed health indicators, and low volunteering rate. Larger Aboriginal population would account for some of this.
Bourke	Poor	An extremely disadvantaged community, mainly related to the very high Indigenous population exacerbated by remoteness, including very poor health outcomes, very high crime rate, and very high disadvantage against key indexes, very poor human capital indicators, and long-term population decline, though much less severe than 2001-06 drop.
Murray Bridge	Poor	The most disadvantaged case study area for socio-economic status and health indicators, despite its size and urbanisation. Also poor educational, occupational, school and labour force participation indicators and high unemployment. Some very vulnerable populations including migrants and refugees, and those from Adelaide and hinterland seeking cheap (including social) housing and lower-skilled in processing jobs.
Mildura	Poor	Profile indicates likely to be quite vulnerable to structural economic change, despite its size and growth from 2001-06. Increasing inter-censal disadvantage, relatively poor health and disability indicators despite younger and low Aboriginal population. Educational and employment indicators and those related to underlying human capital are quite low for a regional area and much lower than Australia. The effects of its more remote location may be evident.
Griffith	Fair	Indicators suggest that area has prospered from irrigated agriculture and associated industries including retention of younger people, lower disadvantage, good health indicators and income and low unemployment. Some of its advantages may also be related to its younger age structure. Others indicate

Case Study Area	Community Status Re Indicators (1)	Summary from Case Study Reports
		vulnerability to structural change including quite poor economic, educational and employment status.
Campaspe	Good	Advantages related to size of Echuca and less remote location, and low Aboriginal population, including lower levels of disadvantage, low unemployment rates and higher school participation rates. Older age profile and popularity among retirees probably influences somewhat worse than average health and disability indicators.

- (1) 'Good' indicates that socio-economic indicators are on balance more favourable than average; 'Fair' indicates that indicators are quite evenly distributed between more and less favourable indicators; and 'Poor' indicates that indicators are on balance more unfavourable than average.

Predicted Changes in Socio-Economic Indicators with Less Irrigation Water

Changes in indicators of community resilience were modelled for a 10%, 25% and 50% reduction in irrigation water. As detailed in previous stages of this study, impacts on indicators of community resilience are mainly related to projected changes in employment and population rather than the nature of land use or agricultural mix *per se*. Changes in the size and mix of the population are relevant in this regard.

Already small and remote areas like Bourke or Balonne are projected to lose even more population, and the population that remains is projected to be more residual, for example with more older people and a higher concentration of Aboriginal residents, which in turn increases the predicted level of disadvantage. Areas like Dalby-Wambo and Murray Bridge are projected to have little change as the quantum of projected population and job loss is not large compared with their population. Though a larger centre, an area like Moree that is more remote and has an already high proportion of Aboriginal people is likely to become more residualised.

The impacts on areas like Mildura and Griffith would be generally negative, as they are remote and highly reliant on irrigated agriculture, and employment and population losses are projected to be quite large, though they are saved from worse impacts due to having a much lower concentration of disadvantaged Aboriginal residents. Though Campaspe is projected to sustain reasonable job and population loss, urbanisation and absence of a large Aboriginal population means it is likely to sustain limited impacts on socio-economic indicators.

Table 3.3: Projected Changes in Indicators with Population and Employment Loss

Case Study Area	Change in Indicators Predicted?	Comment
Dalby-Wambo	Little Change	Fairly small quantum of population loss, a larger area with more diverse economic opportunities, and existing indicators reasonable.
Balonne	Much Worse	Negative impacts across most indicators from more residualised population, e.g. older and more disadvantaged Aboriginal residents in a small, remote area

Case Study Area	Change in Indicators Predicted?	Comment
Moree Plains	Much Worse	Negative impacts across most indicators from more residualised population, e.g. older and more disadvantaged Aboriginal residents in an already disadvantaged area
Bourke	Much Worse	Negative impacts across virtually all indicators from more residualised population, e.g. older and more disadvantaged Aboriginal residents, and from an already severely disadvantaged base
Murray Bridge	Little Change	Fairly small quantum of population loss and larger area, noting the already highly disadvantaged nature of the existing community
Mildura	Worse	Most indicators slightly worse, but a few positive changes including lower crime rate with reduced population
Griffith	Worse	Most indicators slightly worse, but a few improvements from less people including lower assault and property crime rates and more volunteering.
Campaspe	Little Change	More youth unemployment but lower crime rate projected.

Other Factors that indicate vulnerability or resilience

Relevant literature and observations during the first field visits to case study areas indicate that there are a range of other factors that are relevant to community resilience, and which may mitigate or exacerbate projected impacts for reduced irrigation water. These include:

- The nature of the ‘next best’ land use without irrigation water, so as to understand the quantum of likely employment substitution;
- Ability to ‘recover’ from drought and past responses to stressors;
- Potential benefits from open trade in water;
- Ability to make further efficiency gains, which would indicate the extent to which reductions in irrigation water could be absorbed within current business structures;
- Access to other economic opportunities such as mining and extractive industries, or access to major markets such as capital cities that could facilitate business relocation;
- Other natural attributes such as scenic beauty, strategic location and environmental conditions;
- Leadership, networking and co-ordination to facilitate community responses to significant stressors, in this case, potential reduction in irrigation water.

Many of these factors are best understood in a qualitative sense. As such, they were explored further during the second round of field visits with a range of key informants in each case study community, supplemented where possible with data, reports and the like.

It was beyond the scope of this study to look at these factors in detail. However, the overview provided for each case study area as the final part of the ‘resilience checklist’ has assisted in

building up a picture of how resilience a community is likely to be in the face of reduced irrigation water and the extent to which such factors may mitigate or exacerbate the impacts of water reductions predicted earlier.

The following table provides an overview of the status of each factor, looked at in detail in the case study reports at Appendices 1 to 8. Key issues related to each of the main factors are summarised following this table.

Table 3.4: Other Factors Related to Community Resilience or Vulnerability

Case Study Area	Likely to contribute to community resilience /mitigate projected impacts?						
	Nature of 'next best' land use without water	Potential benefits from open trade in water	Ability to 'recover' from drought /past responses to stress	Ability to make further efficiency gains	Access to other economic opportunities	Other natural attributes	Leadership, networking and co- ordination
Dalby-Wambo	X?	X	√	X?	√	√?	?
Balonne	X?	X?	√	X?	X	?	√
Moree Plains	?	X?	?	?	X	X	√
Bourke	X	X	√	?	X	?	√
Murray Bridge	X?	√?	√?	X	√	√	√
Mildura	X	√?	√?	X?	?	√?	√
Griffith	X	?	X?	?	X	X	√
Campaspe	X?	√?	√?	?	X?	√	?

'Next Best Land Use' with Loss of Irrigation Water

There will always be a loss of jobs associated with the **'next best land use'**, in terms of jobs per hectare. The impact will be most severe where the gap between employment in the current use and the most feasible 'next best use' is the greatest, or where there is effectively no feasible alternative to the current use, for example due to fragmentation or quantum of land under irrigation where dryland farming is the next most profitable use. Areas of the Southern Basin with low rainfall, and very high value horticultural uses and smaller holdings, like Mildura and Griffith for example, and where the next best use is often grazing, would be very exposed. Similarly, areas like Bourke and Balonne, where there are limited opportunities for dryland cropping, would also expect to be more vulnerable if they lost irrigated cotton and cereal crops; whereas Moree Plains may have greater opportunity for mitigation due to higher rainfall and a more robust dryland cropping sector, though again job losses between the existing and next best use would be significant.

Potential benefits from increased liberalisation of water trade

In terms of **potential benefits from increased liberalisation of water trade**, a significant Northern-Southern Basin divide is evident due to the greater connectivity, regulation and water security of much the Southern Basin that more readily facilitates water trade. Certainly, the ability to trade temporary water or seasonal allocations during low allocation years and in times of low commodities prices has been a boon to individual growers in the Southern Basin, whether buying or selling, and reported to be a 'saviour' for some communities that have been net importers of water during low allocation times. Differential impacts from trade in permanent water would be expected, depending on whether the area was a net importer or exporter of water or entitlements, and the conditions under which it is traded. For areas like Griffith in the Murrumbidgee that have been a net exporter of water, there may be more trade out from lower value uses, and this is particularly true in low water security areas with seasonal plantings in adjacent NSW LGAs. Horticultural areas in the Lower Murray, like Mildura and Murray Bridge, are likely to be net importers of water due to the high value of their permanent plantings based on evidence in the recent drought. Future trade will depend on a range of factors, including market demand and price for different types of irrigated produce.

Past responses to stress, and ability to recover from drought

One of the most common sentiments expressed in communities throughout the Basin was that 'agriculture has been resilient over many years', continually adjusting to fluctuations in market and climatic conditions through change in farming practices, product mix, technological change, and land and water use efficiencies such as 'no till' farming. Measures to improve productivity and efficiency are reported to have continued, and in some cases accelerated, during the recent protracted drought.

Structural adjustment in the form of farm consolidation and technological change has arguably been occurring for a longer time in the **Northern Basin**, due to a far less regulated river system and lower water security compared to many areas of the Southern Basin (particularly in Victoria and SA). The ephemeral nature of the river systems and 'boom and bust' nature of irrigation water has also influenced what is grown, for example annual plantings like irrigated cotton and cereal crops in the Northern Basin.

The length and severity of the most recent drought has led to further adjustments in the Northern Basin, turning 'cotton farmers' into 'opportunistic irrigators, where no or reduced crops have been grown in a majority of years since 2000-01. Attempts to diversify into horticulture have been largely unsuccessful or quite limited in the lower rainfall areas of the Northern Basin, and a number of such enterprises have failed, though higher value crops in more productive areas like Moree have provided some economic benefits. Cotton generally remains the most profitable crop, and one that provides for a viable 'average business year' and allows for inroads into debt accumulated during the drought. The latter includes major capital investment in irrigation infrastructure made in the years prior to the drought, where government policy favoured such expansion. The much later introduction and expansion of irrigated agriculture in the Northern Basin compared with areas in the South is noted in this regard.

Government policy is also likely to have a significant impact on the extent to which individual businesses and communities are able to ‘bounce back’ after the drought. Concerns about the ‘buyback’ have been raised by civic and business leaders in all areas where the Federal Government has been active in the water market. Examples include the Gwydir Valley, in which Moree Plains is located, where 20% of available irrigation water has been purchased by the Federal Government (the most from any river system); and the purchase of land and water from Toorale Station, which is reported to have a 10% flow on effect through employment loss to businesses in the small local economy of Bourke, although in each of these cases environmental benefits and potential generation of employment in eco-tourism, construction and land management were cited as mitigative factors by other stakeholders such as National Parks and Wildlife Service and state departments charged with environmental conservation. More recent implementation of the cap in areas like Bourke has also significantly impacted on farm viability. Like the buyback, it has removed significant water from irrigation permanently, and led to strong concerns from most sections of the community about post-drought recovery. The loss of more permanent water under the buyback or new SDLs under the Basin Plan was of considerable concern to communities in Bourke, Balonne and Moree Plains.

There was a general sense that most land that had gone out of production in the **Southern Basin** could come back into production with the right growing and market conditions, provided there was not a permanent reduction in irrigation water. The properties of those who had exited the industry could be leased or purchased, for example, as part of ongoing consolidation that has been occurring for some years. There was a sense that there had been a ‘major shakeout’ of less efficient growers during successive waves of modernisation and in the most recent years of the drought. There may be some loss of employment with more large-scale enterprises, but this would depend on the crop grown (for example, if grapes were replaced with vegetables, employment losses from farm consolidation may be mitigated to some extent). Constraints to recovery include the fragmentation and perhaps inflated price of land; and constraints from the requirements of the Small Block Exit Package in the pumped districts of the Victorian Murray, for example, where requirement that irrigation infrastructure be decommissioned and land be ‘locked up’ for five years has led to major concerns about the unintended consequences of government policy versus market interventions, including exacerbation of social impacts on smaller communities and significant constraints on sustainable industry restructuring that had been occurring in a more gradual way. Differences in the effectiveness of market- versus government-led interventions in achieving industry restructuring, and the unintended consequences of the latter, are key issues that emerges from this case study. It also raises issues related to top-down versus more participatory approaches to environmental management and economic restructuring.

The resilience of dairy may be somewhat different to that of horticulture, and it has suffered perhaps the greatest losses during the latter part of the drought and with fluctuating commodities prices. Its resurgence is likely to be related to future market conditions, the extent of recent farm consolidation, and the need to remediate land and infrastructure damage during the exceptionally low flow years since 2000-07 (for example, below Lock 1).

Potential for further efficiency gains to mitigate water loss

A range of improvements in **on-farm and irrigation system efficiencies** were evident from field visits, including through bottom-up water efficiency and environmental improvement programs implemented by State Government NRM bodies working in conjunction with farmers and communities that were generally reported to be having positive outcomes. In the Northern Basin, these efficiency gains were reported to be made in response to ongoing climatic variation and water insecurity, the prolonged drought since 2000-01, regulatory requirements such as water sharing plans and the caps extraction, and as part of good business practice. Similar processes were at work in the Southern Basin, through there were varying degrees of modernisation, such as farm consolidation, system upgrades and the like, with highly modernised areas like Murray Bridge in SA, and less modernised areas like the pumped districts in Mildura, though even these were gradually modernising. The delay in low allocations in the Southern Basin until 2006-07 and then a subsequent 30% allocation meant that rapid restructuring has occurred in some areas, triggered by factors including low commodities prices and facilitated by increasingly liberalised water trade and Federal Government programs like the Small Block Exit Grant, though the latter has had a range of unintended consequences, as discussed elsewhere.

A view was commonly expressed during consultations that it was difficult to make **further on-farm or system efficiencies** without a significant capital investment, and that this appeared unlikely currently due to the effects of the protracted drought, high resultant debt levels, uncertainty about the future of irrigation water, and reductions already sustained under various regulatory mechanisms. In the Northern Basin, remaining system efficiencies largely related to reducing evaporation from storages. In the Southern Basin, there are reported to be varying, but relatively low levels of efficiency gains to be made. In South Australia, horticulture and dairy modernisation started relatively early, and there are reported to be around 1% system efficiency gains possible. In Mildura, efficiency gains may be in the order of 6%. Costs relative to savings may be quite high. All efficiency improvements have a capital cost, and whether they are worth doing relates to growing conditions and market factors including the cost of water and the value of the crop.

Clearly, this assessment is preliminary, and a detailed assessment would be required. However, views expressed that more than 5-10% of water reductions could not be mitigated through efficiency gains appears quite reasonable.

Community Leadership and Co-Ordination

A very high level of community leadership and networking was evident from consultations and the field visits to most case study communities. The central role of local government, working in conjunction with regional economic development and natural resource management bodies and community service agencies was clear in six of these communities, and the level of co-ordination in seeking to understand and respond to current and future impacts of irrigation water reductions was impressive. Areas that were not as engaged seemed less concerned with a future with less water, though the major impacts sustained by irrigated dairy and communities related to dairying in recent years, and projected impacts on such communities make NRM and industry bodies in this area less complacent.

Community leadership is important in co-ordinating responses to future reductions in water under the Basin Plan. It is also likely to be important in advocating for structural adjustment

resources that will be required in communities that are most heavily reliant on irrigated agriculture, like areas in the Murrumbidgee or horticultural districts in the Lower Murray, or where even relatively small job losses in areas with high levels of disadvantages and a more residualised population are likely to have significant social impacts, like the Northern Basin case study areas of Bourke, Moree and Balonne.

Though important, it is questionable whether such leadership will be enough to significantly mitigate the impacts of irrigation water reductions in the face of the range of factors noted above. It is also relevant that communities are reported to be losing key community and industry leaders due to the protracted drought as well as uncertainty about their futures under changing regulatory regimes and the forthcoming Basin Plan, or where such leaders report being ‘burnt out’ and wondering ‘how many times a community can fight’.

Generally, the more remote the area including its distance from a metropolitan market, the less access to **other economic opportunities and other natural attributes** that would be sufficient to offset a significant loss of employment in irrigated agriculture, unless there are opportunities from extractive industries. The Northern Basin case study areas are generally the most remote and have the least access to alternative productive sectors like manufacturing, or the ability to attract industry location from larger urban centres. Proximity to mining and energy resources can also be a double edged sword, for example, in Dalby-Wambo, where the local economy and population base is clearly benefiting from growth in the mining and energy sector, but extraction of large quantities of artesian water and potential sterilisation of agricultural land on the highly productive agricultural land of the Darling Downs may have long-term impacts on farming and the environment unless properly managed. Location of the Darling River and the iconic status of towns like Bourke are advantages for tourism, but increased visitations do not appear to be translating into above average jobs in relevant sectors like food and accommodation.

The proximity of Murray Bridge to Adelaide is a definite advantage in relation to population and industry relocation, though cheaper housing and low skilled employment opportunities are influencing the profile of those moving to the area and appears to be intensifying existing high levels of social disadvantage. Campaspe has advantages from its proximity to large regional centres like Bendigo, and its scenic beauty and location are attracting an older tree-change demography that is likely to increase demand for retail and service sector jobs; however, it has the oldest age structure of any of the case study areas, and issues related to social sustainability may arise in such communities. Mildura is a beautiful rural city, with a high amenity, diverse services and recreational opportunities, and located near the cross roads of three states. Mildura urban centre is the major service centre for a wide region, and it may remain stable in population or even continue to grow with reduced water, but this is likely to be at the expense of smaller towns within the LGA, and smaller more remote LGAs in its hinterland, so that net reduction of population would be expected with job losses. Jobs in retail and the service sector are likely to increase, but Mildura is remote from major urban centres, does not have as favourable transport links as other areas, and has only limited extractive opportunities from mineral sands mining, so that significant economic growth with less water appears problematic. Griffith is not located on a major transport route, is remote and lacks access to other economic resources. It is highly reliant upon irrigated agriculture and effectively exists *because* of it, so that its alternatives with less

irrigation are very limited. Again, tourism is often mentioned as an area of possible expansion, but employment in related industries is not high, even in Campaspe, and all areas appear to be chasing the same limited tourist dollar.

3.2.4 Summary of Each Case Study Community

This section provides a summary of the findings in relation to each of the eight case study communities. A detailed report on each is provided in support of these findings at **Appendices 1 to 8**. This is followed by some concluding remarks about what the research on local case study communities may tell us about differential impacts of permanent reductions in irrigation water under the forthcoming Basin Plan, open trade in water and long-term climate change.

Dalby-Wambo Case Study Area

The Dalby-Wambo case study area lies within the Western Downs Regional Council and is part of the Darling Downs region of southern Queensland, an area known for its long-established agricultural and food processing industries. The area is also part of the wider Surat Basin, which includes the regional council areas of Toowoomba, Western Downs and Maranoa. The Surat Basin is growing rapidly due to the development of the region's energy reserves including coal, coal seam gas and liquefied natural gas.

Whilst there is tremendous optimism about the potential development and future of industry and communities in the region, there are also concerns about inadequate planning for growth and insufficient mitigation of adverse and cumulative impacts.¹⁸ Based on consultations we conducted in the Dalby-Wambo case study area, primary concerns amongst growers and other irrigators are mainly related to the array of impacts to agriculture that the development of the mining and energy sectors across the Surat Basin may bring, with the possibility of reduced water availability under the forthcoming Basin Plan a lesser concern at the present time. The Queensland Government has recognised the significant challenges and cumulative impact that several energy projects are likely to create, as well as the land use conflicts between agriculture and mining that have already occurred and are likely to continue.¹⁹

At the same time, the community appears to be quite resilient, with very low level of unemployment, relatively stable population base over the past 30 years, a small amount of recent population and employment growth and a diverse, and an expanding economic base. It is also less disadvantaged than the other Northern Basin case study areas, and compares quite favourably on most indicators of wellbeing. It is relatively close to the major service centres of Toowoomba, Brisbane and the coast, which is likely to be an attractive location for relocation of younger and older people. Dalby has the critical mass of services and facilities to support a population of 15,000 in town and its immediate hinterland. These attributes are likely to mitigate the loss of agricultural employment to some extent, particularly in the short-to medium-term, if

¹⁸ Queensland Government (2010) Surat Basin Future Directions Statement.

¹⁹ Queensland Government (2010) Surat Basin Future Directions Statement, pg 20.

water availability for agriculture were to decline significantly. They indicate that the area is far less vulnerable to the short-term shocks and long-term stress than more remote case study areas in the Northern Basin like Moree Plains, Bourke and Balonne Shires, which have a far less diverse economic base and less favourable locational attributes.

Based on our consultations, impacts from reduced Sustainable Diversion Limits (SDLs) under the Basin Plan to either surface or groundwater are overshadowed by concerns regarding the adverse impacts to groundwater quality and supply as a result of coal-seam gas extraction. Growers and other agricultural industries in the Darling Downs are concerned about the potential for coal seam gas production and management of its 'associated water' to minimise damage to waterways, crop land and groundwater resources. They note the long-term sustainability and resilience of the agricultural sector in this regard, and are extremely concerned about potential threats to the sustainability of this sector and the longer-term impacts on related communities.

Balonne Shire

Balonne Shire is likely to be very vulnerable to a permanent reduction in irrigation water, with significant job and population loss, and considerable adverse impacts on a range of socio-economic indicators of community resilience and wellbeing projected in the long-term. This is likely to entrench higher levels of disadvantage, particularly among disadvantaged older people and Aboriginal residents. This is because irrigated agriculture forms a large proportion of both agricultural industries and the total economy of the Shire, with irrigated agriculture accounting for around 50% of direct and indirect employment through related multipliers. Other relevant factors include Balonne Shire's locational disadvantage including its remoteness and isolation from major service centres; its large and growing Aboriginal population, which experiences higher levels of disadvantage; and the lack of alternative economic opportunities such as extractive industries. Its small size means that it is not independent of the fortunes of its agricultural base, and smaller communities in its hinterland are likely to be even more exposed to adverse impacts from loss of water.

Importantly, permanent reductions in irrigation water are likely to significantly constrain post-drought recovery, including the ability to regain jobs and population lost during the recent drought. The sharp decline in population from 2001-06, probably as a result of the severity of the drought, was quite different to the upward trend in population generally experienced by Balonne Shire over the past 30 years. Such population increases also occurred at a time when irrigated agriculture became a more significant component of the local economy. Diversification into irrigated agriculture can thus be seen as part of social and economic resilience, as jobs in dryland grazing have declined through increased efficiencies and technological change over time. As well as more immediate impacts, a substantial reduction in water is likely to result in cumulative impacts, leading to further contractions in the local economy, and flowing on to reduced services and facilities as population thresholds are reached.

In terms of its existing socio-economic status, findings are mixed, but generally better and sometimes much more favourable than the other more remote case study areas in the Northern

Basin. The area has more positive indicators related to low youth and general unemployment, high relative SEIFA Index of Education and Occupation, much higher than average median income and labour force and school participation rates, and a healthy long-term growth in population, which is quite different to many other remote areas. There is also a higher than average level of in-migration, indicating reasonable prospects for population replacement, and the cultural importance of the river as something that *'always brings us back here'* was noted in consultations with Aboriginal communities.

Many of the somewhat less favourable indicators are likely to be associated with the large Aboriginal population, including their generally higher levels of disadvantage in relation to education, employment and income. That said, there are much more favourable indicators of health and disability in Balonne Shire compared with the MDB average, which indicates that Aboriginal people in Balonne Shire may experience higher levels of wellbeing than other similar areas. Positive leadership among Indigenous and non-Indigenous communities, civic and industry groups was evident during field visits, and this may also be contributing to the more positive indicators. Nonetheless, there are still obvious areas for improvement, and the area can in no way be complacent about the significant social and economic challenges facing it – a point made often in discussion with civic leaders. The predicted erosion of such indicators with more permanent reductions in water is of concern for a community at this stage of its development.

There are reported to be limited opportunities for increased water efficiencies without significant capital investment, and the next best use without irrigation water is generally dryland grazing, which would lead to significant job losses if replacing cotton or higher value horticultural uses. Connectivity, transmission losses and water security issues are also reported as likely to limit benefits from permanent water trade, though there have been some benefits from temporary trade during the drought within the catchment.

On the positive side, Balonne Shire has evidence of strong community leadership in its civic, community, Indigenous and business groups, who have worked together to develop positive employment, training and community support initiatives, and also to ensure that St George is a well-presented high amenity service centre. The contribution of the cotton industry to a range of community initiatives was also noted often (e.g. the construction of the riverside walk and local employment strategies). As noted in consultations, agriculture has been adaptive over the long-term, including through diversification into irrigated uses like cotton, as well as grapes, fruit and vegetables where possible, which has assisted in buoying population and employment increase in the past. However, a significant permanent reduction of irrigation water is likely to be a 'tipping point' for some irrigation businesses, and may be a social tipping point for a town like St George and smaller communities within the Shire such as Dirranbandi, which are remote and heavily dependent on irrigated agriculture. Strong leadership and community initiative is valuable in this regard, but challenges related to permanent reductions in irrigation water are likely to be difficult to overcome given locational, agricultural, social and economic characteristics of the area.

Bourke Shire

Bourke is a lovely historic town on the Darling River, and service centre to a geographically large and remote area. It is highly reliant upon its agricultural base, with dryland grazing for wool and beef production and irrigated cotton being the main produce. Government and community

services are also important sectors for the local economy. With just over 3,000 people at the time of the 2006 Census, Bourke SLA is the smallest, least urbanised and most remote case study area of the eight selected for more detailed analysis.

Bourke Shire has experienced significant population and employment loss in the period from 2001-06, which was quite different to previous population fluctuations, and almost certainly a result of the severe drought during this time. In many ways, this is a real time simulation for what is likely to occur with a permanent reduction to water from State and Federal Government policy, including the implementation of the Murray Darling Basin Cap ('the Cap') since 2007, the more recent announcement of further adjustment to entitlements by the State Government to maintain compliance with the Cap, and the setting of new Sustainable Diversion Limits (SDLs) under the forthcoming Basin Plan.

Bourke has been relatively resilient to past challenges, despite its size and remoteness, in part due to the robustness of the agricultural sector and the more recent growth in irrigated agriculture, the level of public and community sector jobs due to its role as a service centre to more remote communities, and its 'iconic status' in the public imagination that supports outback and river-based tourism.

A permanent reduction in water is likely to permanently constrain economic and social recovery of Bourke, and entrench and significantly worsen existing high levels of social disadvantage, particularly among its large Aboriginal population. Recent reductions in irrigation water under the Cap are likely to provide significant constraints to such recovery, especially for irrigators and related businesses, and are already reported to have been a 'tipping point' for some businesses. Further permanent water reductions under *future* Federal Government policy decisions are likely to have significant impacts on irrigators and related businesses that have been able to remain viable despite prolonged recent stressors. Further reductions in irrigation water in a community like Bourke may remove 'bounce back' options altogether for some businesses. Demoralisation of the community and business is a significant issue.

Socially, the cumulative impacts of current and future government water policy are likely to be severe. Imposition of further permanent water reduction is likely to accelerate population and employment loss, and have serious associated impacts, as Bourke loses the critical mass to support higher order retail and services that are currently in place. Further permanent loss of water will undoubtedly be a major contributor to such a social 'tipping point' in a highly vulnerable area like Bourke. That said, Bourke's iconic status and its remoteness also continues to work in its favour, as visitations are reported to be increasing significantly, and Bourke continues to provide important service functions for even more remote communities, as well as its large and highly disadvantaged Aboriginal population. Excellent civic leadership and reports that Bourke remains 'a good place to live' by many during consultations also adds to the strength of its community.

Nonetheless, strong concerns of civic leaders about the need for a 'Northern Territory-style intervention' among the growing and highly disadvantaged Aboriginal community, and consequent cost to government and the community, would not appear to be exaggerated if further job and population losses are sustained and constraints to potential recovery are imposed. Simply stated, Bourke cannot afford to lose more jobs or population at a time when its civic, business

and community leaders are working together after recent flood events to achieve any possible economic and social recovery after a prolonged period of severe stress. The environmental benefits from a further reduction in irrigation water would need to be clearly and transparently articulated and costed to demonstrate that they warrant such high social costs.

Campaspe LGA

The Campaspe case study area has a number of positive attributes and indicators of community wellbeing and resilience such as its proximity to large regional and urban centres, location on the river and associated amenity values which make it attractive as a ‘tree change’ location, and positive outcomes for some health, education and employment indicators. As we learned through consultation, there are also many support services and programs through the Victorian Department of Primary Industries, Centrelink and other organisations that are working to assist farmers with adverse individual, family and social impacts that they have experienced in recent years due to the combination of drought and market shocks within the dairy industry.

Despite these positive attributes that are likely to assist some individuals and the community to be more resilient in the face of change, there are other attributes about the area that indicate vulnerabilities. These potential vulnerabilities include its moderate population size, its reliance on agriculture and related industries, its location outside a major transport route unlike other nearby large centres (such as Shepparton) that are more likely to be able to diversify into other industries, the older age profile of the population and its future requirements, and that population growth in Echuca is due to decline in the hinterland. As a result of these potential vulnerabilities, impacts of reduced water availability for irrigation are likely to be more significantly felt in the smaller and more agriculturally dependent towns within the LGA. These areas are more likely to have experienced adverse impacts, including employment and population loss, due to the drought and downturn of the dairy industry in recent years. The extent to which the opportunities available in Echuca are able to offset the declines and losses in the smaller towns throughout the LGA, not to mention replace opportunities for those who cease farming, is uncertain. However, the high degree of dependence on agriculture and related activities, as well as the relatively limited opportunities for industry diversification apparent from the current employment profile, indicate that this is area that would be vulnerable to such changes.

Griffith LGA Case Study Area

More so than any of the other case studies, Griffith is truly an irrigation community. It was established, built and grew for the purpose of producing food and fibre and providing services to farmers and communities within the Murrumbidgee Irrigation Area. Its past and its future are inherently linked to irrigation and its associated industries. As one study participant said, *“Irrigation is inherent to our identity. There is no separation between our identity and our businesses.”*

Griffith’s population experienced no change between 2001 and 2006. Compared to some of the northern basin case study areas where populations declined by as much as 15% over the five year period, this appears to be positive. However, the other southern basin case study areas and the

nation all grew by 2% to 6%. Griffith was also the only southern basin case study area to lose jobs between 2001 and 2006. While again this loss was not nearly as significant as some of the northern basin areas, this clearly went against the trend of job growth in the other southern basin cases, the MDB average and the nation. This stagnation was probably due to the impact of drought and low allocations for general security license holders, such as rice growers, that occurred during this period. Griffith, with its mix of high and general security licences, was more protected than other NSW LGAs in its hinterland like Coleambally, however, where a predominance of general security water left them more exposed to the early years of the drought. These population and employment findings, as well as Griffith's status against a range of other social and economic indicators, show not only a snapshot of the community as at 2006 but also provide an indication of how resilient such a community is likely to be to future impacts of permanent reductions in water availability.

Whilst Griffith is a vibrant regional hub with a number of strengths such as a relatively young population, low unemployment levels and a high median household income level it is particularly vulnerable to further permanent reductions in water availability due to remoteness, lack of a 'critical mass' in terms of population, and continued reliance on irrigated agriculture for its economic base including significant value-adding manufacturing, warehousing and distribution industries related to agriculture locally and in the wider hinterland. Many irrigated agricultural enterprises in the area, both small and large, have made significant on-farm efficiency gains to use water more wisely and expand their businesses in order to remain profitable while using less water. For many, further permanent reductions in entitlements will have a tremendous impact on their business model with few options to further improve efficiencies to make up the loss. Due to the role irrigated agriculture plays in the local economy, these impacts will quickly flow from farms through to local and regional communities. Cumulative impacts are also expected as certain service thresholds are reached in response to population decline.

Mildura Rural City

The impacts of a permanent reduction to irrigation water on **Mildura Rural City case study area** are likely to be significant, as irrigated agriculture forms a large proportion of both agricultural industries and the total economy of Mildura. Our modelling indicates that, with a permanent reduction in water ranging from 10% to 50% on the 2005-06 baseline year, Mildura LGA is predicted to lose at least 661 (3.2%) to 2,933 (14.2%) jobs in agriculture and related activities and from flow-on effects. Population loss ranging from at least 1,843 (3.7%) to 8,200 (16.5%) people is forecast from such water reductions. These are likely to be lower estimates due to Census undercounting and inability to identify all agricultural jobs in our analysis.

Existing indicators of community resilience and wellbeing for Mildura Rural City do not generally compare favourably with the MDB and national averages, and Mildura's relative disadvantage, relatively poor health indicators and measures of underlying human capital indicate that there would be constraints to flexible adaptation to structural change, particularly for more vulnerable groups. These socio-economic indicators are predicted to be somewhat worse with reductions of irrigation water modelled, but with some reductions in crime and increase in voluntary work associated with reduced population.

It is also important to understand factors that may exacerbate or mitigate predicted population, employment and other socio-economic impacts. Mildura Rural City has some significant strengths including its size, its role as a regional service centre, high level of amenity from its location on the Murray River, attractive built and natural environment, multicultural heritage and diverse cultural and recreational institutions, and proximity to a range of natural assets including diverse national parks and environmental assets. Not surprisingly, it has been attracting a reasonable number of ‘tree changers’ from metropolitan areas seeking a better lifestyle, but also those who need more affordable housing, support services and lower skilled job opportunities from smaller and more remote areas in its wide hinterland. Community leadership is a definite strength, with civic and business leaders seeking to maximise any locational advantage from its position near the junction of three states and two major rivers and its high amenity, including opportunities from tourism, mineral sands extraction, warehousing and distribution, riverside development and alternative futures like solar energy.

Other advantages including its somewhat younger median age and relatively small Aboriginal population, the latter typically associated with significant disadvantage, are also predictors of a more robust level of community resilience and wellbeing. It is noted that areas like Wentworth LGA, near Mildura on the NSW side of the Murray, have larger Aboriginal populations and lower water security, and are of smaller size, and may be more adversely affected by less permanent water in the long-term.

That said, Mildura remains very vulnerable to a permanent reduction in irrigation water, particularly where these cuts are above 10%. There are reported to be very limited opportunities for on-farm and system efficiency gains remaining, and there would need to be significant capital investment to achieve further water savings. Significant industry restructuring and on-farm efficiencies are reported to have already been achieved through the latter years of the drought, which coincided with low allocations, falling commodities prices and an increased liberalisation of water trading. Further, the next best use without water is dryland grazing or cropping. The relatively small amount of irrigation land means that very few viable dryland enterprises would be created, even if total land under irrigation *could* be consolidated. A major loss of employment due to the extreme differentials between jobs in dryland uses compared with existing horticultural uses would be predicted from such a change of use in any case.

It is likely that there will continue to be benefits from trade in irrigation water, with Sunraysia likely to be a net importer, though this will depend on cost, relative value of produce, and supply of tradable water depending of the amount and location of reductions in SDLs under the forthcoming *Basin Plan*. There are likely to be quite different impacts from open trade in water on different growers, industry sectors and communities, as there have been in the past few years, with winners and losers from water trade between different users and at different scales.

Though there has been a dramatic loss of irrigation land, with 24% in Mildura currently out of production, most of this has become vacant since 2006. As well as low water allocations, low commodities prices were a significant factor, with ‘unbundling’ of land and water rights since 2007, and programs like the Small Block Exit Package providing the opportunity for many to exit the industry, temporarily or more permanently, or to restructure their business. It is reported that

much of the vacant irrigation land could come back into production with the right growing and market conditions, though there are also constraints such as land prices and fragmentation.

A significant constraint in the short- to medium-term arises from Federal Government requirements related to the Small Block Exit Package to decommission infrastructure and not use the land for agriculture for 5 years. Though there have been benefits to individual growers, especially older producers on smaller blocks, serious concerns about the unintended consequences of this policy have been frequently raised in the Southern Basin. In particular, these concerns relate to exacerbation of social impacts on small communities, and impediments to sustainable economic restructuring including further farm consolidation and use of land for other horticultural uses for which there is market demand. Differences in the effectiveness of market-versus government-led interventions in achieving industry restructuring, and the unintended consequences of the latter, are key issues that emerge from this case study. It also raises issues related to top-down versus more participatory approaches to environmental management and economic restructuring.

Despite the advantage of size, amenity and natural advantages that have supported growth over previous decades, Mildura Rural City and the smaller communities that make up its hinterland remain highly reliant upon irrigated agriculture and economic activities related to it. At least one-third of local employment is directly or indirectly related to irrigated agriculture, and Mildura acts as a service and processing centre for a much wider hinterland from Robinvale to the South Australian border, with many smaller, agriculturally dependent communities. Cumulative impacts related to processing, warehousing and distribution, and other local industry would also be expected. These factors also make it vulnerable to changes in its local agricultural base, and those in the wider region.

Moreover, a loss of irrigation water is likely to trigger job and population loss in smaller towns in Mildura Rural City, and smaller, more remote LGAs in the region, including those that had been 'holding their own' or even growing until 2006. Mildura urban centre may remain stable or continue to grow with less water, but this is likely to be increasingly at the expense of its smaller more remote towns and surrounding LGAs, depending on the size of reductions and their reliance upon irrigated agriculture. For these areas, job and population losses are likely to be more significant than those modelled for Mildura, with net regional job and population losses likely to be considerable.

There would have to be significant replacement industries to offset the loss of jobs above a 10% reduction in irrigation water in the region. Though continued growth in the service sector would be expected for Mildura urban centre, major diversification or expansion would be required in other sectors to offset predicted employment loss in agriculture, value adding, distribution and warehousing. Though community leaders are marketing its natural advantages and strategic location at the junction of three states, Mildura's relative remoteness, limited economic alternatives, limits to urban expansion under State Government planning policy and degree of reliance upon irrigated agriculture and related industries, appear to make this problematic.

Supportive government regional development policy, assistance with economic restructuring, employment, training and small business development programs, and continued strong

community leadership will be required if the region sustains significant reductions in irrigation water.

Moree Plains Shire

Despite the fact that Moree Plains has certain locational and natural advantages compared with more remote case study areas in the Northern Basin like Bourke and Balonne, its very high level of reliance on agriculture, lack of economic alternatives such as mining, energy or manufacturing, relative remoteness and attributes that make it less attractive as a ‘tree change’ location make it more vulnerable to permanent changes to water availability under the forthcoming *Basin Plan* and government water policy more generally.

The vulnerabilities of the area to permanent changes in water availability can be seen in the area’s reliance on agriculture and public sector employment, and the declines in employment and population that occurred during the period of recent drought between 2001 and 2006. Water available for irrigation in the Gwydir Valley, including the Moree Plains case study area, has dramatically reduced as the result of the drought and resultant low allocations since the 2002/03 season.

Though not as significant as in Bourke, Moree Plains’ relatively heavy reliance on public or community sector employment and high proportion of residents in receipt of welfare payments also make it particularly vulnerable to ongoing changes in government policies related to centralisation of services and administrative functions. It is noted that over 60% of employment appears to be in agriculture and industries related to public or quasi-public sector funded employment.

Moree Plains’ net loss of employment between 2001 and 2006 was far greater than its population loss (-16% job loss compared to a -10% change in population), and was much closer to the experience of Bourke and Balonne over the same period. This tends to indicate that people remain in Moree, to a greater extent, when faced with job loss than they do in smaller, more remote areas, possibly due to its status as a larger centre, service opportunities and the potential for employment to ‘bounce back’ after, for example, prolonged periods of drought. Again, it is also noted that the *quantum* of employment loss (or number of jobs) experienced by Moree Plains was far greater in absolute terms than that experienced by Bourke and Balonne.

Employment trends were markedly different for Dalby-Wambo and the Southern Basin case study areas. Apart from a small employment decline in Griffith, all remaining case study areas experienced positive employment growth from 2001 to 2006. The influence of location, size, degree of urbanisation and proximity to larger centres, as well as relatively higher levels of water security are evident in these trends.

Based on the status of Moree Plains against key indicators of wellbeing and resilience, as well as our projections for impacts on employment and population as a result of permanent reductions in water availability, the trends that have been experienced in the short term are likely to be exacerbated by long-term or permanent reductions in water.

Key concerns were expressed by study participants regarding the large proportion (at least 20% is estimated²⁰) of entitlements in the Gwydir have so far been purchased through a combination of federal and state government initiatives for environmental purposes.²¹ These sales represent a long-term and permanent reduction in water. The impact of these sales, including the resultant 'loss' of irrigation water for production in the area, is not fully understood. While the proceeds from the sales have largely been used to retire debt and benefit the seller, study participants and others have raised considerable concerns about the long-term impact of these sales on lost production and the local economy's capacity to 'bounce back' from short-medium term stressors like drought. The NSW government has indicated its intention to trade water from its general security environmental allocation to irrigators on a seasonal basis when conditions are favourable and environmental objectives are able to be achieved.²²

Rural City of Murray Bridge Case Study Area

Modelling of various irrigation water reduction scenarios for **City of Murray Bridge case study area** indicates that impacts of such reductions are likely to be significant, but lesser in magnitude than for other selected case study areas, as irrigated agriculture forms a relatively small proportion of agricultural industries in Murray Bridge. That said, the effects on Murray Bridge are likely to be understated due to Census undercounting, and its role as a major service centre for the **Murraylands Region** and the relatively high rate of jobs in value-adding agricultural processing, transportation, storage, packing and distribution. Impacts are likely to be more significant in the regional context, where most areas are highly dependent on agriculture. Smaller, more remote and agriculturally dependent areas are likely to be far more seriously affected, as has been the case in the latter part of the drought.

A number of factors are likely to mitigate or exacerbate projected impacts on Murray Bridge. Mitigating factors include that it is far less remote than most other MDB case study areas, its proximity to Adelaide, feasible commuting distance to Adelaide and other larger centres, lower Indigenous population, more diverse economy, current and projected employment and population growth under SA planning frameworks, and opportunities related to liberalised water trade. Strong community leadership in the area's regional development, business, civic and NRM institutions is also evident, with clear evidence of agencies and communities working together to respond to ongoing challenges observed during field visits.

²⁰ Study participants reported that 20% of entitlements had been purchased out of the Gwydir to date. We note that based on figures reported on DEWHA and NSW DECCW websites, a combination of 105,612 ML of general security shares and 16,765 ML of supplementary access shares have been purchased, as proportions of all unit shares reported in the Gwydir Water Sharing Plan this equates to 20.7% of general security and 9.8% of supplementary access shares. For more information see: NSW Department of Environment, Climate Change and Water (2010) Water for the environment's achievements, www.environment.nsw.gov.au/environmentalwater/achievements.htm. Department of Environment, Water, Heritage and the Arts (2010) Progress of water recovery under the Restoring the Balance in the Murray-Darling Basin program, www.environment.gov.au/water/policy-programs/entitlement-purchasing/2008-09.html.

²¹ It is our understanding that while 6,832 ML of 'medium security' entitlements have been purchased from the Queensland Border Rivers, there have been no purchases from the NSW Border Rivers. Data obtained from Department of Environment, Water, Heritage and the Arts, accessed online at www.environment.gov.au/water/policy-programs/entitlement-purchasing/borderrivers.html, 14 July 2010.

²² Correspondence with Senior Conservation Officer & Gwydir Environmental Water Manager, 30 June 2010.

Exacerbating factors include existing indicators of significant community vulnerability including very high levels of disadvantage, unemployment, educational and employment status, disability and ill health. Such factors point to limited adaptive capacity of some people and communities to changes in its economic base. A further factor that is likely to limit adaptation of irrigated agricultural is the limited next best use for agricultural land with less water. The fact that many efficiency gains appear to have been made over the past two decades in irrigated dairy and horticulture also calls into question the extent to which further efficiency gains can be made to offset further reductions in irrigation water. The relatively low level of participation in existing Federal Government programs is reported to be due to the size or relative profitability of agricultural enterprises and limited remaining efficiency gains. The extent to which Murray Bridge's value-adding industries source produce from the MDB, and level of commitment by the SA Government to regional economic development including the future growth of Murray Bridge will also play a role in the future resilience of Murray Bridge if there are significant permanent reductions to irrigation water.

The impacts on smaller, more remote and agriculturally dependent towns and LGAs in the wider Murraylands Region are likely to be more severe, and a range of social and economic impacts have already been experienced in the last few years. Until 2006, the area below Lock 1 was relatively cushioned from the worst effects of the drought due largely to high levels of water security. However, the combined effects of prolonged drought followed by three historically low flow years, low river and lake levels, related additional costs of extending infrastructure or buying in feed, and fluctuations in various commodities prices, have had significant economic impacts since this time. This includes major reductions in irrigated agricultural production, and flow ons to related industries and communities. Tourism and recreation industries are also reported to be adversely affected. Significant social impacts include individual and family stress, health and psychological impacts, suicide, and loss of community and industry leaders at a critical time. The statement that, 'we are now losing the efficient operators and industry leaders' was heard frequently in fieldwork, as well as concerns about such loss for post-drought recovery. In many respects, reduced access to water in the latter part of the drought may be regarded as a real time simulation for permanent reductions in water under Federal policy including *Water for the Future* and the forthcoming *Basin Plan*.

Despite reported social and economic impacts during the latter part of the drought, however, responses by farmers, industries and communities also indicate ongoing resilience in the face of significant stress, and there is some optimism about the future of agriculture and related industries 'when the water comes back'. Most noted the 'long-term resilience of agriculture' to ongoing changes in the internal and external environment. Nonetheless, there is considerable concern that more permanent reductions in allocations will limit the ability for industry and communities to 'bounce back' and severely reduce post-drought recovery for agriculture and related industries and communities. As well as the environment, however, a winner from increased water below Lock 1 may also be recreational boating, marina and other urban developments and tourism with if river and lake levels are restored.

Overall, and by comparison with other case study areas, the outcome of reduced water availability in Murray Bridge is likely to be continued existence and growth, but in a different form, changing from an agricultural economy to one that is increasingly dominated by

manufacturing, services and retail and by overspill from the Adelaide housing and labour market, albeit generally at the lower cost and potentially lower skilled end of the spectrum. Although growth is likely to continue, rates of growth with reduced water will likely be less than would otherwise be expected. However, other areas in the region are reported to have been ‘devastated’ by the recent drought, and to some extent Murray Bridge will grow at the expense of these areas, particularly if water for irrigation is permanently reduced in the future. For smaller centres attractive as new urban settlement areas (like Woodlane), it is likely that the demographic mix and character of the area will change significantly.

3.3 The MDB Level

The impacts at the level of the MDB are likely to be significant, with the major effect being loss of employment. Details of our modelling are shown below at Table 3.1. We estimate a 10% reduction in water availability will result in the loss of 6,000 jobs, a 25% reduction in water availability will result in the loss of 14,000 jobs and a 50% reduction in water availability will result in the loss of 28,000 jobs, with the last estimate equivalent to a annual cost of \$2.7 billion in lost output, or \$38.7 billion as net present value. If reductions in water availability are as a result of the provision of environmental water to key environmental assets, then impacts may be much higher because of lack of connectivity and transmission losses across the basin. A model proposed by the Wentworth Group of Concerned Scientists resulting in a 40% reduction in irrigated water use across the MDB is calculated to result in the loss of 41,000 jobs, equivalent to an annual cost of \$4.0 billion in lost output, or \$57 billion as net present value.

We have modelled 10%, 25% and 50% reductions in water availability, with these cuts evenly distributed across all irrigators. This has been modelled with and without the inclusion of the ACT, as the ACT is a quite different economy from the agriculture economies elsewhere in the basin. These estimates are the most likely outcome of water cuts, however we note there is some scope for mitigation of impacts from trade or change of use.

We have not made a quantitative assessment of the mitigating effects of water trade, because detailed hydrological modelling is required to determine whether trade is in fact possible between uses. Factors such as connectivity, transmission losses, levels of regulation and varying degrees of water security requirements for different agricultural uses mean that opportunities for water trade between different uses are extremely limited within the basin. For example increased environmental flows in the St George area are unlikely to find their way into the Darling River except in very large flood events.

The table below summarises key results.

Table 3.5: Effects of changing water availability at MDB level

Scenario	10% reduction in water availability		25% reduction in water availability		50% reduction in water availability	
	Employment loss (numbers)	Employment loss (%)	Employment loss (numbers)	Employment loss (%)	Employment loss (numbers)	Employment loss (%)
Assuming reductions are equally distributed amongst irrigated uses (no trade)	5,672	0.6%	14,178	1.6%	28,354	3.2%
Assuming reductions are equally distributed amongst irrigated uses (no trade) but excluding the ACT	5,670	0.8%	14,175	2.0%	28,349	4.1%

The result of reductions in water availability will be job losses. The inclusion of the ACT in the data will dilute impacts and lead to a lower estimate of proportional job losses, understating job losses in agriculturally based regional economies by around one third.

Based on the figures above, reasonable estimates of job losses in the MDB arising from reduced water availability in an environment of trading, the current situation, will be 6,000 for 10% cuts, 14,000 for 25% cuts and 28,000 for 50% cuts. These are likely to be underestimates due to wider regional impacts on employment and because of undercounting in the census.

While on the face of it, trading of water from less labour intensive to more labour intensive uses could offset some of the job losses associated with reductions in water availability, such considerations are largely theoretical. Such trades, for example between cotton growing in the upper MDB and fruit growing in the lower MDB, is unlikely to be physically possible because of lack of connectivity and because of transmission losses.²³ Other options, such as cotton growers changing to horticulture, are limited by lack of stream regulation, water security and on farm storage.²⁴

There is a further exacerbating factor likely to increase the impacts of reductions in water availability. If reductions in water availability are as a result of the provision of water to

²³ Typically, transmission losses in the MDB in the absence of flow regulation and consumptive use are estimated to be about 48%. CSIRO (2008), *Water Availability in the Murray-Darling Basin*. CSIRO, Australia, page 6.

²⁴ See for example our Bourke case study documenting failure of such an approach.

environmental assets, then the location of those assets and considerations of transmission losses and connectivity will decide from which agriculture uses the water is taken. A proposal from the Wentworth Group of Concerned Scientists has been modelled below, with that proposal estimated to result in the loss of around 41,000 jobs from a 40% reduction in water availability in the MDB. Because of hydrological constraints, the impact of this 40% reduction targeted at key environmental assets on employment is around one third more than the impact on employment of a 50% reduction distributed evenly across the basin.

3.4 The National Level

3.4.1 The Costs and Benefits

Typically within the MDB, scenarios of reduced water availability for agriculture will result in increased environmental flows. A range of costs and benefits are often cited for increased environmental flows, with these being of greater or lesser substance. Those identified in our literature review include maintenance of ecosystems and biodiversity, restructuring or other capital investment as a result of water buyback, recreation and tourism, water quality improvements, certainty for water users, loss of employment, loss of output and infrastructure costs associated with rising water tables. These are examined critically below.

Maintenance of ecosystems and biodiversity. This would appear to be the primary benefit of increased environmental flows. Despite statements linking enhanced agriculture outcomes with maintenance of ecosystems, the causal link is not apparent, nor is it clearly articulated. The vast majority of agriculture in the MDB is rain based, with about 1.9% of agricultural land relying on irrigation to some extent.²⁵ If the river systems of the Murray Darling Basin were flowing fully, or were dry, would seem to have little impact on 98.1% of agricultural land. Similarly, if the Murray Darling system was a system of concrete lined channels for the transmission of water, as may be found in irrigation areas, or was a river in a 'natural' state, would appear to have little or no impact on agricultural production. Other statements reflect the amenity of communities which probably have somewhat more merit. Somewhat surprisingly, we have not found any clear statement to suggest that ecosystems have a value in and of themselves, across a range of material issued by the Murray-Darling Basin Authority. By contrast, a reading of the Water Act would imply that the value of ecosystems and the like is infinite, insofar as the Act suggests that maintenance of ecosystems and the like is given an absolute preference over any other use of water.

This paper adopts the position that the value of preserving ecosystems and biodiversity is the value placed on the ecosystem and biodiversity by the community, rather than having a value

²⁵ ABS 4610.0.55.007 - Water and the Murray-Darling Basin - A Statistical Profile, 2000-01 to 2005-06 and JSA calculation.

only in relation to increasing efficiency in other areas.²⁶ Where externalities, both positive and negative, exist, these will be considered separately. In the absence of a market place, the value placed on ecosystems and biodiversity by the community can be determined by the actions of government, insofar as the actions of government are reflective of the values of the community.

Restructuring, or other capital investment, as a result of water buyback. While this may be a benefit to the individual irrigator or water user, there is also a public cost involved. Insofar as the water buyback takes place in a market situation, the net benefit to the community at the national level could be expected to be zero, in that the benefit to the individual irrigator is equal to the cost to the community. There is additionally a transaction cost involved, resulting in a net cost.

If the restructuring resulted in efficiency gains, and resulted in a market return on capital, then there would be likely to be a net benefit. At the same time, in a market economy, it could be presumed that capital investments that were cost effective would be put in place at the enterprise level, regardless of the availability of government funding. It seems axiomatic that if government funding is required to make restructuring cost effective, then there is unlikely to be a market return on the capital investment, at least at the enterprise level.

Recreation and tourism. Recreation and tourism is a consumptive use by households. If there are no longer opportunities for recreation and tourism associated with healthy rivers, it seems likely that households will seek out the next best recreational or tourist opportunity, presumably at some small marginal cost. While a particular local community may be less well off due to a reduction in income; at some larger scale, say at a regional or state level, alternative recreation and tourism opportunities exist, and it seems unlikely that the loss of one tourist destination will lead to an overall decline in the tourist industries. The cost associated with tourism at larger scales would, at best, be the marginal decrease in value in moving from the next best use. This marginal cost is likely to be both small and difficult to quantify.

Water quality. The main issues relating to water quality appear to be salination and algal bloom or eutrophication. These appear to be clear costs in terms of lost agricultural production and increased costs of water treatment. These can be valued in terms of effects on users and in terms of alternatives.

Certainty for water users. This has been cited as a possible benefit by the MDBA.²⁷ We have assumed that they mean reduced risk rather than removal of uncertainty. It is not clear in what sense this is a benefit. This appears to be premised on the belief that people do not plan appropriately in an environment of uncertainty. Presumably, individual irrigators, when

²⁶ In modern economics, the value of something is taken as its price, with that price set by the confluence of supply and demand. For a discussion see for example Nicholson W (2005) *Microeconomic Theory Basic principles and extensions*, Thompson, Mason, Ohio, pp 8-17.

²⁷ MDBA (2009), *The Basin Plan A Concept Statement*, Australian Government, p. 3.

choosing to invest in infrastructure, have given thought to the probability of obtaining a return from that infrastructure before proceeding. The main effect of reduced allocations or diversions is likely to be that marginal water users, who may for example have obtained a crop in good years, will no longer be able to do so, even though such a strategy may be economically efficient. Generally, where risks increase, higher returns are required to take on the particular risk. Conversely, as risks decrease, lower returns are required. Similarly, people practice risk mitigation strategies. As an example, consider a farmer who owns plant and the like enabling a crop of wheat to be planted. At the most basic level, the farmer is unlikely to plant a crop if there is insufficient soil moisture to ensure some particular probability of getting a return on investment. If the farmer was farming in a marginal area where a crop was expected, say one year in three, the farmer would need to obtain sufficient return from a successful crop to cover the cost of capital tied up in machinery and the like and not utilised two years out of three. On the other hand, if the farmer knew a successful crop could be obtained every year, a lower return could be accepted prior to sowing a crop, as the return does not have to be spread over three years, but just one year.

Loss of employment. While employment is often taken as a benefit, insofar as it relates to consumptive uses the benefit is often likely to be a substitution. As an example, if people stopped buying hamburgers and spent the money on haircuts, there would be a loss of jobs in takeaway shops and an increase in jobs in hairdressers, with perhaps a small marginal change in output. To take employment as a benefit (or loss of employment as a cost) would also assume that people who lose jobs in agriculture will not be able to find work elsewhere, however such assumptions are dependent on the underlying level of unemployment. At the same time, the situation is more complex in a primary industry, particularly where export markets exist or substitutes are likely to be imported, with loss of jobs leading to an overall smaller economy due to a drop in export income or increased expenditure on imports. The conceptualisation of employment change as a substitution is based on the underlying resource (such as labour in the case of hamburger shops and hairdressers) being allocated to the next best use. However in the case of irrigated agriculture, reductions in water availability means that a key input to production, water, has been lost rather than diverted to another alternative productive use. The nearest substitute for consumption is likely to be food exported from elsewhere.

Loss of output. Agriculture is a primary, rather than a tertiary industry, and uses scarce resources, arable land and water, to generate wealth or to add value. Any reduction in output, where that output can be delivered at a competitive cost, is a cost to the community, and can be measured in terms of loss of employment. This paper takes the view that reduction in agricultural output is a cost to the community, and that cost can be determined by loss in employment, with consequential flow ons.

Infrastructure Costs associated with rising water tables. *The Salinity Audit*²⁸ identifies salinity effects on foundations and concrete via sulphate attack and increasing road damage from rising water tables. Such costs are likely to occur, but at the same time, the degree to which they are a result of salination, rising water tables or other factors is not clear. For example, the writer knows from personal experience that sulphate attack of concrete in sewage treatment plants is well known and is unlikely to be a result of groundwater salination even though *The Salinity Audit* cites such an example. These costs have not been considered due to lack of information and the likely comparatively small quantum by comparison with other costs.

Domestic Water. There are also costs and benefits associated with the diversion of water from irrigation uses to domestic water. These have also been considered.

3.4.2 General

There are fundamental questions to be addressed with respect to the diversion of water to environmental flows. The first, and by far the most important, is the question as to how the natural environment, and in particular the impact of particular decisions on the natural environment, is to be considered. There appear to be two broad approaches.

In the first, characterised here as an economic approach, ecosystems and environmental outcomes can be seen as a form of public good. Scarce public resources, in this case water, can be reallocated from private uses, such as irrigation, to public uses such as maintenance of ecosystems or environmental outcomes. Cost Benefit analysis is a common paradigm used to determine efficient outcomes with respect to resource allocation in such cases including the provision of public goods or where externalities exist.^{29,30}

In the second, characterised here as the environmental view, there appear to be three threads. These are the “existence of ecological limits to growth, importance of maintaining the balance of nature, and rejection of the anthropocentric notion that nature exists primarily for human use”.³¹ The primary difference between the two paradigms is the value placed on the natural environment. In the economic approach, the natural environment is seen as having meaning only relative to human society. In the second, the natural environment is seen as having an intrinsic value of its own, independent of, and overriding, human society and social needs. Clearly arguments could be mounted for and against both approaches, however the two value systems appear to be in conflict. Importantly, believers in a particular paradigm could be expected to not recognise the degree of paradigm shift or recognise the gulf between their own view and that of others.

²⁸ Murray Darling Basin Ministerial Council (1999) *The Salinity Audit* Murray Darling Basin Commission, Canberra, pp 22-24.

²⁹ Friedman L, (2002) *The Microeconomics of Public Policy Analysis*, p. 173.

³⁰ New South Wales Treasury (2007), *NSW Government Guidelines for Economic Appraisal*, p. 9.

³¹ Dunlap R, (2008) *The New Environmental Paradigm Scale: From Marginality to Worldwide Use*, The Journal of Environmental Education, Vol. 40, No 1 pp 3-18.

As an example, the Water Act 2007 appears to be firmly sited in the environmental view, albeit with a level of dissonance apparent. Its primary objectives are:

- (a) to enable the Commonwealth, in conjunction with the Basin States, to manage the Basin water resources in the national interest; and*
- (b) to give effect to relevant international agreements (to the extent to which those agreements are relevant to the use and management of the Basin water resources) and, in particular, to provide for special measures, in accordance with those agreements, to address the threats to the Basin water resources; and*
- (c) in giving effect to those agreements, to promote the use and management of the Basin water resources in a way that optimises economic, social and environmental outcomes; and*
- (d) without limiting paragraph (b) or (c):*
 - (i) to ensure the return to environmentally sustainable levels of extraction for water resources that are overallocated or overused; and*
 - (ii) to protect, restore and provide for the ecological values and ecosystem services of the Murray-Darling Basin (taking into account, in particular, the impact that the taking of water has on the watercourses, lakes, wetlands, ground water and water-dependent ecosystems that are part of the Basin water resources and on associated biodiversity); and*
 - (iii) subject to subparagraphs (i) and (ii)—to maximise the net economic returns to the Australian community from the use and management of the Basin water resources; and*
- (e) to improve water security for all uses of Basin water resources; and*
- (f) to ensure that the management of the Basin water resources takes into account the broader management of natural resources in the Murray-Darling Basin; and*
- (g) to achieve efficient and cost effective water management and administrative practices in relation to Basin water resources; and*
- (h) to provide for the collection, collation, analysis and dissemination of information about:*
 - (i) Australia's water resources; and*
 - (ii) the use and management of water in Australia.*

Paragraphs (d)(i) and (ii) appear to fit firmly in the environmental paradigm set out above. However, the act also appears to give cognisance to the economic paradigm in paragraph (c) where it talks of optimising economic, social and environmental outcomes. The Productivity Commission criticised the privileging of natural environmental outcomes by saying that “Avoiding ‘compromise’³² would appear to establish a very high hurdle that could consign all other users to share whatever remains, without regard for the opportunity costs”.³³ This statement itself suggests that the Productivity Commission is operating from an economic paradigm, and is trying to make sense of the Act from within that paradigm, or alternatively, is criticising the Act for not fitting within the economic paradigm.

This paper is sited within an economic approach, taking the view that, while environmental outcomes are a form of public good and are of value to the community, so are other outcomes

³² Where compromise relates to the definition of overallocation in the Act.

³³ Productivity Commission (2009), *Market Mechanisms for Recovering Water in the Murray-Darling Basin*, Productivity Commission, Melbourne.

such as the social and economic effects of changing water allocation. Consequentially, water is seen as a scarce public resource that should be allocated to achieve optimal outcomes, and in particular, marginal environmental outcomes should not be pursued where the social and economic cost is significant.

Within this economic paradigm, a second question arises, particularly with regard to notions of sustainability. This is the question of the time value of money. In classical economic analysis, the time value of money is accounted for by using discount cash flow analysis. Typically in such analysis, an interest rate is adopted to reflect the time value of money. NSW Treasury, for example, adopts an interest rate of 7% for such analysis.³⁴ Such rates are reflective of the value placed on money by the community, (or alternatively, of the weight given by the community to current consumption at the expense of future consumption) but are not generally supportive of economic arguments promoting particular environmental outcomes by seeking to lower consumption in the present in order to reduce adverse environmental outcomes in the future. As an example, Stern, in his review of the economics of climate change, argued for a discount rate of 0.1% based on probability of population survival, when seeking to justify favoured environmental outcomes while using an economic paradigm.³⁵ This approach has been criticised, both on philosophical grounds and for being prescriptive rather than descriptive of human behaviour.³⁶ By comparison, the environmental paradigm as outlined above gives no regard to the time value of money, given the severance of the social and natural environments. This paper will take a mainstream approach and will use a discount rate of 7%. A sensitivity analysis has not been carried out.

3.4.3 Detailed quantification of costs and benefits

Loss of output

Report 2 of this study identified the output associated with use of irrigation water and land for different agricultural uses in terms of employment and identifies an additional factor of 1.11 to account for underreporting arising from 'not stated' and 'inadequately described'. Based on data and analysis in that report, the marginal employment effects associated with the diversion of 1 Gl of water for various users of water have been calculated and are set out in Table 3.6 below.

That employment is further quantified in terms of dollars using Gross Domestic Product data published by the Australian Bureau of Statistics. Such attempts are necessarily imprecise. While good data is available on employment by industry and geographic area, GDP is reported for whole sectors and for Australia, and such values are unlikely to be applicable to regional areas. Individual enterprises, or enterprises across a region, may be more or less productive than the averages. The basis of the calculation of GDP is itself imprecise, with different methods of calculation giving somewhat different values. At the same time, the quantification of job losses

³⁴ NSW Treasury, *op cit*, p. 55.

³⁵ Stern N (2007), *The Economics of Climate Change*, Cambridge University Press, Cambridge, pp46-61.

³⁶ See for example Nordhaus W (2007) *Critical Assumptions in the Stern Review on Climate Change*, Science, Vol 317. no 5835, pp 201-202

in dollar terms allows some comparison of the cost of job losses with the benefits flowing from a public policy proposal.

For 2008-09, GDP for Agricultural, forestry and fishing was reported as \$30,490 million.³⁷ For the same period, average employment in the sector was reported as 367,000,³⁸ giving an average GDP per person employed of \$83,000.³⁹ By multiplying this figure by the amount of lost employment, an estimate can be made of the lost production arising from changing allocations of water. These values are shown in Table 3.3 below. To the extent that factors of production can be used elsewhere, this will be an overestimate. Our calculations allow for the reuse of land, however we have assumed capital, such as machinery and irrigation infrastructure will not be able to be reused, reflecting the limited opportunities for alternative use of irrigation based enterprises at the local and system level, and that jobs will be lost, due to lack of availability of domestic substitutes or loss of export markets, as discussed below.

There are a range of other costs that we have not included, such as costs associated with internal migration, increased populations in regional and state centres and administrative costs and other costs around managing increased frictional and structural unemployment. These costs are likely to be minor in the by comparison with the loss of output from reduced irrigation water.

³⁷ ABS 5206.0 *Australian National Accounts: National Income, Expenditure and Product*, Sep 2009, p. 63.

³⁸ ABS 1350.0 *Australian Economic Indicators*, Jan 2010 p. 103, using average of estimates for August and November 2008.

³⁹ Note that this is an average value across the industry. Some sectors may be more or less productive, however detailed information is not available.

Table 3.6: Estimates of annual net employment loss from changing water availability

Irrigated Agricultural Use	Employment for one GI of irrigation water ⁽¹⁾	Employment from change of land use to dryland cereal	Net loss of jobs per one GI	Employment from change of land use to dryland grazing	Net loss of jobs per one GI
Vegetables	20.0	0.3	19.7	0.1	19.9
Fruit	16.0	0.3	15.7	0.1	15.9
Grapes	20.0	0.3	19.7	0.1	19.9
Grazing (includes dairy)	4.2	Not known	Not known	Not known	Not known
Rice	1.5	0.1	1.4	0.0	1.5
Cotton	1.3	0.3	1.0	0.1	1.2

Source: Strategy 1 report and JSA calculation.

Notes:

⁽¹⁾ Data from Tables 3.1, 3.4 and 3.5 of Strategy 1 report, allowing a factor of 1.11 for not stated and inadequately described. Where two estimates exist in table 3.1, the average has been adopted.

Table 3.7: Estimates of the annual value of net employment loss in agriculture and agriculture related industries from changing water allocations

Irrigated Agricultural Use	Estimated GDP for one GI of irrigation water	Estimated GDP from change of land use to dryland cereal	Net loss of GDP per one GI	Employment from change of land use to dryland grazing	Net loss of GDP per one GI
Vegetables	\$1.66 million	\$0.02 million	\$1.64 million	\$0.01 million	\$1.65 million
Fruit	\$1.33 million	\$0.02 million	\$1.30 million	\$0.01 million	\$1.32 million
Grapes	\$1.66 million	\$0.02 million	\$1.64 million	\$0.01 million	\$1.65 million
Grazing	\$0.35 million	Not known	Not known	Not known	Not known
Rice	\$0.12 million	\$0.01 million	\$0.11 million	\$0.00 million	\$0.12 million
Cotton	\$0.11 million	\$0.02 million	\$0.09 million	\$0.01 million	\$0.10 million

Source: Various as noted previously and JSA calculation.

It can be seen from the table that the opportunity cost of 1 GI of water is quite sensitive to the agricultural use, ranging from around \$1.6 million in the case of vegetable production, down to \$0.1 million in the case of cotton production.

There will be a further effect arising from lost consumption due to reductions in agricultural employment. Given the nature of primary industry, it is likely that jobs will actually be lost, as the primary input, irrigation water, has not been diverted to an alternative productive use. Household expenditure will be diverted to substitutes, however we are of the view that those substitutes are likely to be imported, due to limitations on the agricultural resources of land and irrigation water, that is we have assumed that what land and water is available is already being exploited and there are no readily available unexploited resources. Alternatively, where output is exported, export earnings will be reduced. As a result, we believe there will be a net increase in unemployment. While households employed through irrigated agriculture may find alternative work, we have assumed, due to likely substitution with imported goods or loss of exports, that those finding work will displace other people at the margins of the workforce. This will not hold if the economy is close to the natural rate of unemployment. We have assumed this is not the case, but if the output of the economy were limited by labour, then labour freed up by reduced availability of water could be utilised elsewhere. We are of the view that the effect, at the national level, of reductions in the availability of water, will be that household and industry consumption will reduce to the degree that household income and output has been reduced.

We have previously calculated a multiplier of 0.9 for agriculture in the MDB at the local level, with this including household and industry consumption. For 2008-09, GDP for Australia was reported as \$1,194,695 million.⁴⁰ For the same period, average employment was reported as 10,695,900,⁴¹ giving an average GDP per person employed of \$112,000.⁴² Assuming consumption expenditure is across an average of industries, the additional loss in GDP arising from each lost agricultural job is \$101,000, giving a total loss of output of \$184,000. (Note that this figure assumes that a full range of services are consumed by households and may be a high estimate for the MDB. If the value for agriculture was taken as a benchmark for other services, then the value per job lost would be estimated at \$158,000, a reduction of about 16%).

The total annual cost of lost output associated with each agricultural job lost has been taken as \$184,000, equivalent to \$2.6 million in present value. The value of lost production per GI for the various industries is set out below.

Table 3.8: Lost output per GI as Present Value including lost household and industry expenditure (Discount rate = 7%)

Irrigated Agricultural Use	Estimated lost GDP as annual cost	Estimated lost GDP per GI as present value
Vegetables	\$3.7 million	\$52.3 million
Fruit	\$2.9 million	\$41.8 million

⁴⁰ ABS 5206.0 *Australian National Accounts: National Income, Expenditure and Product*, Sep 2009, p. 63.

⁴¹ ABS 1350.0 *Australian Economic Indicators*, Jan 2010 p. 103, using average of estimates for August and November 2008.

⁴² Note that this is an average value across the industry. Some sectors may be more or less productive, however detailed information is not available.

Irrigated Agricultural Use	Estimated lost GDP as annual cost	Estimated lost GDP per GI as present value
Grapes	\$3.7 million	\$52.3 million
Grazing	\$0.8 million	\$11.0 million
Rice	\$0.3 million	\$3.9 million
Cotton	\$0.2 million	\$3.1 million

Source: JSA calculation

Job losses arising from reductions in water availability have been calculated at section 3.3 above.

The table below shows the loss of output associated with various levels of reductions in water availability from basin wide reductions in water availability. Using various figures above, the cost per job is estimated at $(1.0 \times \$83,000 + 0.9 \times \$112,000) / 1.9$, or \$97,000. While the precise value of lost output could be argued, and these values may be overestimated, it is clear that there will be a loss and the loss will be considerable.

Table 3.9: Annual and capitalised loss (present value) of output from reductions in water availability

	10% reduction in water availability	25% reduction in water availability	50% reduction in water availability
Job losses	6,000	14,000	28,000
Annual Cost	\$582 million	\$1,358 million	\$2,716 million
Cost as net present value at 7% (A perpetuity)	\$8,314 million	\$19,400 million	\$38,800 million

Source: JSA calculation

The costs are significant, particularly at a local or regional level, but are proportionally small as a part of the Australian economy. Calculated job losses range from 6,000 to 28,000. Compared with a total labour force in the 2006 census of 9,607,987, these figures are 0.06% and 0.3% of the labour force respectively. Hence these costs may be seen as proportionally small at the national level. From another perspective, annual GDP increased by 2.0% for the twelve months to December 2009. In the worst case, a decrease of 50% in the availability of water in the MDB in the period (all other things being equal) would have decreased this figure to 1.7%. Based on yearly averages, a one off loss of 0.3% of GDP would be recovered in two months growth. By another measure, the upper capitalised estimate is about \$5,400 per household in Australia, or an annual cost of about \$380 per household. For these reasons, the cost in lost output may be seen by the broader Australian community as an acceptable cost by comparison with the benefits of environmental outcomes. At the same time, if the environmental outcomes can be achieved in a more water efficient way, then the Australian community will be better off overall.

By comparison, the impacts in the MDB will be spread across a smaller number of households, and those households will be disproportionately clustered in a few areas heavily reliant on

irrigated agriculture. We have estimated around 600,000 households in the MDB, excluding the ACT. At the level of the MDB, the upper capitalised estimate is about \$65,000 per household, or an annual cost of about \$4,500 per household.

Impacts will be much more severe at the local level, particularly where irrigation forms a substantial part of the economy. In Bourke LGA for example, a 50% reduction in water availability predicts around 100 lost jobs at an annual cost of \$9.7 million. Across approximately 1,100 households, this is an annual cost of \$8,800 per household or a capitalised cost of \$125,000 per household. For Mildura, 3,000 job losses are predicted across about 18,000 households. This is an annual cost of \$16,000 per household or a capitalised cost of \$230,000 per household.⁴³

Recreation and Tourism

Dyack *et al*⁴⁴ calculated values for tourism associated with The Coorong in South Australia and with the Barmah Forest in Victoria. For The Coorong, they obtained a value for tourism of \$57 million and for the Barmah Forest, a value of \$13 million. These figures estimate the value to the user of the tourist activity. However in Cost Benefit Analysis, the consideration of opportunity cost is paramount, that is the difference in cost or benefit between this option and the next best option. In terms of a larger system, say all of Australia, there are alternative recreational and tourist destinations. At that level, the net benefit from The Coorong and the Barmah Forest is the difference between the cost or the benefit of visiting those destinations compared to other destinations. This would be difficult to quantify, but given the range of tourist destinations available in Australia, is likely to be small.⁴⁵ For the purpose of this analysis, the marginal value is assumed to be zero, that is, one destination is assumed to be similar to another. Dyack *et al* note this methodological issue at page xiii. The benefit at a local level is of somewhat more interest.

The combined data set for The Coorong LGA prepared as part of this study showed a total of 2,054 jobs, with 953 of these in agriculture. Using the results of Report 3 of this study, 953 agricultural jobs would predict around 2,900 jobs in total in “The Coorong”. Assuming coefficients for a population less than 5,000, 2,000 jobs would be predicted based on the level of agricultural employment. This suggests The Coorong, with a population of about 6,000 and total employment of 2,054 jobs, is typical of a community based on agriculture. If tourism was a significant industry, we would expect the number of jobs to be greater than that predicted by underlying agricultural employment. Importantly, there is no evidence of employment being higher than would be expected for a similar area in the MDB. Across the MDB, the category Accommodation and Food accounts for 6.6% of employment. However in The Coorong, this category accounts for 6.0%. Similarly, the category Recreation accounts for 0.6% of employment in The Coorong compared to 0.9% for the MDB, suggesting that tourism employment in The

⁴³ Household data from ABS 2006

⁴⁴ Dyack B, Rolfe J, Harvey J, O’Connell D & Abel N, *Valuing Recreation in the Murray*, CSIRO National Research Flagships, Water for a Healthy Country.

⁴⁵ See for example *Camping in State Forests* at [http://www.dse.vic.gov.au/CA256F310024B628/0/ECB3541655C7C9F8CA25720B000B646C/\\$File/FS0006+-+Camping+in+State+forest.pdf](http://www.dse.vic.gov.au/CA256F310024B628/0/ECB3541655C7C9F8CA25720B000B646C/$File/FS0006+-+Camping+in+State+forest.pdf) showing the number of state forests and parks available for camping in Victoria.

Coorong is less than that for the MDB generally. This data suggests that, if tourism in The Coorong contributes to the local economy, the effect is slight and is much less than the \$57 million estimated as the value of tourism by Dyack *et al.* By another measure, 136 people were employed in accommodation and recreation and food in The Coorong in 2006. The value of \$57 million equates to around \$420,000 per job, an impossibly high figure, and four to five times likely values.

A similar exercise has been conducted for Barmah Forest. This is located in the area of Campaspe. Again this area has levels of employment in Accommodation and Food of 5.7% and in Recreation of 1.0% suggesting that the effect on the local economy of tourism, if any, is slight. Any effect is likely to be much more difficult to detect in Campaspe, as the population is much greater than The Coorong (around 36,000), however based on the assessment of The Coorong, it seems clear that the benefits of tourism, if any, in the local area, are likely to be much less than the value estimated by Dyack *et al.* For these reasons, we have adopted the benefit of tourism associated with the preservation of ecologically significant sites and the like at low or nil. The figures obtained by Dyack *et al.*, while reflective of the value placed on tourism by users, give no insight into the marginal cost associated with the loss of the two “iconic” sites as tourist destinations.

Water Quality

Background

Water quality appears to be an area of significant economic concern, particularly with regard to salination. Irrigation activities result in increasing salinity, particularly in the lower Murray River, through the two mechanisms of runoff from irrigated land increasing salt loads and diversion of flows to irrigation reducing the ability to dilute salt loads.⁴⁶ There are likely to be two major effects of increasing salinity, both with clear economic consequences. The first is the reduction in agricultural output as a result of increasing salinity of irrigation water and through rising water tables. The second is the need to obtain alternative sources of drinking water when saline levels exceed potable limits. Other effects include costs associated with turbidity and eutrophication including algal blooms. The costs and benefits are evident. Increasing salinity leads to additional costs through reductions in agricultural output and through the need for higher levels of processing of drinking water or utilisation of alternative sources. Mitigation of salinity incurs costs through salinity mitigation measures (such as interception and removal of saline groundwater through pumping and evaporation),⁴⁷ and in reductions in agricultural output through increased environmental flows. Each of these costs and benefits will be considered separately.

This analysis will focus on salinity levels at Morgan, at the lower end of the Murray River and just upstream of a major intake for SA water. The Water Act 2007 adopts a Basin Salinity Target

⁴⁶ Quiggin J (2001) *Environmental economics and the Murray-Darling river system*, The Australian Journal of Agricultural and Resource Economics, Blackwell, Oxford, pp 70-71, 84.

⁴⁷ Food and Agricultural Organization of the United Nations [FAO] (1976) *Water Quality for Agriculture* Rome p. 50.

of 800 EC⁴⁸ at Morgan 95% of the time. Modelling data is available for this location from *The Salinity Audit*⁴⁹ and this data has been adopted for the purpose of this report. Average river salinity is reported to be 570 EC for 1998 and predicted to be 670, 790 and 900 EC respectively for 2020, 2050 and 2100. No data is provided for the standard deviation, however this can be inferred from figure 9, using the assumption of a normal distribution and assuming the mean of 570EC.⁵⁰ Using this method, the back calculated standard deviation is 163 EC.⁵¹ Using this figure it can be estimated that for 1998, the 5% exceedance level would be 840 E.C. and the 1% exceedance level would be 950 E.C. These figures have been adopted as the likely do-nothing scenario for 2010. As a check, the figures are similar to the “no further intervention” line shown in *BSMS 2006-07 Summary*.⁵² Assuming a constant relative SD, the following 5% and 1% exceedance limits have been calculated for the various years.

Table 3.10: Predicted Salinity at Morgan (E.C.)

Year	Average Salinity	River Standard deviation	5% exceedance level	1% exceedance level
2010	570	163	840	950
2020	670	192	990	1,120
2050	790	226	1,160	1,320
2100	900	257	1,320	1,500

Source: *The Salinity Audit* and JSA calculation.

This represents a “no intervention” scenario based on 1998 data. Current five year moving averages (see discussion below) for EC levels at Morgan are around 440 EC with a standard deviation of 80 EC, some 130 EC below the values predicted in the table above. This is likely to be an outcome of salt interception schemes, improved agricultural practices and dilution flows put in place as part of the Basin Salinity Management Strategy.⁵³ It can be seen that the target of 5% exceedance of 800 EC at Morgan is predicted to be exceeded in 2010 with no intervention.

Effect on agricultural output.

The Salinity Audit (1999) cites a value of 1,500 EC as a level where irrigation of most leguminous pastures and forage crops is very risky. Rice, maize and grain sorghum should not be irrigated at

⁴⁸ Although not stated in the Act, units are assumed to be micro-Siemens per centimetre.

⁴⁹ Murray Darling Basin Ministerial Council (1999) *The Salinity Audit* Murray Darling Basin Commission, Canberra.

⁵⁰ $570 + 1.41 \text{ SD} = 800$; $\text{SD} = 163$

⁵¹ This figure is likely to be conservative. Using a data set for salinity measurements for Murray Bridge for late 1997 to late 2009 (accessed at <http://data.rivermurray.sa.gov.au/> on 6 January 2010), the calculated standard deviation is 123 EC with an average of 484 EC. This figure may reflect the effects of management practices such as dilution flows, and hence has not been used.

⁵² Murray-Darling Basin Commission (2008) *Basin Salinity Management Strategy 2006-07 Annual Implementation Report*, Murray-Darling Basin Commission, Canberra, Figure 1.

⁵³ Murray Darling Basin Commission (2007) *BSMS 2006-07 Summary Basin Salinity Management Strategy 2006-07 Annual Implementation Report*, p. 4 with Figure 1 suggesting an effect of about 300 EC from salinity management.

this salinity, and soybean only on well drained soil.⁵⁴ No reference is provided. The FAO (1976)⁵⁵ provides tables estimating yield decrement to be expected for certain crops due to salinity of irrigation water when common surface irrigation methods are used⁵⁶. A wide number of crops are listed. A 10% reduction in crop yields is predicted for crops as tabulated below. Crops with thresholds above 1,500 EC are not reported as this is the maximum predicted salinity for 2100 1% of the time in the no intervention scenario.^{57,58}

Table 3.11: Crop yields

Crop	Threshold E.C. for reduction in yield	E.C. for 10% reduction in yield
Sesbania	1,500	2,500
Corn	1,100	1,700
Flax	1,100	1,700
Cowpea	900	1,300
Broadbean	1,100	1,800
Beans	700	1,000
Grapefruit	1,200	1,600
Orange	1,100	1,600
Lemon	1,100	1,600
Apple	1,000	1,600
Walnut	1,100	1,600
Peach	1,100	1,400
Apricot	1,100	1,300
Grape	1,000	1,700
Almond	1,000	1,400
Plum	1,000	1,400
Blackberry	1,000	1,300
Boysenberry	1,000	1,300
Avocado	900	1,200
Raspberry	700	1,000
Strawberry	700	900
Cantaloupe	1,500	2,400
Spinach	1,300	2,200
Cabbage	1,200	1,900
Potato	1,100	1,700

⁵⁴ *Op cit* p. 13.

⁵⁵ World Health Organisation (2008), *Guidelines for Drinking Water Quality*, 3rd Edition, Geneva table 5 (note tables are in mmhos/cm and need to be multiplied by 1,000 for comparable EC).

⁵⁶ Note that methods such as drip irrigation may lead to higher soil salinity levels because of reduced flushing of the soil.

⁵⁷ Including rice (2,000 EC) and cotton (5,100 EC).

⁵⁸ Farmers in the lower Murray at Mypolonga reported irrigating fruit trees and grapes with EC levels of around 1,500 in the 80's and 90's, without apparent loss of production at these levels.

Crop	Threshold E.C. for reduction in yield	E.C. for 10% reduction in yield
Sweet corn	1,100	1,700
Sweet potato	1,000	1,600
Pepper	1,000	1,500
Lettuce	900	1,400
Radish	800	1,300
Onion	800	1,200
Carrot	700	1,100
Beans	700	1,000
Trefoil	1,500	1,900
Alfalfa	1,300	2,200
Lovegrass	1,300	2,100
Corn (forage)	1,200	2,100
Clover (berseem)	1,000	2,100
Orchard grass	1,000	2,100
Meadow foxtail	1,000	1,700
Clover (alsike, ladino, red, strawberry)	1,000	1,600

Based on this data, the following reductions in agricultural output are predicted.

Table 3.12: Agricultural output reductions

Year	5% probability of exceeding threshold	1% probability of exceeding threshold	5% probability of 10% reduction in yield	1% probability of 10% reduction in yield
2010	Beans, Raspberry, Strawberry, Radish, Onion, Carrot, Beans	Cowpea, Beans, Avocado, Raspberry, Strawberry, Lettuce, Radish, Onion, Carrot, Beans		Strawberry
2020	Cowpea, Beans, Avocado, Raspberry, Strawberry, Lettuce, Radish, Onion, Carrot, Beans	Corn, Flax, Broadbean, Cowpea, Beans, Orange, Lemon, Apple, Pear, Walnut, Peach, Apricot, Grape, Almond, Plum, Blackberry, Boysenberry, Avocado, Raspberry, Strawberry, Potato, Sweet corn, Sweet potato, Pepper, Lettuce, Radish, Onion, Carrot, Beans, Clover, Orchard Grass, Meadow foxtail, Clover	Strawberry	Beans, Raspberry, Strawberry, Carrot, Beans
2050	Corn, Flax, Broadbean, Cowpea, Beans, Orange, Lemon, Apple, Pear, Walnut, Peach, Apricot, Grape, Almond, Plum, Blackberry, Boysenberry, Avocado, Raspberry, Strawberry, Potato, Sweet corn, Sweet potato, Pepper, Lettuce, Radish, Onion, Carrot, Beans, Clover, Orchard Grass, Meadow foxtail, Clover	Corn, Flax, Broadbean, Cowpea, Beans, Grapefruit, Orange, Lemon, Apple, Pear, Walnut, Peach, Apricot, Grape, Almond, Plum, Blackberry, Boysenberry, Avocado, Raspberry, Strawberry, Spinach, Cabbage, Potato, Sweet corn, Sweet potato, Pepper, Lettuce, Radish, Onion, Carrot, Beans, Alfalfa, Lovegrass, Corn, Clover, Orchard Grass, Meadow foxtail, Clover	Beans, Avocado, Raspberry, Strawberry, Lettuce, Onion, Carrot, Beans	Cowpea, Beans, Apricot, Blackberry, Boysenberry, Avocado, Raspberry, Strawberry, Radish, Onion, Carrot, Beans
2100	Corn, Flax, Broadbean, Cowpea, Beans, Grapefruit, Orange, Lemon, Apple, Pear, Walnut, Peach, Apricot, Grape, Almond, Plum, Blackberry, Boysenberry, Avocado, Raspberry, Strawberry, Spinach,	Sesbania, Corn, Flax, Broadbean, Cowpea, Beans, Grapefruit, Orange, Lemon, Apple, Pear, Walnut, Peach, Apricot, Grape, Almond, Plum, Blackberry, Boysenberry, Avocado, Raspberry, Strawberry,	Cowpea, Beans, Apricot, Blackberry, Boysenberry, Avocado, Raspberry, Strawberry, Radish, Onion, Carrot, Beans	Corn, Flax, Broadbean, Cowpea, Beans, Grapefruit, Orange, Lemon, Apple, Pear, Walnut, Peach, Apricot, Grape, Almond, Plum, Blackberry, Boysenberry, Avocado, Raspberry, Strawberry, Spinach,

Year	5% probability of exceeding threshold	1% probability of exceeding threshold	5% probability of 10% reduction in yield	1% probability of 10% reduction in yield
	Cabbage, Potato, Sweet corn, Sweet potato, Pepper, Lettuce, Radish, Onion, Carrot, Beans, Alfalfa, Lovegrass, Corn, Clover, Orchard Grass, Meadow foxtail, Clover	Cantaloupe, Spinach, Cabbage, Potato, Sweet corn, Sweet potato, Pepper, Lettuce, Radish, Onion, Carrot, Beans, Trefoil, Alfalfa, Lovegrass, Corn, Clover, Orchard Grass, Meadow foxtail, Clover		Cabbage, Potato, Sweet corn, Sweet potato, Pepper, Lettuce, Radish, Onion, Carrot, Beans, Alfalfa, Lovegrass, Corn, Clover, Orchard Grass, Meadow foxtail, Clover

For predicted 2020 salinity levels, the impacts are likely to be slight or non-existent, with a 5% probability of some vegetable crops exceeding the threshold and of only strawberries having a 5% probability of reduced yield. The 1% probabilities correspond to four days per year of salinity above this level, and we have assumed that such an impact would be minimal, as the crop tolerance tables are based on continuous use of water at the limits stated.

For 2050, we have assumed a 5% probability of a 10% reduction in yield for vegetable crops across the basin, a very conservative assumption, as the yield of many vegetable crops will not be affected, and it is likely that not all areas of the basin will reach the salinity limits calculated. For 2006, we found that, in the MDB, there were 4,364 people employed in vegetable production. Using the factor of 1.11 and the value of \$184,000 for each agricultural job from above, the estimated value of this industry was \$891.3 million⁵⁹ in 2006. A 5% probability of a 10% reduction in yield equates to an annual loss of \$4.5 million. Assuming \$4.5 million loss for the years 2050-2100, and using a 7% discount rate, the net present value in 2010 is \$4.2 million. By comparison with Table 3.4 above, if the cost of avoiding this loss was one Gl of water, then diversion of one Gl of irrigation water from Rice or Cotton production would be warranted now to avoid this productivity loss in the future. The calculation is quite sensitive to time. By 2024, it would be worth losing one Gl of water from grazing to offset this predicted loss in productivity, and from around 2045 it would be worth losing one Gl of water from vegetables, fruit or grapes to offset this predicted loss in productivity. Assuming annual flows in the Murray River of 10-20,000 Gl, an additional 1 Gl of water will have an inconsequential impact on salinity levels. As an example, if salinity levels were 2,000 EC with an annual flow of 10,000 Gl, dilution by one additional Gl would reduce salinity levels to 1,999.8 EC. This analysis suggests that the cost to agriculture from increased salinity would be much less than the cost of reducing salinity by diverting water from irrigation, at least at predicted levels up to 2100.

The calculations above assume that water tables remain constant however this is unlikely to be the case. Rising water tables are likely to be a more significant problem for irrigated crops than increasing river salinity. There are a number of different responses to rising water tables, including changing crops or expending funds on drainage to lower water tables. We have calculated some indicative costs associated with a hypothetical scenario and some possible intervention strategies.

Assume a situation where the water table is rising on 10 ha of irrigated land used for vegetable production, with a productive value of \$200,000. By maintaining current levels of irrigation (Option 1), productivity will decrease by 10% in five years time, 25% in eight years time and 50% in ten years time at which time the only use will be a dryland crop, that is irrigation can no longer be sustained. However by reducing irrigation water use by half (Option 2), there will be an immediate 50% loss of productivity, but this level will not decrease with time. In Option 3, \$200,000 is spent on drainage works to lower the water table in year 1, thereby maintaining productivity.

⁵⁹ Reported in 2009 dollars.

Results are shown in the table below. In the hypothetical scenario modelled, expenditure on drainage works, rather than a reduction irrigation, provides the best outcome. To obtain some further understanding, we have modelled the effect of changes in key variables and inputs.

Table 3.13: Cost comparison of various scenarios (Twenty year life, 7% interest rate)

	Option 1 Accept reduced productivity	Option 2 Reduce irrigation	Option 3 Spend \$200,000 on drainage in year 1
Productivity Year 2-5	\$200,000	\$100,000	\$0
Productivity Year 2-5	\$200,000	\$100,000	\$200,000
Productivity Year 6-8	\$180,000	\$100,000	\$200,000
Productivity Year 8-10	\$150,000	\$100,000	\$200,000
Productivity Year 11-20	\$3,000	\$100,000	\$200,000
Cash flows as Net Present Value (NPV)	\$1.33 million	\$1.06 million	\$1.93 million
Sensitivity Analysis			
Cash flows as NPV using 1% discount rate	\$1.77 million	\$1.80million	\$3.41 million
Cash flows as NPV with irrigation reduction in year 5	\$1.33 million	\$1.47 million	\$1.93 million
Cash flows as NPV with \$1.0 million spent on drainage works	\$1.33 million	\$1.06 million	\$1.18 million
Cash flows as NPV assuming initial productivity of \$50,000 (less productive initial use)	\$0.42 million	\$0.26 million	\$0.34 million
Cash flows as NPV over a 40 year life	\$1.33 million	\$1.33 million	\$2.48 million

The current productive irrigation use is important. For higher order uses, some form of intervention is justified, however as the irrigated use becomes less productive, and the gap between that use and the next use narrows, intervention to lower the water table is less and less justified on economic terms. Lowering levels of irrigation to maintain productivity is favoured in regimes with lower interest rates and when a longer time period is considered. Depending on the details of the scenario, quite high levels of engineering intervention are warranted to maintain productivity, however this is sensitive to the use and the lifetime.

The do nothing approach (Option 1) is favoured in circumstances where the gap between the irrigation use and the next use is relatively small. Reduced irrigation (Option 2) becomes more favourable when the intervention can be left as late as possible, when longer time frames are considered and when the costs of engineering solutions increase markedly. Managed solutions (Option 3) are favoured to maintain higher productive uses and where the costs of those solutions are proportionate to productivity outcomes.

While these trends are of interest, the most important message is that there is no “one right answer” in responding to rising water tables. The answer will depend on the circumstances of the case, and the appropriate response would need to be assessed in each situation.

Effect on drinking water

As more water is used for irrigation, salinity⁶⁰ increases in the river, leading to deterioration in the quality of drinking water pumped from the same river. The matter of salinity has a number of levels. Firstly there are criteria for drinking water, with lower limits set by aesthetic criteria (taste), and higher limits set by health criteria. Methods of controlling salinity in potable water vary also. For example, general salinity in the river could be lowered by restricting irrigation or intercepting saline discharges. More saline river flows could be diluted by additional dam discharges but those discharges will no longer be available for other uses. Alternative sources of potable water can be considered, including rain water tanks and desalination, and this water can be used to supplement river water through dilution. Alternatively, dual supplies can be provided, with a lower quality feed for not potable uses.

Potable Water criteria

A value of 800 EC is commonly cited in literature around water quality and the Murray Darling Basin as a desirable limit for drinking water. EC, or electrical conductivity, is a proxy measure for total dissolved solids (TDS) in water, whereby increasing salt levels are reflected in increased electrical conductivity, and measured in EC. An EC unit appears to be generally taken as one micro-Siemen per centimetre in Australia.⁶¹ The *Salinity Audit*⁶² refers to the World Health Organisation in support of this value, however the WHO *Guidelines for Drinking Water Quality* (2008) do not provide a guideline value for TDS.⁶³ The 1984 guidelines suggested 1000 mg/litre on taste considerations. 1200 mg/litre is considered to be a threshold at which consumers may find it objectionable.⁶⁴ The 2008 guidelines suggest values of 600 mg/litre as giving good palatability, with palatability deteriorating at levels greater than 1000 mg/litre.⁶⁵ No guidelines are given for chloride and sulphates, the other common salts. The value of 800 EC is also found in the Water Act, but is unreferenced.⁶⁶

The *Australian Drinking Water Guidelines*⁶⁷ give guideline values for chloride of 250 mg/l (aesthetic); Calcium Carbonate of 200 mg/l (aesthetic); sulfate of 250 mg/l (aesthetic) and 500

⁶⁰ This report takes salinity as synonymous with total dissolved solids (TDS), as this is reflective of the common measure of salinity cited, that is EC, in the Australian Drinking Water Guidelines.

⁶¹ The Salinity Audit, *Op cit*, p. 13.

⁶² *Op cit*, p. 13. The report also conflates salinity with total dissolved solids (TDS).

⁶³ World Health Organisation (2008), *Guidelines for Drinking Water Quality*, 3rd Edition, Geneva, see for example p. 490.

⁶⁴ *Ibid* p. 445.

⁶⁵ *Ibid* p.218.

⁶⁶ *Op cit*, clause 7(1).

⁶⁷ National Health and Medical Research Council (2004), *Australian Drinking Water Guidelines 6*, Australian Government, table 10.10.

mg/l (health); and TDS of 500 mg/l (aesthetic) with 500-1000 mg considered acceptable and levels above 1000 mg considered unacceptable.

Further detail is provided in the fact sheet on TDS. “Based on taste, total dissolved solids in drinking water should not exceed 500mg/L. The equivalent figure in electrical conductivity units (EC units) can be roughly determined by doubling this value.” “The most common and least expensive method [of measurement] is to convert electrical conductivity measurements to TDS values by multiplication with a factor that varies with the type of water (APHA Method 2510A 1992). Method 2510A⁶⁸ states “estimate total dissolved solids (mg/l) in a sample by multiplying conductivity by an empirical factor. This factor may vary from 0.55 to 0.9, depending on the soluble components of the water and on the temperature of measurement”. The empirical factor is clearly of importance. The Australian Guidelines propose a rough factor of 0.5. The Victorian Department of Sustainability and Environment proposes a factor of 0.6 at 25°C.⁶⁹ Lower Murray Water uses a criterion of 830 EC, equivalent to a factor of 0.6 and a TDS criterion of 500 mg/l.⁷⁰ Using recent data provided by SA water, we have calculated the empirical factor at 0.55 for raw water at Morgan. Using this factor, 800 EC is equivalent to 440 mg/L, around 90% of the value in the *Australian Drinking Water Guidelines* and about 70% of the aesthetic value in the *WHO Guidelines for Drinking Water Quality* (2008).

Using data from Table 3.6 above, the value of 800 EC is expected to be exceeded 8% of the time by 2010 in the absence of any intervention, or exceeded 30 days in a year. For 2020, the value is expected to be exceeded 25% of the time, or 91 days per year, with the values for 2050 and 2100 being 48% (175 days a year) and 65% (237 days a year).

A higher criterion could be considered. Using the upper limit of 1000 mg from the *Australian Drinking Water Guidelines* and the factor of 0.55, the limit for salinity would be 1,820 EC. Again using data from Table 3.6 above, the value of 1,820 EC is expected to be exceeded less than 0.01% of the time by 2010 in the absence of any intervention, or less than one hour in a year. For 2020, the value is expected to be exceeded less than 0.01% of the time, or less than one hour per year, with the values for 2050 and 2100 being less than 0.01% (less than one hour per year) and 0.02% (13 hours per year). Adoption of a higher criterion would essentially be cost free.

Methods of Salinity Control

There are a number of methods of controlling or responding to increasing salinity, both in the source water and in the delivered water. These include salt interception, dilution flows, improving irrigation and dryland farming practice, restricting irrigation, alternative water supply and desalination of water supply.

⁶⁸ American Public Health Association (2005) *Standard methods for the examination of water and wastewater*, 21st edition, American Public Health Association and others, Washington.

⁶⁹ Anderson H and Cummings D, (1999), *Measuring the salinity of water*, Department of Sustainability and Environment, State of Victoria.

⁷⁰ Lower Murray Water (2009), *Drinking Water Quality Report 2008-2009*, Lower Murray Urban & Regional Water Corporation, table 3.41.

The first three will be considered together, as these appear to be the strategies adopted under the Basin Salinity Management Strategy.⁷¹ The Basin Salinity Management Strategy was implemented around 2000 and appears to have been quite successful, both in reducing salinity, and in reducing the variation in salinity levels as evidenced by recent data.

Salt interception, dilution flows and irrigation and dryland farming practice

The figures below illustrate the moving five year average of salinity (measured in EC) and the standard deviation of salinity levels measured at Morgan. In 1998, the average EC at Morgan was 650 EC, with a standard deviation of 95 EC. For 2009, the average was 490 EC with a standard deviation of 70 EC, suggesting a considerable reduction in both average salinity and in the variability associated with salinity. In order to minimise the effects of year to year fluctuations in both averages and standard deviation, we have taken a five year moving average to identify trends. The data suggest a reduction in EC since 1998, but with diminishing returns, and with average levels plateauing. While there may be an upward trend occurring since 2007, this could also be a result of low EC levels due to cessation of irrigation through 2007 as a result of low flows. A longer record is required to determine if in fact such an upward trend is occurring, particularly in the light of the long term decreasing trend. In late 2009, the five year average was 440 EC with a standard deviation of 80 EC.

The decrease in results may also be a result of reduced flows from the Darling River over the time period, with the reduction because of the sourcing of water from Dartmouth Dam through the recent drought. There could also be first flush effects with increased levels of EC from flooding following a dry period. These effects are not evident in data, with data for Burtundy weir on the lower Darling showing EC of around 250 with the recent flood front (February 2010) rather than anticipated elevated levels.⁷² EC data for Lock 9 and for Morgan has remained relatively constant over the flood period (January 2010 to April 2010).⁷³

⁷¹ BSMS 2006-07 Summary *op cit.* p. 4.

⁷² http://waterinfo.nsw.gov.au/water.shtml?ppbm=SURFACE_WATER&rs&3&rskm_url accessed 28 April 2010.

⁷³ <http://e-nrims.dwlbc.sa.gov.au/Telemetry/TimeSeries.aspx?App=RMW&Period=Daily&Site=A4260501&SiteName=Lock%209%20US&Params=12,100> accessed 28 April 2010.

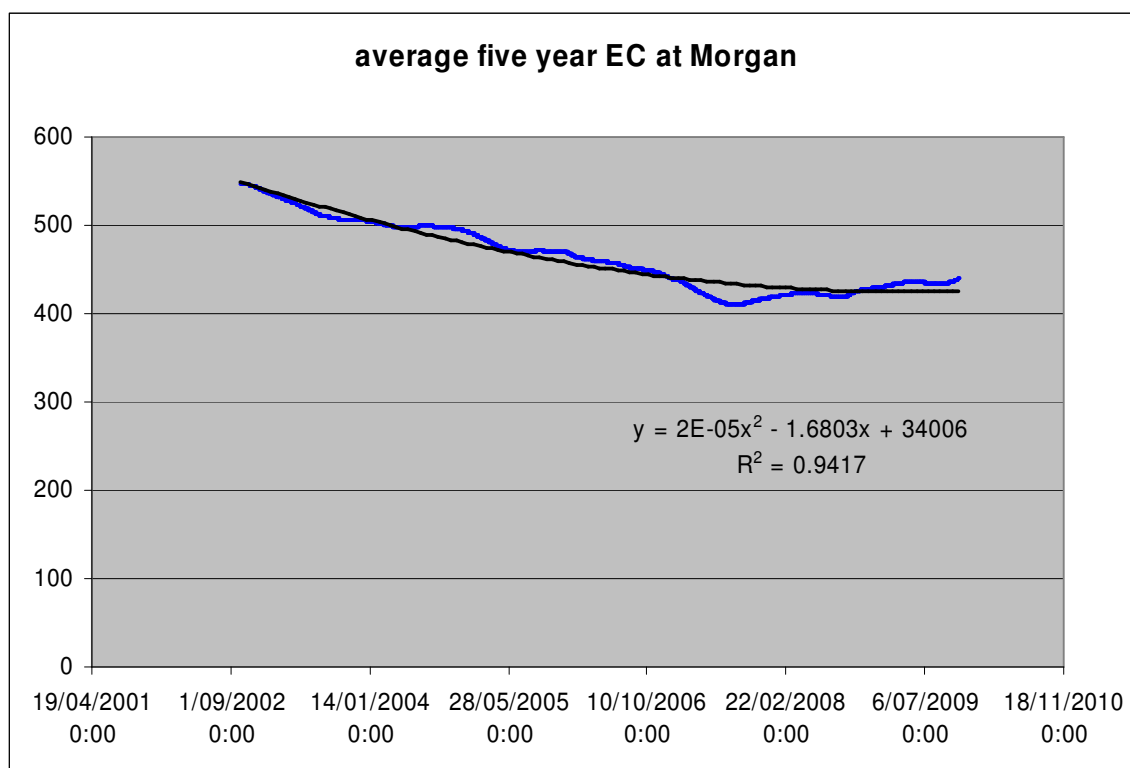


Figure 3.11: Average five year EC levels at Morgan

Source: Data from <http://data.rivermurray.sa.gov.au/> accessed 9/1/10, JSA analysis

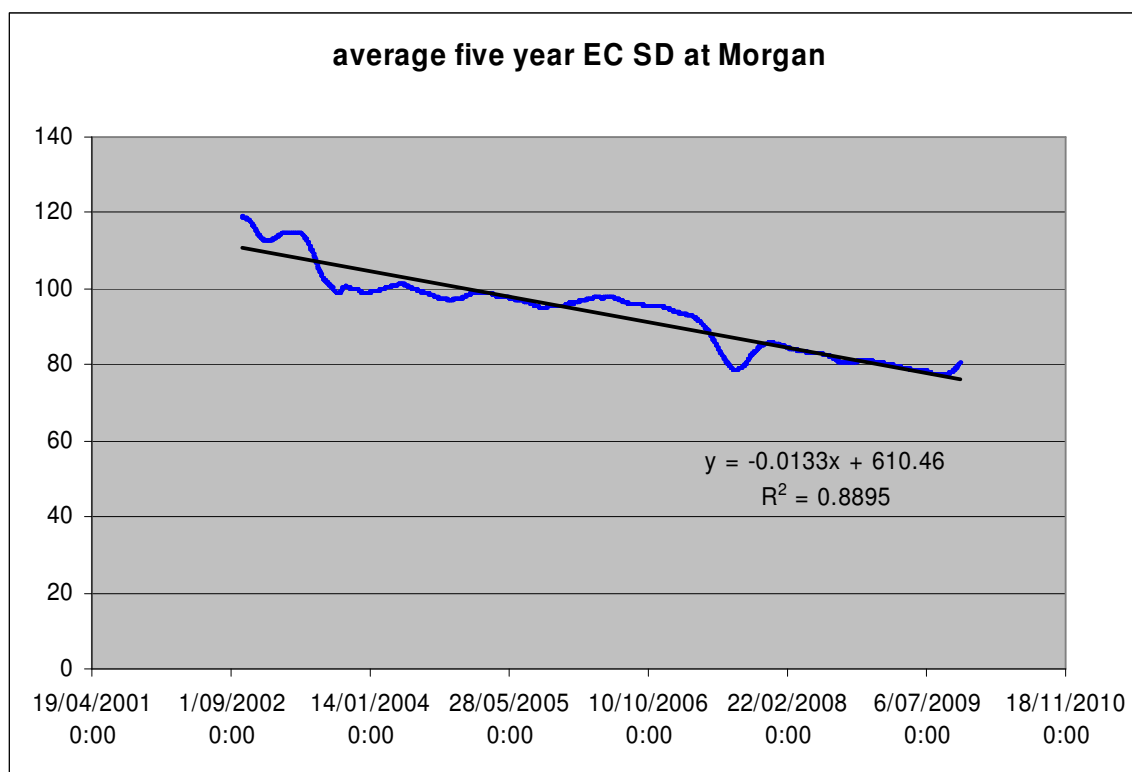


Figure 3.12: Average five year standard deviation of EC levels at Morgan

Source: Data from <http://data.rivermurray.sa.gov.au/> accessed 9/1/10, JSA analysis.

Using the five year averages and the predicted salinities from Table 3.6 above, salinity projections have been calculated. These are based on a 130 EC reduction in average salinity for 2010, with a standard deviation of 80 EC, and the assumption of constant relative standard deviation, that is standard deviation increases proportionally as salinity increases.

Table 3.14: Predicted Salinity at Morgan (E.C.)

Year	Predicted Average River Salinity (<i>The Salinity Audit</i>)	Adjusted Prediction based on 2009 five year average	Standard deviation	5% exceedance level	1% exceedance level
2010	570	440	80	570	630
2020	670	540	100	700	770
2050	790	650	120	850	930
2100	900	770	140	1,000	1,100

Source: *The Salinity Audit* and JSA calculation

Results calculated using a constant standard deviation are tabulated below.

Table 3.15: Predicted Salinity at Morgan (E.C.) assuming constant standard deviation

Year	Predicted Average River Salinity (<i>The Salinity Audit</i>)	Adjusted Prediction based on 2009 five year average	Standard deviation	5% exceedance level	1% exceedance level
2010	570	440	80	570	630
2020	670	540	80	670	730
2050	790	650	80	780	840
2100	900	770	80	900	960

Source: *The Salinity Audit* and JSA calculation

There are three conclusions from the analysis. The first is that the salinity management measures put in place have been quite effective, reducing peak EC measurement through both a reduction in average EC, and through a reduction in variability. The second is that assuming current management techniques, the target of 5% exceedance of the 800 EC threshold would be expected to be exceeded in about 2040. The third is that if management techniques continued to improve, such as through improved irrigation methods, higher levels of system feedback and targeting of dilution flows, resulting in a constant standard deviation or a further reduction, the target of 5% exceedance of the 800 EC threshold would be expected to be exceeded in about 2060.

Salinity diversion works are continuing to be constructed within the basin. We have attempted a preliminary analysis of costs associated with such diversion works. The Pyramid Creek Scheme became operational in 2008-09. The Scheme diverted 26,632 tonnes of salt at an energy cost of 123,922 kWh.⁷⁴ The scheme was costed at \$10 million in 2001.⁷⁵ Based on the Consumer Price Index,⁷⁶ the cost at 2010 would be about \$13 million, equivalent to an annual capital cost of \$0.9 million. Operational costs are less easy to estimate. Domestic electricity rates are about \$0.18 per kWh, suggesting an annual cost of at least \$22,000, although industrial electricity charges are likely to be somewhat lower. There are likely to be other operational costs around labour and machinery. For these reasons, an annual cost of \$2.0 million (including capital and operation) has been assumed for the purpose of calculation. 800 EC is approximately equal to 500 mg per litre, or 500 tonne per Gl. At 800 EC, the salt load of 26,632 tonnes would require a minimum of 53 Gl of water to dilute it for disposal, noting however the demand for water is likely to be higher because the water used for dilution will be carrying an initial salt load. (Storage water in the upper Murray has typical EC values of 30-50 EC.⁷⁷) This gives a cost per Gl of dilution water saved of about \$40,000. As discussed above, the value of one Gl of water to the community varies between \$200,000 and \$3.7 million depending on the agricultural use, with marginal drinking water uses likely to have much higher values. This suggests that salt interception would

⁷⁴ Murray Darling Basin Authority Annual Report accessed on 11 January 2010 at <http://www.mdba.gov.au/MDBA-Annual-Report/chapter2-4.html>.

⁷⁵ http://www2.mdbc.gov.au/salinity/basin_salinity_management_strategy_20012015/salt_interception_scheme.html accessed 11 January 2010.

⁷⁶ Australian Bureau of Statistics.

⁷⁷ Data for site 409016, Murray River at Heywoods accessed at <http://www.vicwaterdata.net/vicwaterdata/ExtractData/ExtractionDetailForm.aspx?SiteID=1705&MDefID=536&MDefDesc=ELECTRICAL+CONDUCTIVITY+%28AT+STREAM+TEMPERATURE%29&ObsCount=218#table>

have a benefit-cost ratio of the order of five by comparison with dilution where the irrigation use is cotton production and up to 100 compared to uses such as vegetable production. Based on this preliminary scoping analysis, such schemes appear to be highly cost effective, particularly when associated with savings in dilution water that would otherwise be used for vegetables, fruit, grape and irrigated grazing and dairy production.

It is likely that as time goes on, salt interception schemes may become less efficient as good sites are developed. However this preliminary analysis suggests that such schemes could be relatively inefficient (between 5 and 100 times less efficient than Pyramid Creek for example) in reducing salt load, and still be expected to be cost effective.

The costs and benefits of improved irrigation practice and dryland farming practices have not been considered here. It is noted however that widespread take up of such practices has been reported in consultations suggesting that costs are either slight or are exceeded by benefits.

Restricting irrigation

Schroback, Adamson and Quiggan⁷⁸ provide modelling data for the MDB under a range of varied flow and diversion limits. In particular, they modelled a scenario whereby irrigation supply was reduced. In table 4, they predict a reduction in EC of 45 at Adelaide (assumed by us to represent Morgan) for a transfer of 600 Gl from irrigation to natural flows, a reduction of 80 EC for a transfer of 1,200 Gl and a reduction of 120 EC for a transfer of 1,800 Gl. This translates to, on average, 15 Gl of irrigation water per one EC reduction, however the initial reduction is slightly more efficient, requiring 13 Gl per one EC reduction. Using the values from Table 3.4 above, the annual cost of a one EC reduction in salinity is estimated to be between \$2.6 million (compared to cotton usage) and \$48.1 million compared to vegetable production. This would appear to be quite inefficient. In order to achieve the same reductions achieved by current management techniques (estimated above to be a 130 EC reduction), the cost would be between \$338 million and \$6,253 million in lost agricultural output from reduced irrigation. This can be compared with management techniques in place and using the cost estimated for Pyramid Creek of \$2.0 million per annum for diversion of 27,000 tonnes of salt, or \$74 per tonne of salt. Around 460,000 tonnes of salt in total across all schemes was diverted in 2008/09.⁷⁹ At \$74 per tonne, the likely annual cost is \$34 million, or about \$0.3 million per reduction of salinity by one EC, between one tenth and one two hundredth of the cost of obtaining the same reduction in EC through diversion of agricultural irrigation water. It must be noted that some proportion of the reduction is accounted for by dilution flows, but if this had contributed to half the estimated reduction of 130 EC, in current circumstances construction of salt interception schemes would be still be between five and one hundred times more efficient than a permanent reduction in irrigation water usage in reducing salinity.

⁷⁸ Schroback P., Adamson D. and Quiggan J (2008) *The Options for salinity mitigation in the Murray-Darling Basin*, 52nd annual conference of the Australian Agricultural and Resource Economics Society.

⁷⁹ Murray Darling Basin Authority Annual Report accessed on 12 January 2010 at <http://www.mdba.gov.au/MDBA-Annual-Report/chapter2-4.html>.

Alternative sources of potable water

Currently potable water is obtained, in the example of Adelaide, partially from the Murray River. The original source of these flows is rainfall in the upper Murray catchment, with water stored in dams such as Hume and Dartmouth Reservoirs. From the viewpoint of the Adelaide water supply, the Murray River can be viewed as a canal transferring water from these reservoirs to the intake below Lock 1. This canal is shared with other users, and can become contaminated from various inflows, with this reflected in increased salinity. Table 3.10 above suggests that by 2050, salinity levels at Morgan will need to be reduced by about 50 EC to meet the 5% exceedance level, and by 130 EC to meet the 1% exceedance level.

There are a number of ways of achieving this target. Using the estimates above, additional salt diversion and management would cost between \$15 million (to achieve 50 EC reduction) and \$39 million per annum (to achieve 130 EC reduction). To achieve the same decrease by diverting irrigation water would cost between \$130 million per annum (in lost cotton irrigation) and \$2,405 million per annum (in lost vegetable irrigation) to achieve a 50 EC reduction, and between \$338 million per annum (in lost cotton irrigation) and \$6,253 million per annum (in lost vegetable irrigation) to achieve a 130 EC reduction.

An alternative approach is one of targeted dilution. In 2007-08, SA Water sourced 186 GL from the Murray River for potable water.⁸⁰ This value is used for estimation purposes, noting that it is likely that by 2050, the population will have increased and demand for water will be much higher. Desalinated water is assumed to have a base EC of zero, and, as discussed above, storage water in the upper Murray has typical EC values of 30-50 EC. For 2050, the target of 800 EC would be expected to be exceeded around 11% of the time, with an average overexceedance of 50 EC. On this basis, around 19 GL of water per annum on average would require dilution to achieve the level of 800 EC. By simple proportions, around 7% of this water would need to have an EC of 50 to dilute the more saline water, and, if the EC of the dilution water was zero, around 6%. Hence, to provide 19 GL of water with EC of 800, around 1.3 GL of dam water, or around 1.1 GL of desalinated water would be required to provide dilution. With respect to dam water, a flow rate would be required of around 375 l/s to achieve this.⁸¹ For this flow rate, the head loss in a 600 diameter concrete lined pipe is around 2.7 m per kilometre, suggesting that such a pipeline would be appropriate.⁸² The distance between the Hume Reservoir and Adelaide is about 900 km, and the cost of 600 diameter ductile iron concrete lined pipe is about \$514 per metre. Allowing a factor of three to include fittings and laying costs, a very rough estimate of cost for a pipeline from Albury to Adelaide is around \$1.4 billion, equivalent to an annual cost of \$97 million. The cost of providing desalinated water is estimated at around \$1 per kilolitre.⁸³ Hence to provide the diluting water through desalination would cost around \$1.1 million per annum. Using the Australian Water Association upper estimate of \$4 per kilolitre, the annual cost is estimated at around \$4.4 million.

⁸⁰ SA Water (2008), *Annual Report*, p. 44.

⁸¹ $1.3 \times 10^9 / 0.11 / (365 \times 24 \times 60 \times 60) = 375 \text{ l/s}^{-1}$

⁸² Using the Darcy equation and assuming f of 0.012.

⁸³ Australian Water Association, *Desalination Fact Sheet*. These costs are based on seawater, and desalinating river water is likely to be cheaper. The estimates appear to include amortisation of capital cost.

Results are summarised in the table below:

Table 3.16: Summary of cost estimates to achieve salinity targets at Morgan in 2050

Method	Estimated Annual Cost
Additional salt diversion and management	\$15-39 million
Reduction in irrigation	\$130-\$6,253 million*
Dilute via pipe line	\$97 million
Dilute via desalination (operation on demand)	\$1-4 million
Dilute via desalination (continuous operation)	\$9-36 million

*The lower value is unlikely because of lack of connectivity and transmission losses across the MDB.

It can be seen that dilution water from desalination or additional salt diversion and management are likely to be the most cost effective solutions, followed by construction of a pipeline with reduction in agriculture likely to be the least cost effective measure. Other methods, such as water tanks and dual supplies, have not been considered here.

Maintenance of ecosystems and biodiversity

There are a number of Ramsar sites in the MDB. We have focused on The Coorong, Lake Alexandrina and Lake Albert Ramsar site as a case study for the analysis of costs and benefits. This is because environmental water requirements for this site are clearly lost to agriculture, as there are no downstream uses. As at early 2010, this site is undergoing significant environmental change and degradation as a result of diversion of flows from the Murray-Darling River system. The flood regime has changed, from a small flood every 1.5 years on average, to a flood every 15 years on average. In addition, barrages were installed to Lake Alexandrina in the 1930's so that it could be used as a water storage.⁸⁴ Lake Alexandrina itself has been generally fresh water over at least the last 7,000 years⁸⁵ but is now increasingly saline. There are a range of threats arising from water diversion including permanent flood conditions in the lake and permanent drought conditions in the estuary and blocking of the Murray mouth, itself a result of lack of flow. The net effect is a reduction in the number of biological niches available.⁸⁶ More recently, evaporation from the lakes combined with lack of inflow has led to the exposure of Acid Sulphate Soils requiring either treatment or inundation.⁸⁷ The biota of the lakes is changing to salt tolerant species and the number of species has decreased from 150 to 117 between 2004/05 and 2008/09. Of the remaining species, abundance has declined.⁸⁸ Current salinity levels vary, being 730 EC at Wellington (the entrance to the lakes), and ranging from 4,000 EC to 6,000 EC within Lake Alexandrina. In the estuary and lagoons, salinity ranges from 13,000 EC to 91,000 EC,

⁸⁴ Department for Environment and Heritage (2000), *Coorong, and Lakes Alexandrina and Albert Ramsar Management Plan*, Government of South Australia, p. 16.

⁸⁵ Kingsford R, Fairweather P, Geddes M, Lester R, Sammut J and Walker K (2009), *Engineering a Crisis in a Ramsar Wetland: the Coorong, Lower Lakes and Murray Mouth, Australia*, Australian Wetlands and Rivers Centre, UNSW, p. 9.

⁸⁶ Department for Environment and Heritage, *op cit*, pp 16-17.

⁸⁷ Kingsford et al, *op cit*, p.3.

⁸⁸ *ibid*, p. 25.

compared to seawater at about 50,000 EC.⁸⁹ Options for management seem somewhat limited and appear to comprise short term engineering interventions, an increase in river flows to return the ecosystem to one characterised by freshwater and tidal flows, or alternatively, opening the barrages and abandoning the lakes to a marine environment. Considerations are further compounded by predictions of sea level rises associated with global warming which could lead to inundation by seawater of the area in 25-50 years.⁹⁰ Kingsford et al propose a median annual flow of at least 3,800 GJ per year at the barrages, an increase in median annual flows of 700 GJ per year at the barrages.⁹¹ This is further quantified in a supplementary report by Kingsford *et al* showing the additional water required over the years 1994 to 2008. When contacted, Mr Kingsford was unable to provide digital data, however the quantum can be scaled from figures in the supplementary report. On average, additional flows of 790 GJ per annum are required, with annual values ranging from zero to 2,400 GJ.

A number of options are considered. These are the do nothing option, current management options, restoration of appropriate environmental flows and changing to a marine environment.

The do nothing option.

Currently there are significant costs being incurred in the Lower Lakes. These are as a result of low water levels, leaving irrigation infrastructure stranded and exposing potential acid sulphate soils, and increasing levels of salinity from evaporation. At the same time, and based on historical climate data, the current circumstance appears to be a rare event. The CSIRO states, “Under the 1895 to 2006 climate and current development, levels in the Lower Lakes never fall below mean sea level”⁹² and cease to flow conditions at the Murray River mouth have increased from 1% of the time to 40% of the time. For the purpose of calculation, we have assumed the current low levels are a one in one hundred year event. We have also assumed that, if water levels have not fallen below sea level, significant evaporation has not occurred and the water is still usable for agriculture.

The do nothing option is likely to result in occasional significant environmental degradation both through increasing salinity and through acidification from the exposure of Acid Sulphate Soils. The main economic effects will be on irrigation uses; and recreational users of the waterways, through loss of fish for recreational fishing, and, at higher levels of acidification, the loss of the lake for swimming and the like, however it is likely there are substitute recreational areas or activities available. Proposed and constructed canal estates are also likely to be at some risk due to reduced land values as a result of lower water levels.

In 2006, prior to any reduction of irrigation, there were 163 people employed in irrigation related agriculture in The Coorong, including vegetables, horticulture, dairy and milk processing. Allowing for not stated, the estimated employment is 181 people directly employed in irrigated agriculture and associated industries. Using the figure of \$184,000 per job estimated above, the

⁸⁹ Data from <http://data.rivermurray.sa.gov.au/> accessed 12/1/10

⁹⁰ *Ibid*, p. 3.

⁹¹ *Ibid*, p. 3.

⁹² CSIRO (2008), *Water Availability in the Murray (Summary)*, page 4.

annual value of this agricultural production is \$33.3 million. Assuming a one in one hundred year event, the expected annual cost is \$0.3 million from low water levels and high levels of salinity.

Current management options.

Current management options to address acid sulphate soils, increasing salinity and hypersalinity across the MDB with some indicative costs are shown in table 2 of Kingsford et al.⁹³ Those directly pertaining to management of the Ramsar area are tabulated below.

Table 3.17: Cost of current management options of the Ramsar area

Management Options	Cost	Annual Cost
Clayton and Currency Creek	\$26 million	This is a sunk cost.
Pumping of water to Lake Albert	\$14 million	Not clear, between \$1.0 and \$14.0 million
Dredging of Murray mouth	\$5.0 million	\$5.0 million
Rehabilitation of Acid Sulphate Soils	\$10.0 million	\$10.0 million

The total current annual cost of these measures appears to be of the order of \$20 million, but may be as high as \$30 million. This estimate may be somewhat high as annual costs pertaining to acid sulphate soils are likely to decrease over time, as the lakes reach a static lower level arising from reduced flows. This approach appears to consist of a holding pattern, in anticipation of higher river flows in the future reducing salinity and increasing lake levels.

In terms of expected costs, we have assumed a 1% chance of pumping water to Lake Albert and of rehabilitation of Acid Sulphate Soils, and a 40% chance of the Murray River mouth closing up. Using these costs, the expected value is calculated as:

$0.01 \times \$24 \text{ million} + 0.4 \times \$5 \text{ million} = \$2.2 \text{ million per annum}$. The cost of lost agricultural production should be added, giving a total expected annual cost of low water levels of \$2.5 million per annum.

Changing to a marine environment

This option will lead to a replacement of current ecosystems with marine ecosystems but will address environmental problems associated with acid sulphate soils and hypersalinity. This option is likely to require ongoing dredging, and channel construction to Lake Albert, with the latter costed by Kingsford et al at \$2-150 million, an annual cost of \$1.5 to \$10.5 million, suggesting a likely total annual cost of this option of around \$10-20 million. Agriculture will no longer be possible, with an additional loss of $\$33.3 \text{ million} \times 0.99 = \$33.0 \text{ million}$, giving a total annual cost of this option of \$43-53 million.

⁹³ *Ibid*, table 2.

Restoration of environmental flows

Kingsford et al propose an increase in median annual flows of 700 Gl per annum, to provide a median annual flow at the barrages of 3,800 Gl. This is further quantified in a supplementary report by Kingsford *et al* showing the additional water required over the years 1994 to 2008. Mr Kingsford was unable to provide digital data to the writers of this report, however the quantum can be scaled from figures in the supplementary report. On average, additional flows of 790 Gl per annum are required, with annual values ranging from zero to 2,400 Gl. Using the same method as used previously in this report, the opportunity cost of these flows in terms of lost agricultural output has been estimated and is tabulated below.

Table 3.18: Cost of increased flows

Interpretation	Jobs		Productivity (annual cost)	
	Upper limit	Lower limit	Upper limit	Lower limit
Additional flow of 790 Gl/year	29,900	1,800	\$2,900 million	\$174 million

Source: JSA calculation

That diversion is likely to come at a significant social and economic cost with the cost being dependent on where the water is sourced. If water came from uses such as cotton production, a loss of around 1,800 jobs is predicted. This estimate is too low, as there are likely to be significant transmission losses as water in dams in the upper Gwydir and Namoi rivers travels the 1,500 km to the Murray mouth, passing through a range of wet lands on the way. Typically transmission losses in the MDB in the absence of flow regulation and consumptive use are estimated to be about 48%.⁹⁴ The estimate also assumes connectivity is available.

If water was to be diverted from more labour intensive irrigation uses such as vegetable growing, 790 Gl of water would be equivalent to the loss of 29,000 jobs in the MDB with this an upper estimate, noting that 790 Gl was around 85% of the water used for irrigation of grapes and fruit in 2006. If connectivity was assumed with 48% losses, then the lower limit would be of the order of 3,800 lost jobs, with an annual cost of \$350 million.

In present value terms, if 790 Gl per year was the cost required so that ecosystem function and biodiversity would not be compromised and government instituted this policy approach, the actions of government would predict an economic value, in net present terms, of the Coorong Ramsar Wetland by the community at between \$5 billion and \$41 billion.

Summary of results

The table below shows a summary of expected annual costs associated with the different approaches to managing the Coorong Ramsar Wetland.

⁹⁴ CSIRO (2008), *Water Availability in the Murray-Darling Basin*. CSIRO, Australia, p. 6.

Policy approach	Annual cost
Allow rare events and do nothing	\$0.3 million
Allow rare events and provide current levels of management	\$2.5 million
Change to marine environment	\$43 million - \$53 million
Institute Kingsford <i>et al</i> proposal	\$350 million - \$2.9 billion

The Wentworth Group of Scientists

A recently published report by the Wentworth Group of Scientists⁹⁵ proposes an increase of environmental flows in the MDB by around 4,400 GL per year.⁹⁶ That report recognises the lack of connectivity of the Darling River and proposes that the majority of this water will come from the Murrumbidgee River and Murray River. The Murray River is said to require 3,636 GL per annum, an 85% reduction on current diversions.⁹⁷ However it is proposed that a proportion of this water will come from the Murrumbidgee River requiring around 74% of current diversions in that river (1,650 GL) and around 44% of current diversions in the Murray River (1,886 GL).⁹⁸ The following figures are calculated from Tables 2 and 3. Including the water demand for the Murrumbidgee River, there is an apparent shortfall (probably from rounding errors) of 392 GL. For the purpose of calculation, we have assumed 1,800 GL from the Murrumbidgee River and 2,128 GL from the Murray River.

Prior to 2006, we understand from consultations that farmers along the Murray River received 100% of their entitlements, that is most of this water is high security water, rather than the situation found in less regulated streams where water diversions are dependent on river flows. The lower order uses of cotton and rice production are not found along the Murray River, so it is likely that the water will come from the uses of grazing, grapes, fruit and vegetables.

If the water in the Murray was taken from grazing, the lowest order use, the job losses associated with the proposed diversion are around 17,000. This is a lower bound estimate. In 2005-06, around 2,571 GL of water were used for dairy and pasture in the MDB and this calculation assumes that nearly all of this water will be diverted to environmental flows.

In the Murrumbidgee, the water could be taken from rice and cereal production, with the balance coming from horticultural and vegetable uses. In 2005-06, around 1,252 GL of water were used for rice growing in the MDB. If the balance of water, (548 GL) came from the uses of grapes, fruit and vegetables, then the total job⁹⁹ losses would be:

$$1,252 \text{ GL} \times 2.8 \text{ jobs} + 548 \text{ GL} \times 35.3^{100} \text{ jobs} = 23,000 \text{ jobs}$$

⁹⁵ Wentworth Group of Concerned Scientists (2010), *Sustainable Diversion in the Murray Darling Basin* and accessed at www.wentworth.org on 2 June 2010

⁹⁶ *ibid* page 1.

⁹⁷ *Ibid*, Table 2

⁹⁸ *Ibid*, Table 3

⁹⁹ Using data from table 3.10 above

¹⁰⁰ Average jobs across the three usages

In addition, losses of around 900 jobs are predicted in cotton growing areas and 700 jobs in dairy areas in Victoria, giving a probable total job loss of 41,000 jobs across the basin from this policy proposal.

The cost of lost production arising from this proposal is calculated at \$4.0 billion per annum or around \$550 per year for each household in Australia. Reduced to net present value, \$4.0 billion per annum is equivalent to \$57 billion, or, in net present value, \$8,000 per household in Australia.

Domestic Water consumption

On economic considerations alone, the value of a Gl of water (in annual value) has been calculated above using the value of \$184,000 per agricultural job. This is set out in the table below. It should be noted that these values assume 100% efficiency, and this is unlikely to be the case. For example, to transfer one Gl of water from an upper catchment to the lower end of the river might require release of two Gl, with the other Gl lost to infiltration and evaporation.

Table 3.19: Value of water for irrigated uses

Irrigated Agricultural Use	Direct employment for one Gl of irrigation water	Total employment for one Gl of water	Value of one Gl of irrigation water
Vegetables	19.9	37.8	\$3.7 million
Fruit	15.9	30.2	\$2.9 million
Grapes	19.9	37.8	\$3.7 million
Grazing	4.2	8.0	\$0.8 million
Rice	1.5	2.9	\$0.3 million
Cotton	1.2	2.3	\$0.2 million

Source: JSA calculation

It is more difficult to place a value on drinking water. While people pay water usage charges, these charges are more reflective of the cost of producing water rather than the value placed on water by people, as the rates are set by authorities (such as IPART in NSW), rather than in a market.

Sydney Water residential customers, for example, pay a \$100 annual water service charge and a usage charge of \$1.90 per kl.¹⁰¹ For a typical annual water usage of 200 kl, the cost per kl is \$2.40, equating to a cost of \$2.4 million per Gl. For water users in Adelaide, prices are a \$140 annual usage charge, \$1.00 per kl for the first 100 kl, and \$1.90 per kl up to 520 kl.¹⁰² For a typical annual water usage of 200 kl, the cost per kl is \$2.20, equating to a cost of \$2.2 million per Gl. It is likely that these prices underestimate the value placed on water by the community, as

¹⁰¹ <http://www.sydneywater.com.au/YourAccount/PricingInformation/> accessed 8 January 2010.

¹⁰² <http://www.sawater.com.au/SAWater/YourHome/YourAccountBillPaymentCharges/Pricing+Information.htm> accessed 8 January 2010.

people will pay \$0.6 billion per G1 for bottled water.¹⁰³ However the range of costs between bottled water and bulk domestic supply is interesting, suggesting that some marginal uses of drinking water, such as watering lawns or washing footpaths, are likely to be valued lower than irrigated agricultural uses, while other uses, such as water for personal consumption, are valued very highly.

For this reason, it cannot be assumed that supply of drinking water is automatically a more valuable use compared to irrigated agriculture, particularly for marginal uses of drinking water. In 2007-08, SA Water sourced 186 G1 from the Murray River for potable water.¹⁰⁴ If water was priced in a market, that is if SA water had to compete with other users of water by bidding in an open market, the usage charge to consumers for water may be somewhat higher, reflecting the opportunity cost of the use of the water elsewhere. Such an increase in price is likely to lead to some reduced consumption. If this reduction was as little as 1%, an additional 2 G1 of water would be available for irrigation, equivalent to 30-40 jobs in the areas of vegetables, fruit and grapes. On this basis, an argument can be made for removing any price distortions in the supply of potable water.

However such approaches are likely to be electorally unpopular. In SA, there were around 1,100,000 people of voting age in 2006, suggesting around 6,000 votes for each G1 of water taken from the Murray. However the same G1 of water used for irrigating vegetables is likely to be associated with perhaps 20 votes, suggesting that the “electoral” value of drinking water is 300 times greater than other uses.

¹⁰³ <http://www.tranquilwater.com.au/spring-water/?gclid=CKm7yPLSk58CFRD7agod4EM2jQ> accessed 8 January 2010.

¹⁰⁴ SA Water (2008), *Annual Report*, p. 44.

Appendix 1: Balonne Shire, QLD Case Study



Report 4: Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Social and economic impacts of reduced irrigation water

July 2010

This report has been prepared for



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1. Key Findings

1.1. Background

The primary driver for long-term reductions in water availability for irrigation communities in the Murray Darling Basin will be government policy, including the purchase of water entitlements under *Water for the Future* and the setting of new Sustainable Diversion Limits under the forthcoming *Basin Plan*. Climate change is also projected to have an impact on reduced water availability by 2030. Whilst there are likely to be benefits from increased water for the environment, reduced water for irrigation will result in a range of social and economic impacts on agriculturally dependant communities across the Basin. It is important in this regard to distinguish between **short-term stressors** such as rainfall variation and fluctuating commodities prices, to which agricultural communities have been adapting over many years, and more permanent impacts from **long-term stressors**, in this case policy-driven and climatic permanent reduction of water for consumptive uses.

In the face of possible permanent reductions in water availability and the associated impacts, this part of the study aims to answer the question, ‘how resilient are communities likely to be to permanent changes to irrigation water?’ A number of factors were found to predict changes in indicators of wellbeing and resilience in earlier stages of this study¹ including changes in employment and population. Our findings for the MDB were generally in line with other research on rural and regional communities, with key indicators that predict wellbeing and resilience including degree of remoteness, degree of urbanisation (population size), proportion of Indigenous people particularly remote populations,² and age of the population.³ Degree of economic diversity and opportunities to diversify were also relevant factors identified in the literature,⁴ though our findings indicate that these factors are largely a function of other more endogenous factors like remoteness, proximity to a large urban centre or to other economic resources like extractive industries. Though things like community leadership and collaborative initiatives are important, it can be difficult for communities to respond to major stressors where they have characteristics that work against their ability to adapt to change.

¹ JSA (2010) Report 2: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Understanding Agricultural Employment*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri; and JSA (2010) Report 3: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Irrigated Agriculture and Socio-Economic Indicators*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri.

² It is noted that, although ‘Indigenous people’ is a proxy indicator, it is not being Aboriginal *per se* that signifies disadvantage but a range of attributes that are more likely to found among Aboriginal people, such as low income, educational and employment status, being sole parent, lower likelihood of home ownership, etc

³ JSA (2010) Report 2: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Understanding Agricultural Employment*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri; and JSA (2010) Report 3: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Irrigated Agriculture and Socio-Economic Indicators*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri.

⁴ JSA (2010) Report 1: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Scoping Paper*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri.

To explore the likely social and economic impacts and degree of resilience to more permanent changes in water at different geographic scales, JSA has researched eight case studies across the Murray Darling Basin in different types of irrigated agricultural communities. The eight case study areas are Dalby-Wambo, Queensland; Balonne, Queensland; Moree Plains, NSW; Bourke, NSW; Griffith, NSW; Campaspe, Victoria; Mildura, Victoria; and Murray Bridge, South Australia. These are augmented by an overview of the regional context, or of smaller communities within these areas, to illustrate some of the impacts that are likely at different scales.

This report presents the findings of the Balonne, Queensland case study. The key findings from the study, particularly the area's current status against a range of wellbeing and resilience indicators is presented first, and is followed by a detailed discussion of quantitative and qualitative findings from the research. It is important to note that, although we have only been able to focus on eight areas, it is hoped that the case studies will provide information for communities within the Basin facing similar challenges, and draw out the characteristics that are likely to mitigate or exacerbate the impacts of permanent reductions in irrigation water.

1.2. How Resilient is Balonne Shire likely to be to permanent reductions in water?

1.2.1. Overview of Findings

Balonne Shire is likely to be very vulnerable to a permanent reduction in irrigation water, with significant job and population loss, and considerable adverse impacts on a range of socio-economic indicators of community resilience and wellbeing projected in the long-term. This is likely to entrench higher levels of disadvantage, particularly among disadvantaged older people and Aboriginal residents. This is because irrigated agriculture forms a large proportion of both agricultural industries and the total economy of the Shire, with irrigated agriculture accounting for around 50% of direct and indirect employment through related multipliers. Other relevant factors include Balonne Shire's locational disadvantage including its remoteness and isolation from major service centres; its large and growing Aboriginal population, which experiences higher levels of disadvantage; and the lack of alternative economic opportunities such as extractive industries. Its small size means that it is not independent of the fortunes of its agricultural base, and smaller communities in its hinterland are likely to be even more exposed to adverse impacts from loss of water.

Importantly, permanent reductions in irrigation water are likely to significantly constrain post-drought recovery, including the ability to regain jobs and population lost during the recent drought. The sharp decline in population from 2001-06, probably as a result of the severity of the drought, was quite different to the upward trend in population generally experienced by Balonne Shire over the past 30 years. Such population increases also occurred at a time when irrigated agriculture became a more significant component of the local economy. Diversification into irrigated agriculture can thus be seen as part of social and economic resilience, as jobs in dryland grazing have declined through increased efficiencies and technological change over time. As well

as more immediate impacts, a substantial reduction in water is likely to result in cumulative impacts, leading to further contractions in the local economy, and flowing on to reduced services and facilities as population thresholds are reached.

In terms of its existing socio-economic status, findings are mixed, but generally better and sometimes much more favourable than the other more remote case study areas in the Northern Basin. The area has more positive indicators related to low youth and general unemployment, high relative SEIFA Index of Education and Occupation, much higher than average median income and labour force and school participation rates, and a healthy long-term growth in population, which is quite different to many other remote areas. There is also a higher than average level of in-migration, indicating reasonable prospects for population replacement, and the cultural importance of the river as something that *'always brings us back here'* was noted in consultations with Aboriginal communities.

Many of the somewhat less favourable indicators are likely to be associated with the large Aboriginal population, including their generally higher levels of disadvantage in relation to education, employment and income. That said, there are much more favourable indicators of health and disability in Balonne Shire compared with the MDB average, which indicates that Aboriginal people in Balonne Shire may experience higher levels of wellbeing than other similar areas. Positive leadership among Indigenous and non-Indigenous community, civic and industry groups was evident during field visits, and this may also be contributing to the more positive indicators. Nonetheless, there are still obvious areas for improvement, and the area can in no way be complacent about the significant social and economic challenges facing it – a point made often in discussion with civic leaders. The predicted erosion of such indicators with more permanent reductions in water is of concern for a community at this stage of its development.

There are reported to be limited opportunities for increased water efficiencies without significant capital investment, and the next best use without irrigation water is generally dryland grazing, which would lead to significant job losses if replacing cotton or higher value horticultural uses. Connectivity, transmission losses and water security issues are also reported as likely to limit benefits from permanent water trade, though there have been some benefits from temporary trade during the drought within the catchment.

On the positive side, Balonne Shire has evidence of strong community leadership in its civic, community, Indigenous and business groups, who have worked together to develop positive employment, training and community support initiatives, and also to ensure that St George is a well-presented high amenity service centre. The contribution of the cotton industry to a range of community initiatives was also noted often (e.g. the construction of the riverside walk and local employment strategies). As noted in consultations, agriculture has been adaptive over the long-term, including through diversification into irrigated uses like cotton, as well as grapes, fruit and vegetables where possible, which has assisted in buoying population and employment increase in the past. However, a significant permanent reduction of irrigation water is likely to be a 'tipping point' for some irrigation businesses, and may be a social tipping point for a town like St George and smaller communities within the Shire such as Dirranbandi, which are remote and heavily dependent on irrigated agriculture. Strong leadership and community initiative is valuable in this

regard, but challenges related to permanent reductions in irrigation water are likely to be difficult to overcome given locational, agricultural, social and economic characteristics of the area.

1.2.2. Balonne Shire's 'Resilience' Report Card

The following provides an overview of key factors that have led to this assessment of how resilient Balonne is likely to be in the face of further permanent reductions in water availability. Key factors are reviewed as a 'report card' on resilience, and include:

- Projected changes in employment, population, and indicators of community wellbeing modelled for 10%, 25% and 50% cuts in irrigation water on the 2005/06 growing season;
- Degree of reliance upon agriculture and in particular irrigated agriculture and related industries;
- Factors that have a statistically significant relationship to wellbeing and resilience;
- The current status of Balonne in terms of existing socio-economic indicators; and
- Factors which are likely to mitigate or worsen projected impacts identified during field research.

Each of these is looked at in turn below. This is followed by detailed data and information from desktop analysis and fieldwork undertaken by JSA from January to May 2010.

Population and Employment Impact Forecast

The 'long term' impacts of reduced water availability on Balonne Shire are likely to be significant, particularly with regard to employment and population change. This is because irrigated agriculture forms a large proportion of both agricultural industries and the total economy of the area.

The primary effect will be a loss of employment, ranging from at least a 2% loss (44 jobs) predicted from a 10% reduction in water availability, a 5% loss (110 jobs) predicted from a 25% reduction in water availability, to a 9.6% loss (220 jobs) predicted from a 50% reduction in water availability, including direct and indirect employment in agriculture and multipliers. Given the job loss experienced during the recent drought (prior to 2006), the fact that irrigated agriculture is anecdotally stated to have higher multipliers than the average for agriculture, and the likelihood that some agricultural jobs have not been identified in our analysis, this is almost certainly an underestimate. Subsequent population loss is estimated as at least a 2.7% loss (123 people) predicted from a 10% reduction in water availability, a 6.6% loss (307 people) predicted from a 25% reduction in water availability, to at least a 13.3% loss (615 people) predicted from a 50% reduction in water availability.

Permanent reductions in irrigation water are likely to significantly constrain post-drought recovery, including regaining employment and population lost during the recent drought, and significantly entrench higher levels of disadvantage, as discussed below. It is noted in this regard

that the 2001-06 population loss was quite different to the upward trend in population generally experienced by Balonne Shire over the past 30 years, including at the time when irrigated agriculture became a more substantial part of the local economy.

Predicted Changes in Indicators of Wellbeing and Resilience

Modelling of impacts on indicators of community wellbeing and resilience for Balonne from reduced water availability also predicts that there will be significant adverse impacts on such indicators as a result of employment and population loss (or failure to regain population and jobs in a post-drought period). Such adverse socio-economic impacts are generally a result of a more residualised population, which is likely to be both older and have a greater proportion of disadvantaged people including those from an Indigenous background. Notable changes⁵ are predicted as:

- a decrease in median household income,
- an increase in disability support pension rates, and in levels of profound or severe disability,
- a decrease in labour force participation 65+,
- an increase in median age,
- an increase in youth and general unemployment,
- less population replacement /in-migration, and
- an increase in assaultive violence, both domestic and non domestic.

Factors Affecting Wellbeing and Resilience

A number of factors were found to predict changes in indicators of wellbeing and resilience in earlier stages of this study,⁶ including changes in employment and population. These included degree of remoteness, degree of urbanisation (population size), proportion of Indigenous people particularly remote populations,⁷ and age of the population.⁸ Degree of economic diversity and

⁵ More than 5% change

⁶ JSA (2010) Report 2: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Understanding Agricultural Employment*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri; and JSA (2010) Report 3: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Irrigated Agriculture and Socio-Economic Indicators*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri.

⁷ It is noted that, although 'Indigenous people' is a proxy indicator, it is not being Aboriginal *per se* that signifies disadvantage but a range of attributes that are more likely to found among Aboriginal people, such as low income, educational and employment status, being sole parent, lower likelihood of home ownership, etc

⁸ JSA (2010) Report 2: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Understanding Agricultural Employment*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri; and JSA (2010)

opportunities to diversify were also relevant factors identified in the literature,⁹ though our findings indicate that these factors are largely a function of other more endogenous factors like remoteness, proximity to a large urban centre or to other economic resources like extractive industries, and to a large extent not within the control of a local community like Balonne Shire.

The following table provides an overview of these key factors, which are discussed in more detail in the body of this case study report.

In summary, Balonne Shire performs poorly against the key factors that indicate how resilient a community is likely to be in the face of change. It is a 'remote area', with a very high proportion of Aboriginal people who are likely to be far more disadvantaged than average. It has not achieved the critical mass that makes it in any way independent of the fortunes of its predominantly agricultural economy, lacks economic diversity and has few alternative economic options to replace a significant loss of jobs predicted with permanent reductions in irrigation water. It has a younger than average age profile, but this is likely to be strongly influenced by its youthful Aboriginal population though anecdotally this may also relate to the younger profile of those working in irrigated agriculture.

Moreover, it is an area that cannot afford to lose employment or population through permanent reductions in water for consumptive uses, and whose post-drought recovery is likely to be severely constrained by such permanent reductions in water. As such, the drought and resultant low allocation years can be seen as a real time simulation during low allocation for more permanent reductions in water.

Table 1.1: Key Factors in Community Resilience

Statistically Significant Factors	Likely to be Resilient	Comment
Remoteness	X	'Remote area' and much more remote than the MDB average of areas, with some part of the Shire 'very remote'.
Degree of Urbanisation:	X	Below the 5,000 population threshold so very vulnerable to further population loss, or any constraints to regaining population.
• Population Size		
• Proximity to a large regional centre	X	Around 5 hours from the coast and remote from major service centres and capital cities.
Indigenous Population	X?	3 time the MDB and 6 times the national average. Associated with significantly worse socio-economic outcomes. However, Aboriginal people are not as disadvantaged as the average of the MDB, and more

Report 3: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Irrigated Agriculture and Socio-Economic Indicators*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri.

⁹ JSA (2010) Report 1: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Scoping Paper*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri.

Statistically Significant Factors	Likely to be Resilient	Comment
		engaged in the labour market.
Age	√?	Younger than the MDB and Australian median age. Likely a polarised population, with younger Indigenous age profile and older farmers and smaller communities. Also younger people in entry level jobs and retained in more high value/irrigated agriculture.
% of employment by industry compared with Australian benchmark	X	Highly reliant on agriculture and directly related activities (42% compared with 29% in MDB). With an average multiplier of 1.1, around 85% of jobs are related to agriculture. Irrigated agriculture forms a relatively high component of the total local economy and employment in Balonne Shire, and at least 50% of jobs are likely to be directly or indirectly associated with irrigated agriculture in Balonne Shire given the anecdotally higher than average multipliers associated with this type of agriculture.

Current Status on Community Resilience Indicators

It is also necessary to understand the current status of Balonne Shire with regard to key socio-economic indicators in order to examine its resilience or vulnerability to changes in employment and population related to reduced water availability. The following provides a 'report card' on the extent to which the current status of Balonne compares with the MDB and National benchmarks.

In summary, the indicators are mixed, but show a community that has likely benefited from the expansion of irrigated agriculture to offset job losses and population decline associated with technological changes and climatic variation that have been experienced in other more remote communities where dryland agriculture is the prominent use and there is limited irrigation. Such irrigation may be seen as part of a resilience or diversification strategy in areas that are more remote and where there is very limited access to other economic opportunities such as extractive industries or manufacturing. It also appears to support field observations of a highly engaged civic, business and Aboriginal leadership, and high level of general community engagement.

The area has more positive indicators related to very low youth and general unemployment, high relative SEIFA Index of Education and Occupation, much higher median income and labour force participation than the MDB average, and a healthy long-term growth in population, which is quite different to many remoter areas. It is noted that the area remained fairly stable or

improved slightly in terms of key indicators, even through the drought years of 2001-06, though it became somewhat more disadvantaged overall.¹⁰ This may indicate that those in lower skilled jobs who were nonetheless employable left the area to work (for example in extractive industries elsewhere in Queensland), and the proportion of Aboriginal people also increased. It is somewhat less socially polarised than all other case study areas.

Many of the less favourable indicators are likely to be associated with the large Aboriginal population, who are generally far more disadvantaged in terms of education, employment and income. These indicators include lower than average SEIFA disadvantage, SEIFA Economic Resources, high school participation rates, and post-secondary qualifications, through the latter two indicators are more favourable than for other Northern Basin case study areas. That said, it is positive that there are much more favourable indicators of health and disability than communities like Bourke and Moree, and much better youth and general unemployment statistics, and that these are more favourable than the MDB average. This indicates that Aboriginal people in Balonne Shire have higher levels of wellbeing than many other areas, and that there is likely to be more positive engagement with employment and pro-active Indigenous and non-Indigenous leadership.

This perception is perhaps supported by the fact that Balonne Shire has around 2.5 times the rate of engagement in voluntary work compared with Australia, for example. As noted in Section 4.2 below, such concern to ensure the improved wellbeing of Aboriginal people was very evident among community and industry leaders in field visits, and is likely to be contributing to the more positive indicators. In-migration levels are also above the MDB average, and bode well for population replacement. Aboriginal people also noted that community members *'always return to the river'* as a strong part cultural attachment. Nonetheless, there are still obvious areas for improvement in wellbeing evident in the following table, and this was also noted in consultations with Aboriginal and other community members and civic leaders.

Again, the predicted erosion of such indicators with more permanent reductions in water for consumptive uses is noted above, and is of concern for a community at this stage of its development, and in light of the need to focus its efforts on post-drought recovery.

Table 1.2: Current Status Report on Indicators of Community Resilience

Proxy Indicator of Resilience	Likely to be Resilient?	Comment
Community Wellbeing:		
SEIFA Disadvantage	X	Lower than the MDB average and much lower than Australia, likely related to high Aboriginal population.
SEIFA Economic Resources	X	Lower than the MDB average and much lower than Australia, likely related to high Aboriginal population,

¹⁰ For example, unemployment dropped slightly, median income increased as did SEIFA Index of Economic Resources, though SEIFA Index of Disadvantage increased as did the Aboriginal population as a proportion of all people.

Proxy Indicator of Resilience	Likely to be Resilient?	Comment
		the lower value of residential property, etc.
SEIFA Disadvantage	X	Lower than the MDB average and much lower than Australia, likely related to high Aboriginal population.
SEIFA Economic Resources	X	Lower than the MDB average and much lower than Australia, likely related to high Aboriginal population, the lower value of residential property, etc.
Median Household Income	√	Much higher than the MDB average and slightly lower than Australia likely due to higher incomes and wages associated with irrigated agriculture, and low unemployment.
Social Capital /Volunteering rate	√	Higher level of engagement in voluntary activity than the MDB average and around 2.5 times the Australian rate. Highest of the case study areas.
Disability Support Pension	√	Lowest of the case study areas, and much lower than MDB and Australian averages. May be due to younger median age, but also indicates higher labour market engagement of Indigenous and other residents.
Premature Death	√	Lower than the MDB average despite the high % of Aboriginal people which is generally associated with this indicator.
Profound or severe disability	√	Much lower than both the MDB and Australian average, and again the lowest of the case study areas. Likely in part due to a lower median age, but also an indicators of more positive community outcomes.
Chronic Ill Health	?	Higher than the MDB and Australian averages, and possibly related to high Aboriginal population (e.g. diabetes, heart disease). Noted that this conflicts with above indicators and appears likely to be due to sampling error (small sample size).
Economic growth/ Human Capital :		
Change in Total Employment 2001-06	X	Significant employment loss during drought (-18.3%). Previous long-term employment quantum was relatively stable. Reports that irrigated ag keeping people on wherever possible in drought.
Labour force participation 15+ years	√	Much higher than the MDB and national average, and the highest of any case study.
Labour force participation 65+ years	X?	Very high older work force, including among farmers. Also likely out-migration of retirees, which increases %. Advantages of skills and experience of older work force also noted in consultations, as well as choices to relocate to St George by older people due to increased employment opportunities.
Post-school qualification (skills base)	X	Relatively low rate of those with post-secondary qualifications, likely related to larger Aboriginal population and nature of local job opportunities.
School participation at 16 years	?	Low relative rate of high school attendance, though may also be due to low youth unemployment rate and local

Proxy Indicator of Resilience	Likely to be Resilient?	Comment
		entry-level job opportunities as well as more disadvantaged Aboriginal people.
SEIFA Index of Education and Occupation (brings together relevant Census variables on the general level of education and occupation-related skills of people within an area)	√	Interestingly, performs quite well on this broad indicator of human capital, indicating the presence of sufficient people with higher educational and occupational status to balance out other individual indicators. Anecdotally, higher skill levels associated with irrigated agriculture were noted.
% of employment by industry compared with Australian benchmark	X	Highly reliant on agriculture and directly related activities (42% compared with 29% in MDB). With an average multiplier of 1.1, around 85% of jobs are related to agriculture. Irrigated agriculture forms a relatively high component of the total local economy and employment in Balonne Shire.
GINI co-efficient of household income distribution/polarisation	?	Like other areas of the MBD, the Murray Bridge shows quite a high level of polarisation between the 'haves' and 'have nots' based on household income, though it is somewhat less polarised than all other case study areas.
Youth unemployment rate	√	Lowest case study area, and much lower than MDB and national average, likely due to entry-level jobs and unemployed leaving the area. Reports of recent labour and skill shortages, and sourcing outside labour (e.g. into grapes). Also reported by Aboriginal community leaders to be difficult to recruit and retain some Aboriginal people in existing jobs, with the need to 'import seasonal and other workers' noted, despite the fact that there are reported to be Aboriginal young and older people unemployed.
General unemployment rate	√	Lowest case study area, and also much lower than average. Again, reports of labour and skill shortage in horticulture and other irrigated agriculture during field visits is noted. Noted several times that <i>'if you want a job here, you should be able to find one'</i> (for example, in seasonal work associated with horticulture).
Amenity:		
Population Growth /Retention 2001-06	?	Significant loss of population (-14.6%) compared with MDB average (no change). However, Balonne Shire generally experienced reasonable population growth over the past 30 years, which is generally against the trend for more remote communities reliant predominantly on dryland agriculture. Population increase was particularly marked between 1996 and 2001, with a significant expansion in irrigated agriculture including cotton and some higher value horticultural uses. This preceded the most recent prolonged drought, with its significant employment and population loss from 2001-06, and was against the general trend in this regard. The smaller loss in population between 1991-96 also accompanied some 'dry years', and the recovery from 1996-2001 is interesting to note in this regard.

Proxy Indicator of Resilience	Likely to be Resilient?	Comment
In-migration	√	Equivalent to Australia and higher than MDB average. Indicates reasonable turnover of jobs and regular inflow of residents and employees.

Other Factors that indicate vulnerability or resilience from consultation

Fieldwork and other consultations have provided valuable insights into other aspects of current and future vulnerability or resilience, as well as other factors that are likely to mitigate or worsen projected impacts. See **Section 4.2** for a more detailed discussion of fieldwork.

In summary, there are reported to be limited opportunities for increased water efficiencies without significant capital investment, which seems unlikely due to uncertainty regarding future water reductions and reduced farm viability; and the next best use without irrigation water is generally dryland grazing, which would lead to significant job losses if replacing cotton or higher value horticultural uses. Connectivity, transmission losses and water security issues are also likely to limit benefits in permanent water trade, and limited ability to participate in existing Federal programs including due to the lack of a gazetted ROP, though there have been some benefits from temporary trade during the drought within the catchment. Together with the remoteness of the area, other locational disadvantages and lack of alternative economic resources, these factors do not bode well for a future with significantly reduced irrigation water. Smaller communities like Dirranbandi are likely to experience more significant impacts due to greater reliance upon agriculture, less diverse economy and services, as discussed in Section 5 below.

Nonetheless, Balonne Shire has evidence of strong community leadership in its civic, community, Indigenous and business groups, who have worked together to develop positive initiatives and ensure that St George is a high amenity service centre. Agriculture has been highly adaptive and resilient over the long-term, including through diversification into irrigated uses like cotton, as well as grapes, fruit and vegetables where possible, which has assisted in buoying population and employment increase over the past 30 years, and is likely to continue to adapt to short-term stressors like climatic and market variability. Reductions in irrigation water is likely to remove opportunities for such resilience.

Table 1.3: Other factors of vulnerability and resilience relevant to Balonne

Factor	Likely to be Resilient?	Comment
Nature of 'next best' land use with reduced water	X?	Dryland grazing generally 'next best use', as rainfall generally too low for dryland cropping. This would lead to significant reductions in jobs, as dryland grazing typically has 0.4 jobs /1,000 ha compared with around 6-7 jobs for cotton and 70 to 100 jobs in fruit, grapes and vegetables/1,000 ha. Cotton growers reported that varying scenarios were likely with reduced water for irrigation, depending on

Factor	Likely to be Resilient?	Comment
		scale of operation, commodities prices and amount of permanent water lost: ○ Larger growers may decide to grow a smaller crop, as cotton by far most profitable use; ○ Smaller growers may decide to grow nothing if insufficient scale without irrigation to be viable. Existing horticultural uses could expand, but there are reported to be significant barriers regarding experience and expertise, infrastructure and capital investment required, lack of adequate water security, and market risk (e.g. commodity prices and over-supply of grapes, etc), and the need to compete with the established markets and technical sophistication of Southern Basin growers. As one horticulturist noted: <i>'There's plenty of horticultural land for sale, but you don't see the buyers flocking in'</i>.
Potential benefits of water trade	X?	Benefits of temporary 'within-catchment' trade was reported by irrigators to supplement income or production since unbundling. Around 30-40% localised trade reported to be possible. Very limited 'out of area' trade is reported to be feasible due to very limited connectivity to Darling River system, dissipation of runoff in terminal wetlands (e.g. 'delta' at the Culgoa Floodplain National Park), as well as the lack of a resource operations plan (ROP) to provide guidance for such trade until recently. The gazettal of the ROP for the Lower Balonne has been stalled since 2008 due to a legal dispute between a license holder and the State Government. This has now been resolved, and outstanding sections of the <i>Condamine and Balonne Resource Operations Plan (ROP)</i> can now be finalised. This will give greater certainty to water users and the environment regarding water allocations, water trading rules and monitoring, and allow irrigators to participate in the Federal Government 'buyback', as up until this point they have been excluded from the program. However, concerns have continued to be expressed by civic leaders regarding permanent out of area trade due to permanent loss of production and related social impacts. Reported to be no opportunity to participate in the Federal buyback to date despite large number of offers from irrigators in first rounds. Anticipate more offers in next round, though concerns that many will be selling under duress and price will be an issue. However, at the time of writing the government was reporting that, <i>'no value for money offers have been received in this catchment to date.'</i>

Factor	Likely to be Resilient?	Comment
Past responses to 'stressors' e.g. drought	√	Ongoing on-farm efficiency gains to deal with incremental reductions in water due to previous policy initiatives were reported. Long-term efficiencies consistently reported in an environment of ongoing climatic variation, low water security and commodity price fluctuations, and the ongoing adaptability of agriculture was noted. This included diversification in cotton and higher value irrigated land uses in more recent time. Some report that they have become 'opportunistic irrigators' rather than 'cotton farmers', and will use water from other crops depending on commodity prices, growing conditions, etc. A common comment was, <i>'If the drought taught us anything, it was that we had to change and think differently. We've had to adapt and be flexible'</i>. However, most reported to still rely on a 'good cotton crop' every few years to provide for an 'average year' that ensures long-term viability and in order to make in-roads into debt. Cotton therefore remains an important part of the farm economy for such irrigators.
Ability to make further efficiency gains	X?	Irrigators noted that 'anything we can do we have done as part of good business practice', including ongoing productivity gains as part of good business practice and in response to incremental water reductions Further water efficiency reported to be very limited without major capital investment, and mainly reported to relate to evaporation from major storages and terminal wetlands. Such major capital improvements reported to be unlikely with reduced profitability if there are cuts to permanent water, as well as the ongoing environment of uncertainty. 'Any permanent water reductions above 5-10% will have a major impact on profitability. Some will not be able to take even this level of cut'.
Access to Other Economic Opportunities	X	Very limited opportunities outside of agriculture due to remoteness and lack of mineral resources or other economic opportunities. Civic leaders note that irrigation has kept the economy buoyant, and has significant flow ons to other businesses. <i>'Businesses come to town to support irrigation – it would be devastating if this sector is threatened'</i>.
Natural attributes	?	St George is an attractive town on the Balonne River above the weir, with a beautifully presented public domain that maximises its river aspect (e.g. its well-used riverbank walking trail). Despite the recent drought, there is obvious care and pride in the town, and a good range of services, cafes, and recreational opportunities. On the less positive side, low rainfall limits

Factor	Likely to be Resilient?	Comment
		opportunities for other agricultural uses apart from dryland grazing; and locational disadvantage noted above mean no realistic opportunities to offset job losses.
Leadership /Social Capital	√	Excellent leadership evident from Council and other economic development and industry bodies evident from consultations. The presentation of St George as the main service centre for the Shire and a wider area also indicates strong community leadership and pride. Excellent leadership and activity from Aboriginal leaders, in particular proactive elders group, job creation and skills development initiatives reported. Contribution of the cotton industry also noted to a range of community initiatives and support.
Other factors in vulnerability /resilience identified in consultations	X	Concern that community leaders and industry innovators will be the ones lost in water reductions that threaten viability of irrigation Significant concerns regarding the potential for a highly residualised population, in particular the concentration of more disadvantaged Indigenous people with more limited employment opportunities, with more employable people leaving to seek employment elsewhere and a more residualised population who remain (both Aboriginal and non-Aboriginal). Increased cost to government of increased welfare dependence and service needs Noted by Shire that smaller communities like Dirranbandi are likely to experience more significant impacts due to greater reliance upon agriculture, less diverse economy and services (see Section 5 below for review of differential effects on smaller communities)

2. Introduction

In June 2009, Judith Stubbs and Associates (JSA) were engaged by the Cotton Catchment Communities Co-operative Research Centre to undertake a significant research project investigating wellbeing and resilience of communities, particularly those engaged in irrigated agriculture including cotton, within the Murray Darling Basin (MDB). The study seeks to understand the likely social and economic impacts on communities at different scales arising from changes in government water policy, in particular, *Water for the Future* and the forthcoming *Basin Plan*, and projected climate change. This project included three research strategies and has so far produced three reports.¹¹

2.1. Rationale

Given findings from the literature and the first three reports of this study, it is likely that the social and economic impacts related to changes in water availability will be experienced differently at different geographic scales (eg. farm, local community, region, MDB, national), and by different groups within a community (e.g. farmers, Aboriginal people, businesses). Key factors will include the existing wellbeing and resilience of these communities, and other mitigating factors such as access to the water market and alternative economic opportunities.

In order to understand the differential impacts upon areas and groups, we have carried out a cost-benefit analysis to determine impacts at the MDB and national levels and prepared eight case studies to explore the likely impacts at the farm, regional and local community levels. These documents comprise the fourth and final report for this study.

The eight case study areas were selected in order to represent different states, different CSIRO Sustainable Yields Regions, cotton and non-cotton producing areas, a diversity of irrigated agricultural uses and diversity across three key attributes including population size, remoteness and Indigenous population. The eight case study areas include Dalby-Wambo, Queensland; Balonne, Queensland; Moree Plains, NSW; Bourke, NSW; Griffith, NSW; Campaspe, Victoria; Mildura, Victoria; and Murray Bridge, South Australia.

2.2. Case study methodology

This case study is informed by JSA's extensive analysis of agriculture and population data; a review of policy, relevant document and reports; and a series of telephone and face-to-face interviews with individuals from a range of perspectives and organisations. These included a wide range of staff and elected or appointed representatives of the following agencies/ groups:

¹¹ JSA (2010) Report 1: Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Scoping Paper, JSA (2010) Report 2: Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Understanding Agricultural Employment, and JSA (2010) Report 3: Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Irrigated Agriculture and Socio-Economic Indicators.

- Balonne Shire Council
- A range of individual irrigators and dryland farmers
- Agricultural and irrigation industry groups and peak bodies including Smart Rivers, Qld farmers' Federation, Water Resource Taskforce, Cotton Australia, CDRC,
- St George Aboriginal Elders Group
- Businesses and community representatives in Dirranbandi
- Interested community members who attended workshops and report back sessions

Interviews and a field visit to the Balonne Shire were conducted between January and May 2010 in order to understand how water availability, agricultural land use and agricultural employment has changed in recent years as a result of government policy and short term climatic change (eg, the recent drought), how these changes resulted in social and economic impacts at the farm and wider community levels, and therefore how more permanent reductions in irrigation water are likely to affect wellbeing and resilience at the farm and community level.

2.3. Case study overview

This case study provides:

- A description of the case study area including its location, land and water use, water policy, and relative social and economic wellbeing and resilience against key indicators;
- A prediction of impacts to community wellbeing and resilience based on hypothetical reductions in water availability of 10%, 25% and 50% from the most recent year for which comparative agricultural and population data is available (the 2005/06 growing year and 2006 Census);
- An exploration of the 'short term' social and economic impacts that have been experienced as a result of the recent drought, fluctuations in commodities prices, water market and other relevant factors affecting communities; and
- An analysis of how the attributes of the area and other factors have exacerbated and/or helped to mitigate the impacts already experienced as an indicator of the area's resilience, and how it may therefore respond to more permanent changes in water availability under the forthcoming Basin Plan or permanent trade out of area.

3. Description of the Case Study Area

3.1. Location

The Balonne Shire case study area is located in south-eastern Queensland sharing a border with the Queensland local government areas of Paroo, Booringa, Warroo, Tara and Waggamba¹² and the NSW LGAs of Walgett, Brewarrina and Moree Plains. It has an area of 31,130 square kilometres, and had a population of 4,625 at the time of the 2006 census, making it the second least populated of the eight case study areas. It is also the second most remote according to the ABS Remoteness Index.



St George is the major service and administrative centre of the Shire, whilst smaller urban settlements are found at Dirranbandi, Bollon, Thallon, Mungindi and Hebel. Small localities such as Nindigully and Boolba are also important meeting places for the rural communities and travelling public.

Figure 3.1: Welcome to St George

Source: JSA (2010)

Balonne Shire has a predominately rural economy, with cotton, wool, beef, grain and horticultural production being the most common agricultural industries. More recently, the Council reports that promising growth has been shown in areas such as tourism, as well as wine, table grapes and melons.¹³

¹² As per the 2006 ABS Census

¹³ Balonne Shire Council (2009) *Annual Report 2008-09, BSC*

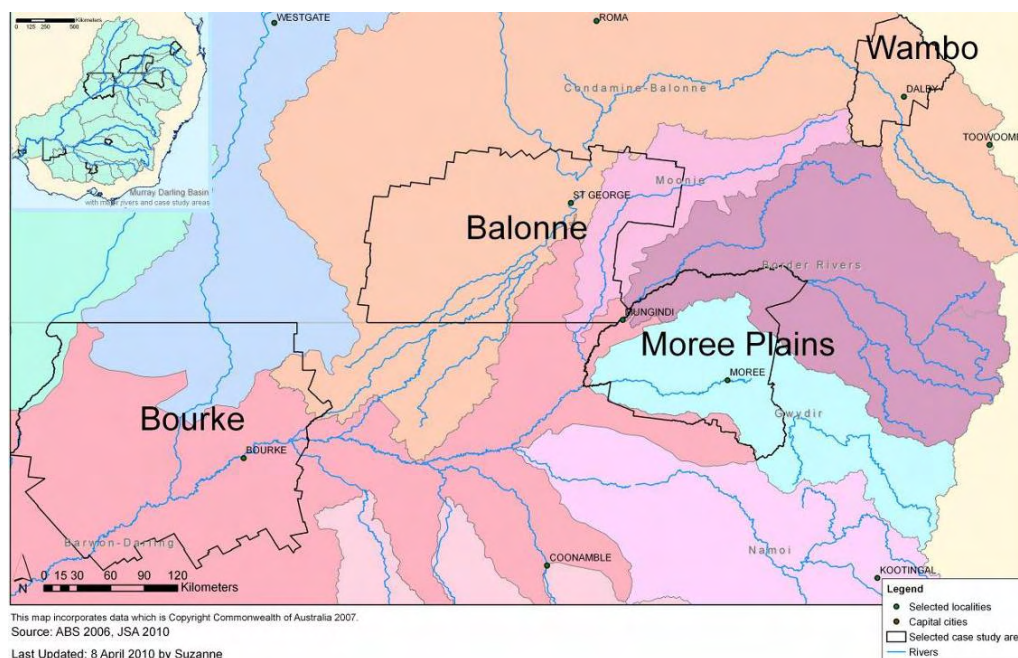


Figure 3.2: Riversands Winery, St George

Source: JSA (2010)

Balonne Shire is located in the Lower Balonne catchment within the Condamine-Balonne Sustainable Yield Region as defined by the CSIRO. St George is located just south of the Beardmore Dam, a major public storage facility in this part of the catchment. The map below shows the location of the four northern basin case study areas in the context of the CSIRO Sustainable Yield Regions.

Map 3.1: Balonne Case Study Area



3.2. Water and Land Use Context

3.2.1. Channel Farmers and Water Harvesters

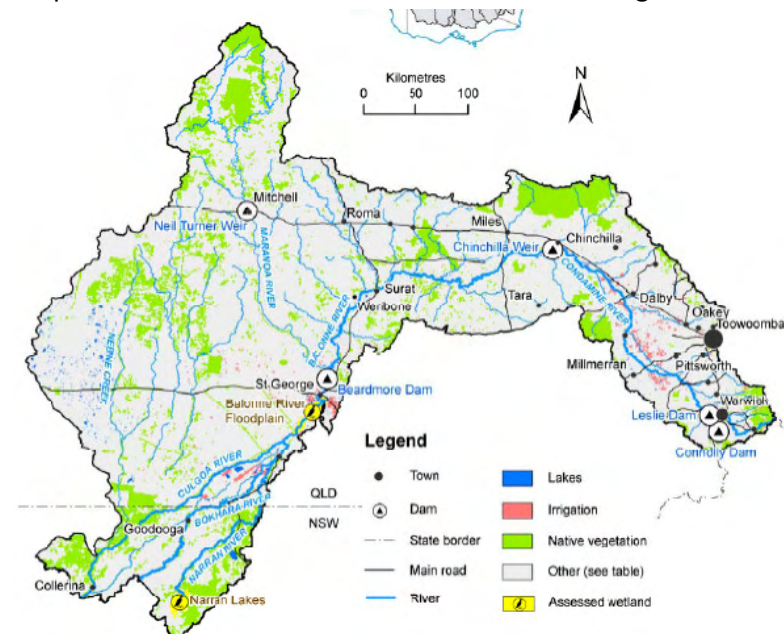
The St George Irrigation Area was established in the mid 1950s based on supply from Jack Taylor Weir on the Balonne River and the construction of the original St George supply channel. The system was extended in the 1960s and 70s with completion of the Beardmore Dam, which has a capacity of 81,700 ML, and the Buckinbah supply channel. Beardmore Dam supplies water to the Balonne River and Thuraggi Watercourse, which further supplies a network of channels and drains extends 32 kilometres south-east of St George and provided a reliable supply of water for a variety of crops ranging from cotton to table grapes. Irrigators utilising this system are typically referred to as the ‘channel farmers’.

The Balonne, and particularly the St George area, is perhaps better known for its ‘water harvesters’ or those broadacre irrigators with private storages that divert water when flows reach certain thresholds, such as Cubbie Station.

3.2.2. CSIRO Sustainable Yield Region and Projections

The Condamine-Balonne Sustainable Yield Region is predominantly located in southern Queensland but it also extends around 100 kms into northern NSW. It covers 13% of the land area of the MDB and uses 3% of surface water diverted for irrigation in the Basin and 10% of ground water used for this purpose.¹⁴ It accounts for 8.5% of runoff in the MDB.

Map 3.2: Condamine-Balonne Sustainable Yield Region



Source: CSIRO (2008) Murray Darling Basin Sustainable Yields Project

¹⁴ CSIRO (2008) *Water Availability in the Condamine-Balonne, Summary Sheet from the CSIRO MDB Sustainable Yields Project*, p.1.

The CSIRO reports that the region has an ‘extremely high’ average use of surface water for current development (around 53% of available surface water or 722 GL per annum),¹⁵ which is reported to have significantly reduced end of system flows, including to the Ramsar-listed Narran Lake Nature Reserve in NSW, part of the large terminal wetlands of the Narran River at the end of the Condamine System.¹⁶ The Culgoa Flood Plain National Park is the other major environmental asset in this region, and is located at the end of the Culgoa River that extends southward from the Balonne River system.

Monitored groundwater use in the Condamine-Balonne region was reported by the CSIRO to be around 160 GL per annum for 2004-05, although actual use is thought to be around 25% higher,¹⁷ possibly due to unmetered usage in more remote areas and inadequate monitoring of water extraction reported during local consultations. Although only 18% of water used on average in the Condamine-Balonne region is sourced from groundwater, groundwater is reported to be over 60% of total water used in times of low surface water flows.¹⁸ However, 97% of the region’s total ground water extraction occurring in the Upper Condamine Catchment,¹⁹ where Dalby-Wambo (the other Qld case study area) is located; while towns, industry and farmers in the Lower Balonne are far more reliant upon surface water extraction including overland flows. The extent to which concerns regarding the future supply and quality of groundwater in the Upper Condamine are relevant to this part of the Condamine-Balonne region is a matter for consideration, and the reader is referred to the Dalby-Wambo case study for more detail on this issue.

Condamine-Balonne CSIRO SYR 2030 Climate Change Projections

In terms of the CSIRO climate change projections for the Condamine-Balonne Sustainable Yield Region, the recent climate (1997 to 2006) is not statistically different to the historical climate averages. Under the CSIRO’s best estimate of climate change, runoff in the Condamine-Balonne is projected to reduce by 9% by 2030. As a result, average surface water availability would reduce by 8%, total end-of-system flows would decrease by 12%, surface water diversions would reduce by 4%, whilst relative surface water use would be 55% (2% increase from current use). Likely future development of farm dams and groundwater extractions are projected to have negligible impacts on stream flow and surface water use.²⁰ The CSIRO also projects that groundwater extraction is likely to decrease overall due to management intervention through the

¹⁵ CSIRO (2008) *Water Availability in the Condamine-Balonne, Summary Sheet from the CSIRO MDB Sustainable Yields Project*, p.1.

¹⁶ CSIRO (2008) *Water Availability in the Condamine-Balonne, Summary Sheet from the CSIRO MDB Sustainable Yields Project*, p.1.

¹⁷ CSIRO (2008) *Water Availability in the Condamine-Balonne, Summary Sheet from the CSIRO MDB Sustainable Yields Project*, p.1.

¹⁸ CSIRO (2008) *Water Availability in the Condamine-Balonne, Summary Sheet from the CSIRO MDB Sustainable Yields Project*, p.1.

¹⁹ CSIRO (2008) *Water Availability in the Condamine-Balonne, Summary Sheet from the CSIRO MDB Sustainable Yields Project*, p.1.

²⁰ CSIRO (2008) *Water Availability in the Condamine-Balonne, Summary of a report to the Australian Government from the CSIRO MDB Sustainable Yields Project*.

downward revision of entitlements. If these steps were not taken, the CSIRO warns that the system would be 'severely over-allocated' and additional stream flow impacts would occur.²¹

3.2.3. Land and water use in the case study area in a model year

Land use in the Condamine-Balonne sustainable yield region is dominated by cattle and sheep grazing, and there are significant areas of grain. Over 112,000 hectares of irrigated crops were reported to be grown in 2000, and 63% of this was cotton.²² It is noted that this period preceded the prolonged drought that has affected irrigation in this region over the past decade.

In 2005/06, there were 2,485,443 hectares of land under cultivation in Balonne SLA. The majority of land was used for grazing, with a small proportion used for broadacre crops and with cotton a smaller but significant use. Again, it is likely that this growing season was affected by drought conditions during this period, so that the following may not represent an 'average year'.

Table 3.1: Agricultural Land Use Balonne SLA 2005/06²³

Agricultural Use	# Hectares	% of Agricultural Use Hectares
Vegetables	228	0.01%
Fruit	4	0.00%
Grapes	354	0.01%
Grazing	2,293,580	92.28%
Cereal, oilseeds, feed & other broad acre crops	169,413	6.82%
Cotton	21,864	0.88%

Source: JSA Derived from ABS 2005/06 Agricultural Census

The largest employer during the 2005/06 was dryland grazing, with over half of all direct agricultural employment identified by ABS, whilst identified employment in cotton was 21% and in cereals, feed and other broadacre crops was 8%. It is noted this may not have been an average year due to drought effects, and that these are minimum figures due to Census undercounting and the fact that the identification of all agricultural jobs was not possible due to issues with identification, coding and the like.

²¹ CSIRO (2008) *Water Availability in the Condamine-Balonne, Summary Sheet from the CSIRO MDB Sustainable Yields Project*, p.1.

²² CSIRO (2008) *Water Availability in the Condamine-Balonne, Summary Sheet from the CSIRO MDB Sustainable Yields Project*, p.1.

²³ Note: See JSA (2009) *Report 2 – Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Understanding Agricultural Employment*, Appendix 2: Data sources and methods used, for an explanation of how each agricultural use has been determined.

It is significant that over 40% of identified jobs were in agriculture, and that with average multipliers, over 80% of all employment in the Balonne Shire is likely to be associated with agriculture, and **at least 50% with irrigated agriculture** given the anecdotally higher than average multipliers associated with this type of agriculture. It is also likely that grapes and other horticultural uses would not have picked up the significant amount of seasonal labour associated with these industries.

Table 3.2: Agricultural Land and Water Use Balonne SLA 2005/06²⁴

Employment & Water Use	2005/06	% Ag Emp
Employment in Grazing	513	55%
Irrigation water use (G1)	0 G1	
Employment in Cotton	199	21%
Irrigation water use	163.7 G1	
Employment in Cereal, oilseeds, feed & other broad acre crops	75	8%
Irrigation water use	1.7 G1	
Employment in Grapes	27	3%
Irrigation water use	1.6 G1	
Employment in Vegetables	6	0.6%
Irrigation water use	0 G1	
Employment in Fruit	4	0.4%
Irrigation water use	0 G1	
Employment (Balance Agriculture)	113	12%
Employment (Total Agriculture)	937	
Total Irrigation Water Use	167.0 G1	
Total Employment	2284	2284
Population ⁽³⁾	4625	4625

Source: JSA Derived from ABS 2005/06 Agricultural Census

²⁴ Note: See JSA (2009) Report 2 – Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Understanding Agricultural Employment, Appendix 2: Data sources and methods used, for an explanation of how each agricultural use has been determined.

3.3. Water Policy Context

3.3.1. Key differences between the northern and southern basin

Water policy and trading in the Northern Basin states of NSW and Queensland varies significantly to the Southern Basin states primarily due to the ‘less regulated’ nature of the systems, characterised by a mixture of large-scale storage and delivery systems providing reliability alongside extensive private storages and diversions for opportunistic capture when flows reach certain thresholds. The characteristics of the systems in the Northern Basin, particularly its lower level of reliability when compared to the Southern Basin, have limited the level and type of water trading that has been available to irrigators and determined the types of crops that are grown in these areas.

Similar to areas of the Southern Basin, regulated systems in both Queensland and NSW provide varied entitlements based on reliability. In Queensland, there are high security and medium security entitlements. High security generally means that in most years nearly 100% of entitlement will be allocated, while the reliability of medium security can vary significantly between river systems. Medium security allocations (comparable to ‘general security’ in NSW and ‘low reliability’ in Victoria) can be highly variable and in some years will provide no water at all (e.g. 0% allocation). This reduced reliability precludes many types of permanent plantings that require a high reliability of water supply; as a result crops that thrive in a ‘medium’ or ‘general’ security allocation environment, like cotton, are more prevalent in the Northern Basin.

Private on-farm storages are used across the Northern Basin to capture local run-off to enable irrigation in areas where water is not necessarily ‘delivered’ to irrigators by a water provider through a regulated system. The process of pumping or diverting water from flows in regulated and unregulated systems is referred to as ‘water harvesting’. This water may be derived from medium security (Qld) or general security (NSW) allocations from regulated systems and/or unsupplemented (Qld) or supplementary (NSW) water from river flows in unregulated systems and spills from dams.

In Queensland, irrigators may hold entitlements for either or both, unsupplemented and/or medium security water. Rules determine how unsupplemented/supplementary water may be diverted up to an annual limit and to certain flow conditions, typically that licenses are activated once flows exceed certain thresholds. In Queensland, every license to divert unsupplemented water has a specified volumetric limit (VL).

3.3.2. Relevant Queensland Water Policy and Regulation

Under the *Queensland Water Act 2000*, water resource plans were developed to sustainably manage surface and groundwater resources for human and environmental uses. The *Water Resource (Condamine and Balonne) Plan 2004*, with its provisions implemented through the *Condamine and Balonne Resource Operations Plan 2008*, provides the framework for water management in the Balonne case study area, including water sharing rules, environmental flow objectives and the

regulation of supplemented and unsupplemented water. The plans place limitations on the amount of water that users can access from surface, groundwater and overland flows. These water resource plans will expire in 2014, when new plans will be required under the forthcoming *Murray Darling Basin Plan*. The recent gazettal of the *Condamine and Balonne Resource Operations Plan 2008* reassessed allocations based on current and historical water usage patterns, and will not significantly change access to surface water for irrigators.

The gazettal of the ROP for the Lower Balonne area has been stalled since 2008 due to a legal dispute between a license holder and the State Government that was taken through to the Queensland Supreme Court. In March 2010, the Supreme Court ruled in favour of the Queensland Government. This decision cleared the way to finalise those parts of the *Condamine and Balonne Resource Operations Plan (ROP)* relating to the Lower Balonne area, which will give greater certainty to water users and the environment in the region regarding water allocations, water trading rules and monitoring arrangements. Finalising the ROP will also allow irrigators to participate in the buyback of entitlements by the Federal Government under its Restoring the Balance program, as up until this point they have been excluded from the program.²⁵ However, at the time of writing the government was reporting that, '*no value for money offers have been received in this catchment to date.*'²⁶

3.4. Social and Economic Context

3.4.1. Population Profile

Overview of Population and 2001-06 Change

Balonne Shire case study area had a population of 4,625 at the time of the 2006 census, making it the second least populated of the eight case study areas. It is also the second most remote case study according to the ABS Remoteness Index.

In the five years from 2001 to 2006, Balonne Shire lost almost 15% of its population, on par with Bourke LGA as the largest population loss of the selected case study areas. This contrasts with the MDB (1.1% growth in the same period) and Australia as a whole (almost 10% growth). The significant population decline for the period also strongly contrasts with most of the case study areas in the Southern Basin, where Murray Bridge, Mildura and Campaspe grew by 2.4%, 4.3% and 5.4% respectively.

However, the 5 years to 2006 was quite an anomaly on previous growth over 30 years, as noted below.

²⁵ Queensland Department of Environment and Resource Management website, www.derm.qld.gov.au/link/2010issue01/rop.html, accessed 10 June 2010.

²⁶ Department of Water, Environment, Heritage and the Arts website, www.environment.gov.au/water/policy-programs/entitlement-purchasing/condaminebalonne.html, accessed 10 June 2010.

St George Township

The town of St George, within the Balonne Shire, increased in population in a linear fashion between 1976 and 1991 by approximately 20%, before flattening out in 1996. The town reached its peak of 2,781 people in 2001 before losing 367 people in the next five years (a decrease of around 13%). The town now has approximately the same population now as it did in the late 1980's.

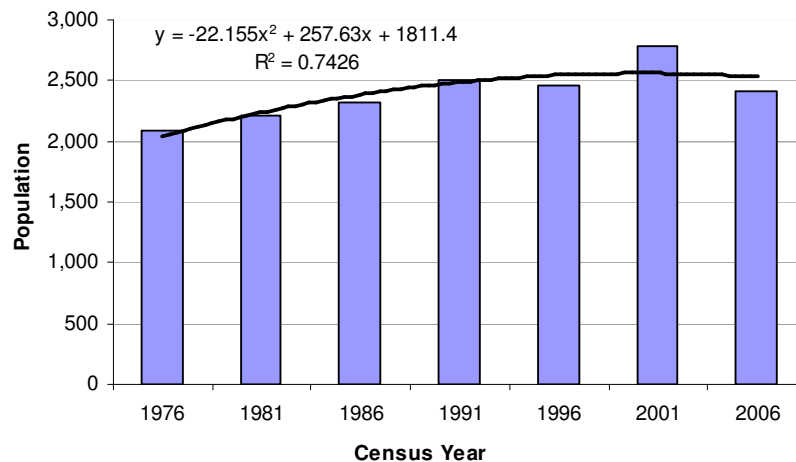


Figure 3.3: Population Change 1976-2006 for St George township

Source: ABS Census of Population and Housing, by Place of Enumeration

Balonne LGA

Balonne LGA has experienced an overall increase in population over the 25 years to 2001, with a sharp decline in the severe drought years between 2006-01, taking the population back to levels experienced in the early 1980s. Looked at over the long-term, the past 5 years can be seen as part of longer-term population fluctuations, as changes have been experienced in the growing and market conditions of agriculture and related businesses, as well as ongoing efficiencies and technological change. The expansion of irrigated agriculture in the past few decades is also evident in these figures, with such diversification helping to offset job losses in dryland grazing with ongoing technological innovation. The significant drop of 15% in 2006 from a population high of 5,420 in 2001 is probably indicative of the severe drought, but with good rainfalls the area could be expected to 'bounce back' to some degree, as it has in the past.

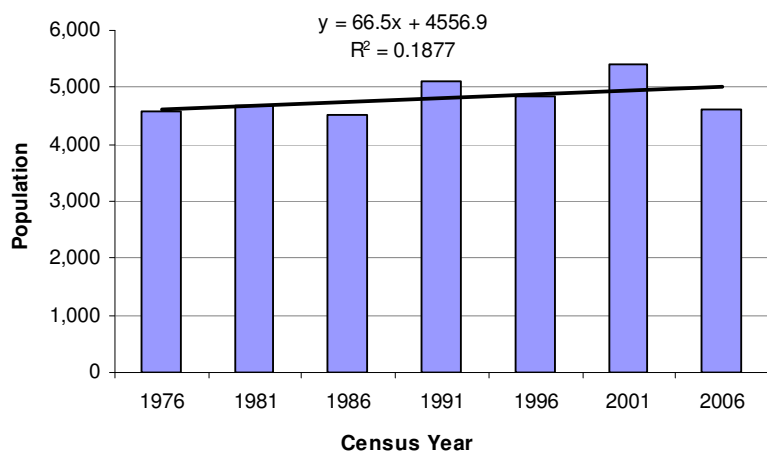


Figure 3.4: Population Change 1976-2006 for Balonne LGA

Source: ABS Census of Population and Housing, by Place of Enumeration

3.4.2. Employment and Industry Profile

Employment Change

Balonne Shire experienced an 18% decline in employment (in absolute terms) in the five years from 2001 to 2006, the largest decline of any of the eight selected case study areas. This was a far different trend to the employment growth experienced by the MDB (+ 1.2%), and a long way behind average national employment growth of almost 10% during this period. The significant decline in employment in most of the Northern Basin case study areas was also very different to employment growth experienced by Dalby-Wambo (+1.4%), and that of most of the Southern Basin case study areas, where employment in Murray Bridge grew by 7% and Mildura and Campaspe grew by around 4% during this period.

The employment loss in Balonne Shire generally mirrored the quantum of population loss, more so than in Moree Plains, but not to the same extent as in Burke SLA. This indicates that more people have remained in the area after losing their jobs, or at least a greater lag time between employment and population loss. This may reflect optimism in the future or more attachment to area than in some other remote rural areas.

Agricultural Employment

In 2006, there were 2,058 people employed in Balonne SLA. Of these, 844 people (41%) were employed in agriculture (22% grazing and 9% cotton). The retail, education and health industries also represent significant but smaller proportions (11%, 8% and 8% consecutively). The majority of people employed in the agricultural industry represent grazing land uses (462 people, 55% of all agriculture employment). Lesser but relatively high proportions were represented by cotton (179 people, 21% of all agriculture employment), the balance of other agricultural services (102

people, 12% of all agriculture employment) and cereals, oilseeds and other broadacre land uses (68 people, 8% of all agriculture employment).

Over 40% of all jobs in the Balonne Shire were in agriculture compared with around 28% in the MDB as a whole, meaning that it is highly dependant on agriculture. As noted above, with average multipliers, around 80% of total employment is likely to be related directly or indirectly to agriculture, and at least 50% of all employment related to irrigated agriculture in the Balonne economy. This is supported by JSA's previous research findings on the disproportionate importance of agriculture to smaller economies,²⁷ and indicates the serious impacts that are likely to be experienced in such an area with permanent reductions in water for irrigation. Any reduction in agricultural production would therefore impact more heavily on the Balonne Shire than on many other areas within the MDB.

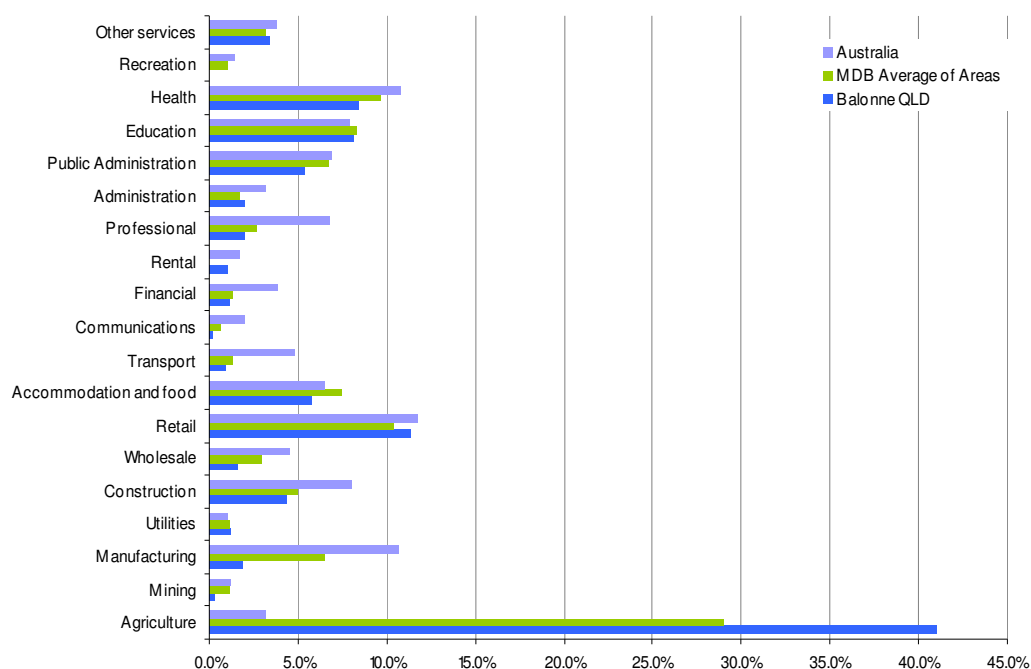


Figure 3.5: Employment Profile, Balonne QLD

Source: ABS (2006) Census of Population and Housing, JSA (2009)

3.4.3. Indicators of Community Wellbeing and Resilience

Comparative indicators for the eight case study areas are reviewed in detail in Report 4 of this study (JSA 2010 forthcoming), of which this case study will form a part.

²⁷ JSA (2010) Report 2: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Understanding Agricultural Employment*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri; and JSA (2010) Report 3: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Irrigated Agriculture and Socio-Economic Indicators*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri.

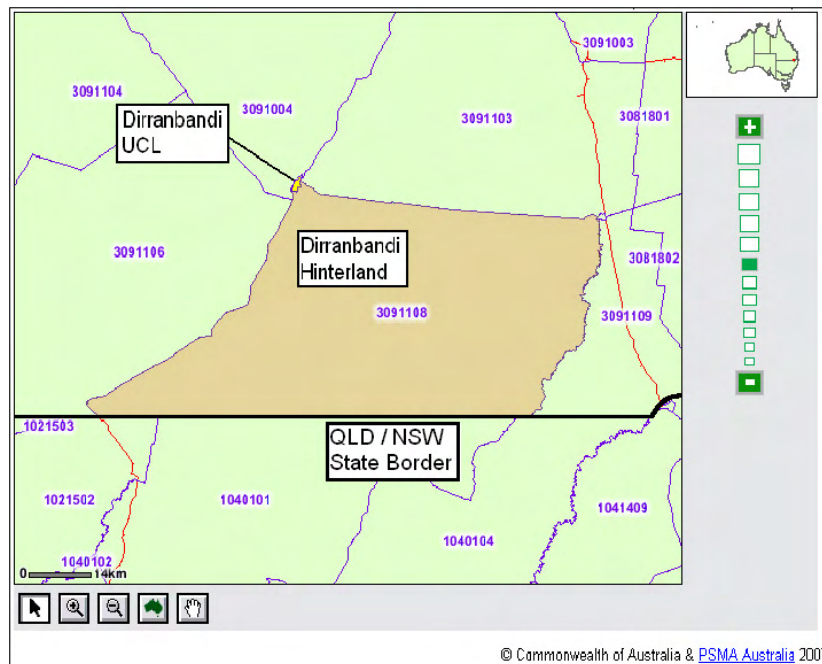
The findings against each of these indicators is summarised in **Table 1.2 above**, and the reader is referred to this section, as well as to Report 4 when issued.

3.4.4. Profile of a small town in the region: Dirranbandi, Queensland

Dirranbandi is a small town located 80 kilometres south-west of St George. At the time of the 2006 census the population was 437, a decline of 17% from 526 at the 2001 census. The area that has been considered the hinterland had a 2006 population of 121, ten people less than in 2001. Dirranbandi is predominantly agricultural, with 84% of working persons in the hinterland employed in this industry.

Background information on Dirranbandi is provided here in order to provide a context to discussions on the disproportionate impact of loss of agriculture in **Section 4.2** below.

Map 3.3: Dirranbandi UCL & Hinterland



Source: ABS Website 2010

The Dirranbandi Urban Centre/Localities (UCL) also experienced a substantial drop in its population (90 people between 2001 and 2006), approximately 15% of its 2001 population. Consequently the area lost about 60 of its employed persons, a 20% reduction on 2001.

Dirranbandi experienced a large increase in its labour participation rate of persons aged 65 and over, with the rate of the UCL and hinterland increasing by one-quarter, while for Balonne Shire the increase was about 10%. This rate for Dirranbandi was well above both the Balonne Shire and MDB average rates (about 40% greater and more than double respectively). This indicates

that older unemployed people tend to leave the area, and that younger people are likely to leave the area, leaving fewer options for succession planning for agricultural and other businesses.

The youth unemployment rate is large in Dirranbandi, especially in the township, with a rate around double that for the MDB and over three-times that for Balonne Shire in 2006. This rate increased by over 65% from 2001 to 2006, while the rate for Balonne Shire remained fairly steady. The general unemployment rate was much less dramatic for Dirranbandi.

The number of persons in Dirranbandi aged 15 years or more with a tertiary qualification was quite low, especially in the township, where the proportion was about 20% lower than for Balonne Shire and 35% lower than for the MDB. This rate in the greater Dirranbandi area showed a steady increase similar to that for Balonne Shire.

The median household income for Dirranbandi was slightly less than that for Balonne Shire, but still higher than for the MDB average. Median income had increased by about \$50-\$100 in Dirranbandi and Balonne Shire between 2001 and 2006, including CPI adjustment.

Table 3.3: Dirranbandi UCL & Hinterland Key Indicators

	2006				2001		
	Dirranbandi UCL	Dirranbandi UCL & Hinterland	Balonne Shire	MDB Average 2006	Dirranbandi UCL	Dirranbandi UCL & Hinterland	Balonne Shire
Population	437	558	4,625	2,004,560	526 ²⁸	657 ²⁹	5,420 ³⁰
Persons Employed	206	285	2,341	921,300	264	352	2,809
Labour Force Participation of persons aged 65+	20.9%	36.4%	25.5%	15.4%	12.0%	29.0%	23.6%
Youth Unemployment	21.4%	17.6%	6.7%	10.4%	12.8%	10.3%	6.8%
General Unemployment	5.5%	4.0%	3.3%	5.0%	3.3%	2.5%	3.7%
Tertiary Qualification, Certificate or Higher (% of persons aged 15+)	22.0%	26.3%	28.2%	34.1%	22.1%	24.7%	25.9%

²⁸ Note that the 2001 population was based on place of enumeration on the census night, whereas the 2006 population was based on place of usual residence. Place of usual residence data is not available for small area data in 2001. The 2001 population includes 62 visitors to the area.

²⁹ Includes 68 visitors.

³⁰ Includes 605 visitors.

	2006				2001		
	Dirranbandi UCL	Dirranbandi UCL & Hinterland	Balonne Shire	MDB Average 2006	Dirranbandi UCL	Dirranbandi UCL & Hinterland	Balonne Shire
Median Age	34	35	34	38	32	32	32
Median Weekly Household Income (CPI Adjusted for 2001)	\$950	\$905	\$975	\$780	\$830	\$850	\$875
Voluntary Work Participation	22.0%	28.5%	31.8%	29.0%	Data not available	Data not available	Data not available
SEIFA: Disadvantage	851	901	964	953	921	1092 (Hint.)	978
SEIFA: Education-Occupation	879	936	957	953	887	998 (Hint.)	932

Source: ABS Census 2001/2006

Note: Data for 2001 is based on place of enumeration, whereas data for 2006 is based on place of usual residence

The proportion of persons working in agriculture in Dirranbandi was slightly more than for Balonne Shire, and substantially larger than for the MDB. Other relatively large employment industries were transport and education. (Note that the following graph is inconsistent with other employment data provided above as it has not included direct employment in associated activities like value added processing).

Dirranbandi had very few persons working in manufacturing, and relatively few in public administration. Nobody in the area worked in mining, utilities, wholesale, communications, financial, rental, administration or recreation related jobs.

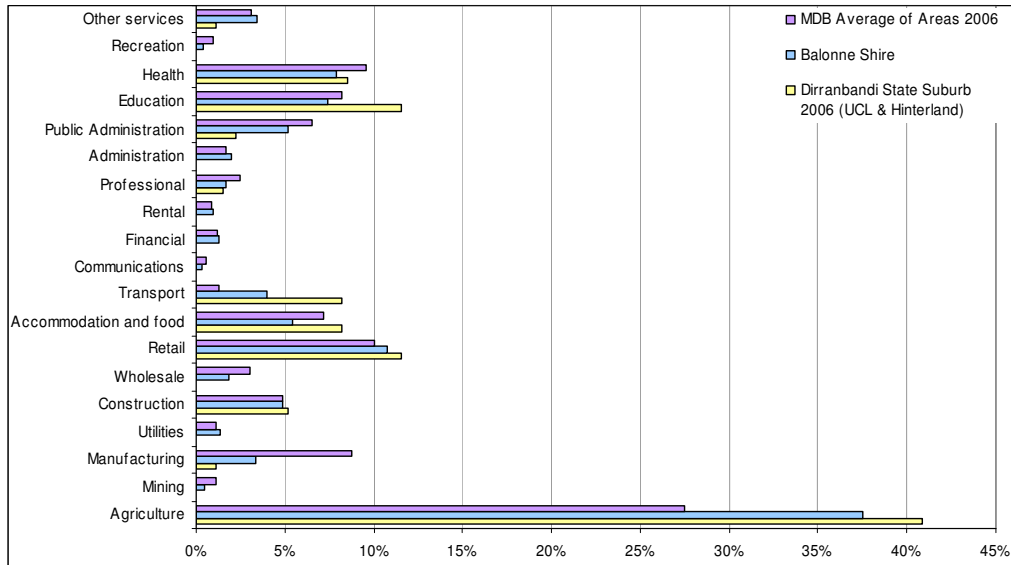


Figure 3.6: Employment Industry Breakdown – Dirranbandi UCL & Hinterland 2006

Source: ABS 2001 / 2006 Census

The proportion of persons employed in agriculture in Dirranbandi increased by 9 persons between 2001 and 2006, resulting in an increase of 6 percentage points. Other industries that experienced substantial growth in number of jobs were accommodation and food and transport, in which the proportion almost doubled, as well as education.

Industries experiencing a substantial decline in the proportion of persons employed were manufacturing (likely related to agricultural processing), in which the proportion halved, construction, public administration and health.

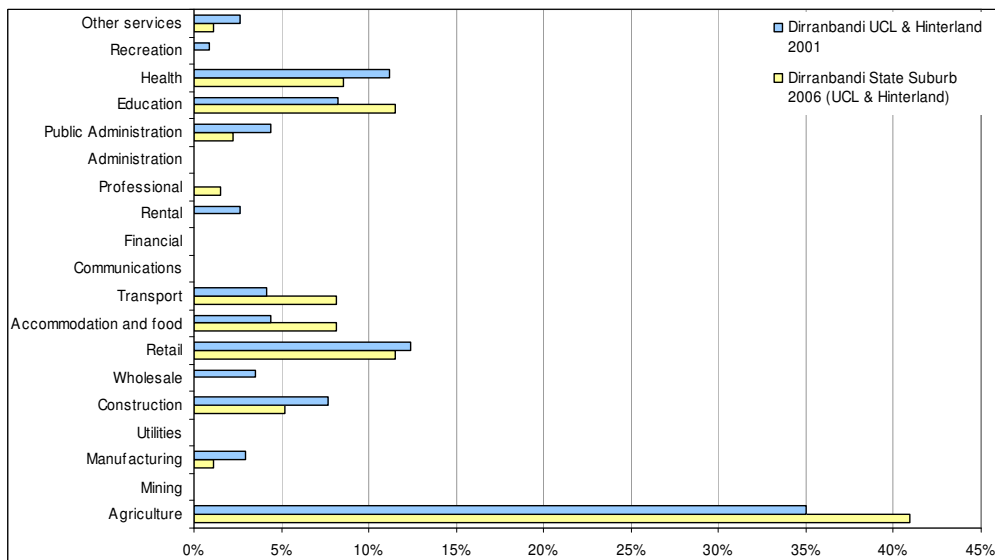


Figure 3.7: Employment Industry Comparison – Dirranbandi UCL & Hinterland

Note: 2001 Census did not include the categories for 'Professional' and 'Administration'

Source: ABS 2001 / 2006 Census

4. Potential Impacts of the Long-Term or Permanent Reductions in Water

4.1. Modelling and Quantification of Impacts

The impact on the Balonne Shire case study area from permanent reductions in the availability of irrigation water that may occur under the forthcoming *Basin Plan* and permanent trade of water out of area (whether open market or government ‘buyback’) has been modelled using data from Research Strategies 1 and 2 of this study.³¹

The impact on Balonne Shire from reductions in the availability of irrigation water has been modelled using data from Research Strategies 1 and 2. Such reductions may arise under the forthcoming Basin Plan, and permanent out of area trade or purchase of water, including under the Federal Government ‘buyback’. The extent to which water may be purchased or entitlements may be reduced under the Basin Plan are unknown at the time of writing. As such, we have modelled 10%, 25% and 50% cuts in irrigation water from that used in 2006. The results of that modelling in relation to the likely impact on employment, population and other key indicators of wellbeing and resilience are summarised here, and detailed in the table below.

The effects of cuts to irrigation water on Balonne are significant, although the quantum is small by comparison with other areas due to the small population and economy. This is because irrigated agriculture forms a large proportion of both agricultural industries and the total economy of Balonne and because job losses and hence outward migration will lead to further concentration of existing disadvantaged aged and indigenous populations. Effects appear to be further exacerbated because of the narrower base of the Balonne economy.

4.1.1. Employment and Population Projected Impacts

The primary effect of reductions in the availability of irrigation water will be a loss of employment, ranging from a 2% loss (44 jobs) predicted from a 10% reduction in water availability to a 9.6% loss (220 jobs) predicted from a 50% reduction in water availability, including direct and indirect employment in agriculture and multipliers. Given the job loss experienced during the drought (prior to 2005/2006), the fact that irrigated agriculture is anecdotally stated to have higher multipliers than the average for agriculture, and the likelihood that some agricultural jobs have not been identified in our analysis, this is almost certainly an underestimate.

³¹ JSA (2010) Report 1: Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Scoping Paper, JSA (2010) Report 2: Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Understanding Agricultural Employment, and JSA (2010) Report 3: Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Irrigated Agriculture and Socio-Economic Indicators.

Subsequent population loss is estimated to range from at least 2.7% (123 people) predicted from a 10% reduction in water availability to at least 13.3% (615 people) predicted from a 50% reduction in water availability. Again, these are noted as lower-bound estimates.

4.1.2. Community Wellbeing and Resilience

Socio-economic indicators are expected to be generally predicted to be adversely affected as a result of changing water availability, generally as a result of a residual population which is both older and has a greater proportion of Aboriginal people. Notable changes³² are:

- a decrease in median household income,
- an increase in disability support pension rates,
- an increase in profound or severe disability,
- a decrease in labour force participation 65+,
- an increase in median age,
- an increase in youth unemployment,
- an increase in unemployment,
- a less mobile population, and
- an increase in assaults, both domestic and non domestic.

The table below shows the predicted impacts for each of the three water availability reduction scenarios across all population, employment, and community wellbeing and resilience variables.

³² More than 5% change

Table 4.1: Predicted 'long term' impacts of reduced water availability for Balonne

Indicator	Base case 2006	Predicted indicators for 2006 for reduction in irrigation water			
		10% reduction	25% reduction	50% reduction	
irrigation water use (Gl)	167.0	150.3	125.3	83.5	
Employment (total) (1)	2284	2240	2174	2064	
% decrease in employment		1.9%	4.8%	9.6%	
Employment (Vegetables) (2)	6	6	6	6	
irrigation water use (Gl)	0	0.0	0.0	0.0	
Employment (Fruit) (2)	4	4	4	4	
irrigation water use (Gl)	0	0.0	0.0	0.0	
Employment (Grapes) (2)	27	24	20	12	
irrigation water use (Gl)	1.6	1.4	1.2	0.8	
Employment (Grazing) (2)	513	515	517	521	Assumed next best use
irrigation water use (Gl)	0	0.0	0.0	0.0	
Employment (Cereal) (2)	75	75	75	75	
irrigation water use (Gl)	1.7	1.5	1.3	0.9	
Employment (Rice) (2)	0	0	0	0	
irrigation water use (Gl)	0	0.0	0.0	0.0	
Employment (Cotton) (2)	199	177	144	90	
irrigation water use (Gl)	163.7	147.3	122.8	81.9	cotton usage not published but estimated from totals
Employment (Balance Agriculture)	113	113	113	113	
Employment (Total Agriculture)	937	914	879	821	
Population (3)	4625	4502	4318	4010	remains below 5,000 threshold

Indicator	Base case 2006	Predicted indicators for 2006 for reduction in irrigation water			
		10% reduction	25% reduction	50% reduction	
estimated % decrease in population		2.7%	6.6%	13.3%	
Indigenous population (4)	14.9%	15.1%	15.3%	15.8%	
Number of indigenous people	689	678	662	634	
Dependent variables:					
SEIFA disadvantage	942	940	937	932	from changing age and indigenous structure
SEIFA Economic Resources	928	926	923	917	
Premature death	288.8	289.9	291.8	295.2	from changing indigenous structure
LFP 15+	70.3%	69.9%	69.2%	67.9%	from changing age and indigenous structure
Median Household income	\$ 974	\$ 962	\$ 943	\$ 908	from changing age and indigenous structure
Disability support pensioners	4.5%	4.6%	4.8%	5.2%	from changing age and indigenous structure
Profound or severe disability	3.1%	3.2%	3.3%	3.5%	from changing age structure
Chronic ill health	255.8	255.0	253.9	251.7	from reduced cotton employment
LFP 65+	22.5%	22.3%	22.0%	21.5%	from changing age structure
Median Age	34	34.4	34.9	35.9	from change in agriculture and indigenous structure
Skills Base	28.1%	27.9%	27.7%	27.2%	from changing agriculture and age and indigenous structure
Education participation	63.9%	63.9%	64.0%	64.0%	
SEIFA Education and Occupation	957	957	957	957	
Polarisation	0.83	0.83	0.83	0.84	
Youth unemployment	6.8%	6.9%	7.1%	7.5%	from changing age and indigenous structure
Unemployment	3.3%	3.4%	3.6%	3.9%	from changing age and indigenous structure

Indicator	Base case 2006	Predicted indicators for 2006 for reduction in irrigation water			
		10% reduction	25% reduction	50% reduction	
Change of SLA five years ago	24.2%	23.9%	23.4%	22.5%	
Voluntary work	31.8%	32.0%	32.2%	32.7%	from change in agriculture and age
Assault (Non domestic violence)	1659	1675	1699	1746	2006 value estimated
Assault (Domestic violence)	1549	1567	1596	1650	2006 value estimated
Property Crime	9520	9525	9473	9400	2006 value estimated

Notes:

- (1) Includes factor of 1.11 to account for census under reporting, and allows loss of 0.9 jobs for each lost agricultural job
- (2) Estimates using data from Table 3.1 of report two and using regression analysis data to account for dryland production, factor of 1.11 included)
- (3) Assumed one job per household, 2.8 people per household, unemployed households leave the area
- (4) In 2006, the indigenous LFP rate was 64%, compared to 76% for the non indigenous population

We have assumed that job losses will therefore have a lesser effect on indigenous populations, leading to an increased proportion of indigenous people in the population, at the rate of the loss of one indigenous person for each 1.2 non-indigenous persons.

4.2. Field Work: Understanding Likely Impacts Through Responses to the Recent Drought and Other Stressors

4.2.1. Overview

Compared to a ‘long term’ or permanent reduction in water availability that may occur as a result of government policy and climate change, the recent drought represents a relatively short- or medium-term impact. Given its duration and severity, in many ways it represents a ‘real time simulation’ of what may happen if water for consumptive or productive uses is removed permanently from production, and how communities may experience the impacts and respond.

It also sheds some light on the way in which government policy and progressive deregulation of the water market is already affecting communities, the ‘winners and losers’ that may be created, and the way in which water policy is experienced and responded to in communities facing significant stress.

Moreover, an understanding of how farms, agricultural industries and the local community have responded to the ‘short to medium term’ stressor of the drought is necessary to better predict the likely impacts of ‘long term’ stressors like more permanent reductions in water availability in the context of other important issues facing communities.

4.2.2. Balonne Shire Field Visits

The mood in the town was celebratory at the time of the first field visit, as high flow licences had been triggered for the first time in some years, and the prospect of a full cotton crop looked possible. As one large irrigator said,

It’s been 10 years since we’ve grown a full crop of cotton. If we get a few good seasons, we could trade out [of debt]. Others won’t be so lucky, but at least they can improve their trading conditions. What people don’t understand is some of our dams have not been full since they were built. They’ll only be full when there are flood conditions, or when we can top up from good rain.

The relative resilience of St George was noted by Council officers and irrigators compared with smaller towns in the hinterland.

We had a small flow last year, and we saw people come back into the town. Real estate agents can tell - rentals vacant since 2006 are starting to fill. We’ll really see things pick up with this rain, and if we get a bit more at the right time. St George is not as bad as places like Dirranbandi – with the river flowing we’re seeing the vitality come back into the town. The whole place feels different over night. Smaller towns are a lot harder hit, and it would take more to bring them back to where they were.

Commenting on the long-term population trends presented at the workshop on the second field visit, a Council elected representative said,

If you look at the stats for Balonne Shire, you'd have to say it's doing a lot better than some areas. You'd be hard pressed to say that irrigation hasn't been a really important part of our resilience...Cotton's important, grapes, there's melons, pumpkins. I went down [to the Government irrigation scheme] the other day and thought, 'what's that strange thing?' It was a pomegranate! Some years, we've got 500-700 itinerates in the town, and that's a lot in a small community.

Others thought that the drought had fostered adaptation and increased flexibility and hence resilience.

If there's one good thing the drought has done for us, it's to make us more flexible. We came to think of ourselves as 'irrigators' first and 'cotton farmers' second. Now we've come to regard ourselves as 'opportunistic irrigators'.

However limits to diversification were also noted by irrigator groups.

There are opportunities in new markets that we should be exploiting. But there are also limits to how much we can diversify into other products. There's a danger in flooding the market [for example, with table grapes] and becoming a victim of your own success. Moving to fruit or vegies is a long-term commitment and requires a big capital investment - packing sheds, refrigeration, distance from market, risks of flooding. We're on black soil and that's a big risk when you've got a limited opportunity to pick and get to the market. We're trying to compete with more sophisticated and established growers in the Southern Basin. Some are doing well. [One grower] is the biggest suppliers to Coles and Woolies in his time slot, with pumpkins, garlic and onions.

The spirit of optimism masked underlying problems. A local councillor stated

600 people left with the drought...we have lost business in St George as well. [Businesses] have closed or are struggling. We have only been developing irrigation in a large way in the last 10 or 15 years in the lower Balonne...like Cubbie, a lot of dollars have been invested for no return. [Cotton] Gins have not been operating at all – Dirranbandi just opened again.

An irrigators group talked about the economics of farming and of irrigation, particularly the significant capital investment required and the precarious economics once water is separated from land. Where people had diversified into cotton or expanded capacity more recently, foreclosure is a real possibility.

We have two metres of evaporation [per year] here so there was a lot of investment by Cubbie to reduce the evaporation and keep as much water as possible by deepening storages...

The equity in larger properties is generally around 20%. At the same time, if your property is worth say \$10 million, then \$8 million of that is in the value of the water. If the government takes 40% through SDLs then what is the remaining equity? When the banks realise that the value of the asset is less than the debt they will foreclose. There is no capacity to pay out the bank...

For many, it's not a question of growing something else. A 'good cotton crop' is the only opportunity to make inroads into debt due to its high returns, and the banks won't take a risk on anything else.

The opportunity to mitigate impacts through trade was discussed on the second visit. Opportunities were limited through lack of connectivity, and much of the irrigation water was captured from overland flows. The lack of connectivity of the area with the Darling was noted, with water only reaching the Darling, and hence the Murray, in major flood events. As one irrigator stated,

The opportunity to trade in water is limited. About 40% of the water can be traded within the area but there is no connectivity for downstream trade. So far no water has been bought in the area through the buyback.

The stalling of the ROP has also been an impediment to permanent trade. The ability to achieve efficiency gains was also thought to be limited, not by opportunities but by economics. Some farmers felt that they could probably recover around 10% from efficiency gains but offsetting large cuts would not be cost effective.

There is a huge capacity to make efficiency gains through reducing evaporation in storages, but nothing is cost effective. Cotton farmers would do anything cost effective to gain water. And it's hard to justify further capital investment when you're in debt and the water situation is so uncertain.

Irrigators and other stakeholders noted the negotiations that had been conducted over many years to develop a plan for water sharing. Civic, Aboriginal and business leaders reported a sense of achievement in negotiating this trade off, though the ROP had been stalled due to a protracted court case between one irrigator and the Queensland Government, which has now been resolved.

Farmers have negotiated to give 10% of their water to the environment in the last three years. No one questions the value of the environment. Last year there were three flows and they gave up 10% each time, though many did not understand that it was not just coming from the first flow.

The graduated extraction system that triggers licences of increasing volumes, depending on the amount of water available in the system was also noted. At the same time there appears to be concern that the area has been singled out in the debate about the future of the Murray River, despite the lack of connectivity.

Through the drought, everyone is hurting but the South Australian farmers say to us 'you've got to give us more water, when we're empty as well...we can't help them'. When they came up here last year and saw the situation, they understood.

And there was some concern about the environmental outcomes from increased environmental flows, again reflecting the lack of connectivity of the River system and its remoteness from well publicised areas of environmental stress such as the lower lakes. Some noted that there are only two key environmental assets in Balonne Shire, the Narran Lakes and the Culgoa floodplain. However the value of environmental water was seen differently by other stakeholders. An environmental scientist noted that

Water harvested from the lower Balonne has the potential to perform environmental work over a very long length of river.

However he was cautionary regarding the method of providing environmental water, as this would have a big impact on the efficiency of environmental flows.

If water comes from supplementary flows from the dam, it might be released when the river is low and might not get to wetlands, the water may be cold [or unsuitable in other ways]...taking environmental flows from water being harvested from natural flows has the ability to do environmental work. It will reach wetlands and remain there long enough to ensure breeding cycles...

Discussions with representatives of the Aboriginal community at the St George Elders' Group highlighted some of the tensions between the competing needs and aspirations of Aboriginal people regarding the spiritual and cultural importance of the river, and the continuing importance of employment in providing for the social and economic wellbeing of all people in the community. Consultations with other community, civic and business leaders also highlighted the importance of strategies to increase engagement of more marginalised groups in employment and education, the challenges that decreased water for irrigation is likely to pose, and some of the ways in which the community has responded to date.

The importance of the river to traditional owners was a key theme running through the meeting with the St George Elders' Group, which also included other Aboriginal community leaders concerned about water issues. The need to engage Aboriginal young people in the opportunities that irrigated agriculture offered was the other major concern raised.

The changing employment opportunities provided by irrigated agriculture was noted by one woman, who had first worked in cotton chipping and then in other more skilled employment since 1969.

Cotton created a lot of employment in this community. Most people around the table would have done some chipping in the 1970s and 80s, so sometimes it felt like the whole community would be out in the paddock. No matter what happened, we always had a Christmas...

Now jobs that could have been done by 56 people in 2000 can be done by 6. Module building was another good source of employment, but the round bale picker will cut this down too. Cotton uses a lot of water; it takes a lot out of the system. The employment is still important but there's a lot less of it now...

As another participant who has been employed at one of the cotton gins in bookkeeping commented,

The drought's hit hard too. In a good year, you'd have 140,000 to 150,000 bales. Last year there was 110,000, and this year only 80,000 so you can see the impact of the drought. There's been a lot less employment because of the drought, too.

Commenting on the importance of diversification, another noted,

A lot of the slack has been picked up by grapes and [horticulture]. But a lot of that's being done by outside contractors now. There's 3 peak times for labour during the grape growing year. Last year was a very good season, and we had 200 Koreans bought in. So really, there's no shortage of jobs that our kids could do... There's still a lot of work [in irrigated agriculture].

There also appeared to be general agreement about the difficulties of engaging some young people in available employment, though a range of positive strategies including training, skills development and more proactive steps were being taken.

The problem is it's really hard to get the kids to work for the wages. Part of the problem is that you need specific skills, but to be honest, it's hard work and the dole and the CDEP has just made it too easy for our young people. Their expectations are different to ours. We expected to do a hard day's work, get paid and go home. They expect to get paid without the hard day's work.

I go and take some of the young people out [to the irrigation properties], introduce them, go with them the first few times. Really try to encourage them to stick it out. Sometimes they do, and they make a success of it, sometimes they don't, and that's really disappointing. People here care and we do what we can.

The role of other bodies was also noted in dealing with a complex issue.

The Council has become more involved lately, and this is a really good thing. They've got some good leaders and they are trying as well.

On the first site visit, concerns about the future of Aboriginal people if there are significant permanent reductions in irrigation water was probably the issue that civic leaders wanted most to talk about. As noted by one Council elected representative,

We've got to make a difference to this issue. In many ways Aboriginal people are the future of these towns. If they're not the future then they're a big part of it. We ignore that at our peril. That's probably the thing that worries me the most when I think about job losses in the future with the Basin Plan. There are people who can get out and they'll be OK anywhere. There are others who can't leave – they won't get a job elsewhere - and there are many in the Aboriginal community who don't want to go elsewhere. This is their home and their country.

A recent Council initiative had commenced by the second field visit involving 10 Aboriginal trainees in diverse Council positions. The passion and commitment of the Council representative was clear, commenting that, 'I really don't care how we make this work. I'll go and pick [the trainees] up in the morning if I have to. This is very important for their future and our future'.

Other industry leaders also wanted to talk about their concerns for Aboriginal members of the Balonne community, including one cotton grower who employs 8 to 10 Aboriginal people on his property. Though he echoed some of the challenges raised in the Elders' meeting, he was also proactive in encouraging his employees to attend work. He noted,

I see this as an investment in all our futures. I'm in a different position to some as I went to school locally, I've got the personal relationships with the families, so they know me and they can tell me if there's a problem. Really it's all about the relationship, and there's got to be some flexibility and tolerance on all sides.

These types of discussions perhaps help shed some light on the better performance of Balonne Shire against a number of the key socio-economic indicators noted above when compared with other communities with similar more favourable characteristics. Opportunities associated with irrigated agriculture are likely to have been important for all members of the community, and it is clear that there will need to be active strategies to ensure that all continue to benefit from current and future employment opportunities. Community leadership is also vital. As noted by a Council elected representative,

We've got some great community leaders in the Aboriginal community. We need to support them. It's not enough for people to just be in jobs, though this is vital. They've got to be helped to move into skilled jobs, and to take up the reins of civil society.

But concerns were also evident about the state of the river, and the importance of river health to Aboriginal people. Access to places of cultural and spiritual significance was clearly important and people valued the river for itself.

The river is so beautiful now with the floods. The last time it was in flood we caught 16 yellow belly. I'm not sure if we'd get them now. There's a lot less fish. The big blue yabbies are coming back, so it's encouraging that they're not gone for good. But there have been changes. Before [Beardmore] dam the river was clear, you could see the sandy bottom. It was so beautiful when we were kids.

That's why I keep coming back –I can't stay away too long. The river draws me back. We've got to look after it. It's our life, so we shouldn't be greedy about how much we take out. We need jobs but we need the river to be healthy, too.

Appendix 2: Bourke Shire, NSW Case Study



Report 4: Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Social and economic impacts of reduced irrigation water

July 2010

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1 Key Findings

1.1 Background

The primary driver for long-term reductions in water availability for irrigation communities in the Murray Darling Basin will be government policy including the purchase of water entitlements under *Water for the Future* and the setting of new Sustainable Diversion Limits under the forthcoming *Basin Plan*. The recent implementation of the MDB Cap and further Cap adjustments announced more recently are also relevant issues for Bourke Shire, while climate change is also projected to have an impact on reduced water availability by 2030. Whilst there are likely to be benefits from increased water for the environment, reduced water for irrigation will result in a range of social and economic impacts on agriculturally dependant communities across the Basin. It is important in this regard to distinguish between **short-term stressors** such as rainfall variation and fluctuating commodities prices, to which agricultural communities have been adapting over many years, and more permanent impacts from **long-term stressors**, in this case policy-driven and climatic permanent reduction of water for consumptive uses.

In the face of possible permanent reductions in water availability and associated impacts, this part of the study aims to answer the question, ‘how resilient are communities likely to be to changes in irrigation water?’ A number of factors were found to predict changes in indicators of wellbeing and resilience in earlier stages of this study¹ including changes in employment and population. Our findings for the MDB were generally in line with other research on rural and regional communities, with key indicators that predict wellbeing and resilience including degree of remoteness, degree of urbanisation (population size), proportion of Indigenous people particularly remote populations,² and age of the population.³ Degree of economic diversity and opportunities to diversify were also relevant factors identified in the literature,⁴ though our findings indicate that these factors are largely a function of other more endogenous factors like remoteness, proximity to a large urban centre or to other economic resources like extractive industries. Though things like community leadership and collaborative initiatives are important, it can be difficult for communities to respond to major stressors where they have characteristics that work against their ability to adapt to change.

¹ JSA (2010) Report 2: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Understanding Agricultural Employment*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri; and JSA (2010) Report 3: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Irrigated Agriculture and Socio-Economic Indicators*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri

² JSA (2010) Report 2: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Understanding Agricultural Employment*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri; and JSA (2010) Report 3: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Irrigated Agriculture and Socio-Economic Indicators*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri.

³ JSA (2010) Report 2: *Quantifying the impacts of cotton production on employment within cotton growing areas in the MDB and in Southern Queensland*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri; and JSA (2010) Report 3: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Irrigated Agriculture and Socio-Economic Indicators*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri

⁴ JSA (2010) Report 1: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Scoping Paper*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri

To explore the likely social and economic impacts and degree of resilience to more permanent changes in water at different geographic scales, JSA has researched eight case studies across the Murray Darling Basin in different types of irrigated agricultural communities. The eight case study areas are Dalby-Wambo, Queensland; Balonne, Queensland; Moree Plains, NSW; Bourke, NSW; Griffith, NSW; Campaspe, Victoria; Mildura, Victoria; and Murray Bridge, South Australia. These are augmented by an overview of the regional context, or of smaller communities within these areas, to illustrate some of the impacts that are likely at different scales.

This report presents the findings of the **Bourke NSW case study area**. The key findings from the study, particularly the area's current status against a range of wellbeing and resilience indicators is presented first, and is followed by a detailed discussion of quantitative and qualitative findings from the research. It is important to note that, although we have only been able to focus on eight areas, it is hoped that the case studies will provide some learnings for communities within the Basin facing similar challenges, and draw out the characteristics that are likely to mitigate or exacerbate the impacts of permanent reductions in irrigation water.

1.2 How Resilient is Bourke Shire Likely to be to Permanent Reductions in Water?

1.2.1 Overview of Findings

Bourke is a lovely historic town on the Darling River, and service centre to a geographically large and remote area. It is highly reliant upon its agricultural base, with dryland grazing for wool and beef production, and irrigated cotton, being the main produce. Government and community services are also important sectors for the local economy. With just over 3,000 people at the time of the 2006 Census, Bourke SLA is the smallest, least urbanised and most remote case study area of the eight selected for more detailed analysis.

Bourke Shire has experienced significant population and employment loss in the period from 2001-06, which quite different to previous population fluctuations, and almost certainly as a result of the severe drought during this time. In many ways, this is a real time simulation for what is likely to occur with a permanent reduction to water from State and Federal Government policy, including the implementation of the Murray Darling Basin Cap ('the Cap') since 2007, the more recent announcement of further adjustment to entitlements by the State Government to maintain compliance with the Cap, and the setting of new Sustainable Diversion Limits (SDLs) under the forthcoming Basin Plan.

Bourke has been relatively resilient to past challenges, despite its size and remoteness, in part due to the robustness of the agricultural sector and the more recent growth in irrigated agriculture, the level of public and community sector jobs due to its role as a service centre to more remote communities, and its 'iconic status' in the public imagination that supports outback and river-based tourism.

A permanent reduction in water is likely to permanently constrain economic and social recovery of Bourke, and entrench and significantly worsen existing high levels of social disadvantage, particularly among its large Indigenous population. Recent reductions in irrigation water under the Cap are likely to provide significant constraints to such recovery, especially for irrigators and related businesses, and are already reported to have been a ‘tipping point’ for some businesses. Further permanent water reductions under *future* Federal Government policy decisions are likely to have significant impacts on irrigators and related businesses that have been able to remain viable despite prolonged recent stressors. Further reductions in irrigation water in a community like Bourke may remove ‘bounce back’ options altogether for some businesses. Demoralisation of the community and business is a significant issue.

Socially, the cumulative impacts of current and future government water policy are likely to be severe. Imposition of further permanent water reduction is likely to accelerate population and employment loss, and have serious associated impacts, as Bourke loses the critical mass to support higher order retail and services that are currently in place. Further permanent loss of water will undoubtedly be a major contributor to such a social ‘tipping point’ in a highly vulnerable area like Bourke. That said, Bourke’s iconic status and its remoteness also continues to work in its favour, as visitations are reported to be increasing significantly, and Bourke continues to provide important service functions for even more remote communities, as well as its large and highly disadvantaged Aboriginal population. Excellent civic leadership and reports that Bourke remains ‘a good place to live’ by many during consultations also adds to the strength of its community.

Nonetheless, strong concerns of civic leaders about the need for a ‘Northern Territory style intervention’ among the growing and highly disadvantaged Aboriginal community, and consequent cost to government and the community, would not appear to be exaggerated if further job and population losses are sustained and constraints to potential recovery are imposed. Simply stated, Bourke cannot afford to lose more jobs or populations at a time when its civic, business and community leaders are working together after recent flood events to achieve any possible economic and social recovery after a prolonged period of severe stress. The environmental benefits from a further reduction in irrigation water would need to be clearly and transparently articulated and costed to demonstrate that they warrant such high social costs.

1.2.2 Bourke Shire’s Resilience ‘Report Card’

Overview

The following provides an overview of key factors that have led to this assessment of how resilient Bourke is likely to be in the face of further permanent reductions in water availability. Key factors are reviewed as a ‘report card’ on resilience, and include:

- Projected changes in employment, population, and indicators of community wellbeing modelled for 10%, 25% and 50% cuts in irrigation water on the 2005/06 growing season;

- Degree of reliance upon agriculture and in particular irrigated agriculture and related industries;
- Factors that have a statistically significant relationship on wellbeing and resilience;
- The current status of Bourke in terms of existing socio-economic indicators; and
- Factors that are likely to mitigate or worsen projected impacts.

Each of these is looked at in turn below. This is followed by detailed data and information from desktop analysis and fieldwork undertaken from January to May 2010.

Population and Employment Impacts Forecast

Our modelling of a permanent reduction in water applied for irrigation by 10%, 25% and 50% on the 2005/06 growing season indicates a minimum loss of 33, 69 and 103 jobs respectively would be expected. Minimum population loss of 93, 193 and 289 people respectively is projected. This is equivalent to a decline of 2.6%, 5.6% and 8.5% of jobs in 2006, and 3.1%, 6.7% and 10.3% of the 2006 population (see **Section 4.2** below).

Though small in *quantum*, the effects of cuts to irrigation water on a small economy and population like that of Bourke Shire are likely to be significant. This is because irrigated agriculture forms a large proportion of agricultural industries and the total economy of Bourke, and because job losses and attendant outward migration will exacerbate existing very high levels of disadvantage and lead to a more residualised population, as discussed below.

Given the job and population losses experienced during the recent drought (around -16% and -15% respectively), the fact that irrigated agriculture is anecdotally stated to have higher multipliers than the average for agriculture, and the likelihood that some agricultural jobs have not been identified in our analysis, this is almost certainly an underestimate. The likelihood that these are lower-bound estimates is supported by the fact that it has not been possible to identify all agricultural jobs, Census undercounting and our finding that smaller, more agriculturally dependent communities have much employment greater flow-ons associated with agricultural production.

In many ways, the recent drought could be seen as real time simulation for cuts to water through the implementation of the Cap since 2007, and further potential cuts to water under current Federal policy. At a minimum, reduction in water availability after 2006 is likely to significantly constrain recovery that has been evident in fluctuating population figures for the past 30 years, though a steady downward trend is evident.

Predicted Changes in Indicators of Wellbeing and Resilience

Modelling of impacts on indicators of Community Wellbeing and Resilience for Bourke Shire also indicate serious adverse impacts on such indicators will accompany employment and population loss, in particular an increasingly residualised population among those who remain

including more disadvantaged families, older and Aboriginal people. A further erosion of virtually all of the indicators measured is likely. Notable changes⁵ are projected to be a decrease in median household income, an increase in the rate of those on disability support pension, an increase in profound or severe disability, an increase in unemployment and a less in-migration or population replacement in the case study area. It should be remembered that a number of these indicators already show a severely stressed community, for example in relation to the crime rate and level of disadvantage (see Table 1.2 below).

Factors Affecting Wellbeing and Resilience

A number of factors were found to predict changes in indicators of wellbeing and resilience in earlier stages of this study,⁶ including changes in employment and population. Our findings for the MDB were generally in line with other research on rural and regional communities, and included degree of remoteness, degree of urbanisation (population size), proportion of Aboriginal people particularly remote populations,⁷ and median age of the population.⁸ Degree of economic diversity and opportunities to diversify were also relevant factors identified in the literature,⁹ though our findings indicate that these are largely a function of other things like remoteness, proximity to a large urban centre or to other economic resources like extractive industries.

The following table provides an overview of these key factors, which are discussed in more detail in the body of the case study report. In summary, Bourke Shire is likely to be very vulnerable to population and employment loss due to its remoteness, small size and distance from major service centres, large Indigenous population and very high reliance on agriculture including irrigated agriculture. In its favour, it is an important service centre for even more remote communities and so has a much higher than average public and community sector employment. On the down side, a substantial component of such employment is likely to be related to the provision of services required to support a large population of very disadvantaged people in particular among the Aboriginal community, with high levels of reliance on Centrelink payments and social problems requiring significant resources (e.g. a very high per capita police force) (see also Table 1.2 below).

⁵ More than 5% change

⁶ JSA (2010) Report 2: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Understanding Agricultural Employment*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri; and JSA (2010) Report 3: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Irrigated Agriculture and Socio-Economic Indicators*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri

⁷ JSA (2010) Report 2: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Understanding Agricultural Employment*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri; and JSA (2010) Report 3: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Irrigated Agriculture and Socio-Economic Indicators*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri.

⁸ JSA (2010) Report 2: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Understanding Agricultural Employment*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri; and JSA (2010) Report 3: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Irrigated Agriculture and Socio-Economic Indicators*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri

⁹ JSA (2010) Report 1: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Scoping Paper*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri

Table 1.1: Key Factors in Community Resilience

Statistically Significant Factors	Likely to be Resilient?	Comment
Remoteness	X	Bourke is a 'Remote area' under the ABS Remoteness Classification and much more remote than the MDB average of areas, with some part of the Shire classified 'Very Remote'.
Degree of Urbanisation:		
• Population Size	X	Bourke Shire is below the 5,000 population threshold found to be critical for resilience in terms of having a localised economy heavily reliant upon agriculture. As such, it is very vulnerable to further population loss, or any constraints to recovery of population and employment following the prolonged drought.
• Proximity to a large regional centre	X	It is around 5 hours to its nearest regional centre of Dubbo and remote from major cities and the coast.
Indigenous Population	X	More than 6 times the MDB and 12 times the national average. Associated with significantly worse socio-economic outcomes.
Age	√?	Younger than the MDB and Australian median age. Likely due to the much younger age profile of its Indigenous people, though also likely to be related to the regular turnover of younger professionals. Also younger people found in entry-level jobs, with higher retention of young people reported in irrigated agriculture.
% of employment by industry compared with Australian benchmark	X?	Very reliant on agriculture and directly related activities (25%) though slightly lower than the MDB average (29%) largely due to the relatively high level of public and community sector employment related to the large welfare sector and important role as a remote service centre. The local economy is highly reliant upon agriculture and government employment (directly or government-funded agencies), with these sectors accounting for at least 65% of employment in Bourke Shire compared with 29% for Australia and 53% for the MDB. A positive aspect of it remoteness is the likely retention of key services for an even more remote region. It is also noted that the vast majority of land is devoted to dryland grazing, and more than half of all direct agriculture is in this sector. As such, dryland grazing remains the major land use and an important employer, and the diversity provided by this alternative landuse is an important factor in resilience. However, employment per ha in dryland grazing is much lower than for irrigated agriculture, and substitution of irrigated agriculture with dryland agriculture as the next best use would lead to significant job losses as discussed below.

Current Status on Community Resilience Indicators

The current status of the community is also important in understanding its resilience or vulnerability to changes in employment related to a permanent reduction in irrigation water. The

following provides a 'report card' and compares the current status of Bourke Shire with MDB and national benchmarks on key indicators of community resilience.

In summary, the following signifies an extremely disadvantaged community, mainly related to the very high Indigenous population exacerbated by remoteness, much of this relates to its highly disadvantaged Indigenous population, and there are likely to be more mixed or positive indicators for other residents including the high proportion of those in government and community sector jobs (both Indigenous and non-Indigenous workers).

The community experiences very poor health outcomes, has an extraordinarily high rate of violence and property crime, and very high levels of disadvantage against key indexes. It experienced significant population and employment loss from 2001-06, a sharp downturn after previous census periods that have shown smaller downturns or increases in employment, and likely related to the depth and severity of the drought. Bourke Shire has much lower than average school participation rates, low levels of post-secondary qualifications, very high unemployment rates, though general labour force participation rates are quite high and very high for those aged 65+ years. These types of human capital indicators may mean a less adaptive labour force to cope with changes in its agricultural base, though it is also likely that more employable people have left the area during the recent severe recent downturn.

Overall levels of educational and occupational resources are relatively high, however, most likely due to the high rate of public and community sector employment, and anecdotally of those engaged in irrigated agriculture and related sectors, and indicates a good resource for community leadership in this respect.

Table 1.2: Current Status Report on Indicators of Community Resilience

Proxy Indicator of Resilience	Likely to be Resilient?	Comment
Community Wellbeing:		
SEIFA Disadvantage (includes indicators related to people's access to material and social resources, and their ability to participate in society)	X	Much lower than the MDB average and much lower than Australia, likely largely related to the high Aboriginal population and their severe levels of disadvantage
SEIFA Economic Resources (including income, housing expenditure and assets of households)	X	Much lower than the MDB average and much lower than Australia, likely related to high Aboriginal population, the lower value of residential property, capital assets, etc
Median Household Income	√	Lower than Australia but much higher than the MDB average likely due to higher incomes and wages associated with public sector employment. Incomes are likely to be polarised between very low and quite high (see GINI Co-Efficient below)
Social Capital /Volunteering rate	X	Lower engagement in voluntary activity than the MDB average, but much higher than Australia. Local civic leaders noted that they are actively engaging in activities to increase

Proxy Indicator of Resilience	Likely to be Resilient?	Comment
		volunteering at the present time
Disability Support Pension (DSP)	X	Much higher than average reliance on DSP, likely due to the very high Indigenous population, severe levels of disadvantage and related higher levels of disability despite the younger age profile
Premature Death	X	Double the national average and much higher than the MDB, most likely related to the very high Aboriginal population (e.g. much higher rates of diabetes, heart disease, etc) and their severe levels of disadvantage, and possibly due to higher rates of accidents and suicide
Profound or severe disability	?	Much lower than both the MDB and Australian average, which may be due to the younger age profile, but also may be unreliable due to sampling error and the above two indicators.
Chronic Ill Health	X?	Not reported due to sampling error, but likely to be high given the premature death rate high level of reliance on Disability Support Pension.
Domestic Violence- Related Assaults	X	More than 10 times the NSW rate, and over 6 times the MDB of a average of areas
Non-Domestic Violence- Related Assaults	X	More than 10 times the NSW rate, and over 6 times the MDB average of areas
Aggregate Property Crime	X	Around 4 to 5 times the NSW and MDB average of areas
Economic growth/Human Capital:		
Change in Total Employment 2001-06	X	Significant employment loss during drought period 2001-2006 (-16.1%), and a sharp downturn after previous census periods that have shown smaller downturns or even increases in employment.
Labour force participation 15+ years	√	Slightly higher than the MDB and national average, which will also include the high proportion of those unemployed who are assumed to be actively seeking work. Also relates to the reportedly high level of entry-level jobs, and very high rate of labour force participation among older people.
Labour force participation 65+ years	X?	Very high older work force. Also likely out-migration of retirees, which increases % of older workers of those remaining. The advantages of skills and experience of older workers was also noted in consultations, and the opportunities for continued participation of older people who want to continue working compared with metropolitan areas. A younger age among those in irrigated agriculture was also reported anecdotally.
Post-school qualification (skills base)	X	Rate of those with trade, degree or better qualification was lower than MDB and much lower than the national average, likely related to the Aboriginal population and

Proxy Indicator of Resilience	Likely to be Resilient?	Comment
		nature of local jobs.
School participation at 16 years	X	Much lower than the MDB and national average of school retention, likely among the large Indigenous youth population.
SEIFA Index of Education and Occupation (includes relevant Census variables on the general level of education and occupation-related skills and status of a community)	√	Interestingly, performs quite well on this broad indicator of human capital, indicating the presence of sufficient people with higher educational and occupational status to balance out other individual indicators. The presence of a large public and community service sector is noted in this regard, and the presence of a good resource for community leadership, also noted in consultations
GINI co-efficient of household income distribution	X	Like the MDB average, this indicates that incomes tend to be polarised at the high and lower ends of the spectrum
Youth unemployment rate	X	Very high relative youth unemployment (around 17% compared with 10% in MDB and nationally), most likely concentrated among Aboriginal young people. Nonetheless, difficulties sourcing workers and the need to source external labour for some jobs was noted during consultations, especially as the local economy begins to recover after recent floods/ high rainfall
General unemployment rate	X	Higher than the MDB and national average, though again demand for workers was noted with the breaking of the drought.
Amenity:		
Population Growth /Retention 2001-06	X	Significant loss of population (-14.6%) compared with MDB average (no change). Though there has been a gradual long-term loss of population, this has fluctuated probably with climatic and market variations and technological change, and government regional development and servicing policies. The sharp decline between 2001-06 was not characteristic of previous fluctuations and is likely due to length and severity of the drought.
In-migration	?	Slightly lower than the MDB average, though there is a regular in-flow of professionals into public and community sector jobs.

Other Factors that indicate vulnerability or resilience from Consultation

Fieldwork and other consultations have provided valuable insights into other aspects of current and future community vulnerability or resilience, as well as other factors that are likely to mitigate or worsen projected impacts. These are looked at in detail in **Section 4.2** below.

In summary, there are likely to be limited opportunities for replacement employment with further permanent reductions in water for irrigation to maintain compliance with the 'Cap' and/or the

forthcoming *Basin Plan* in Bourke Shire due to the nature of the ‘next best’ land use (dryland grazing), locational disadvantage, absence of alternative economic resources, and very limited future benefits from open trade in water. Attempts at agricultural diversification to higher value uses (permanent plantings of grapes, citrus, etc) have been largely unsuccessful with low water security during the drought; and further land and water use efficiencies are reported to be unlikely without significant capital investment (principally to upgrade storages). Such investments are unlikely due to projections of significantly reduced income for farmers and related sectors due to the implementation of the ‘Cap’ in 2007 and a further 17% reduction recently announced, as well as uncertainly regarding further reductions in irrigation water under the forthcoming *Basin Plan*.

Moreover, there is clear evidence that community, civic and business leaders are working together to achieve any possible post-drought recovery, but this is likely to be made far more difficult by implementation of the Cap and further reductions in allocations to maintain compliance with existing MDB diversion limits, which has proven to be a ‘tipping point’ for some businesses. It has reduced the overall profitability of businesses, lowering the ‘average’ year by removing the possibility of high production years during times of good rainfall. This will reduce the viability of agriculture, and flow on to related sectors and population decline.

On the positive side, agriculture is clearly a robust and resilient sector, and has been adjusting to high levels of ongoing exposure to climatic variation and low water security in this part of the Basin for at least a century. The history and ‘iconic status’ of Bourke is a significant advantage in terms of increasing tourism. Its remote location and role as a service centre to even more remote areas has distinct benefits in the likely retention of a range of key services and social infrastructure. Strong and highly skilled leadership is evident, and a number of people interviewed report that they experience a positive way of life and high social capital, despite the quantitative indicators of community wellbeing and resilience noted above. It would thus be simplistic and probably inaccurate to consign Bourke to the fate of ‘rural decline’, though current and future reductions in water for irrigation will certainly impose major constraints on the future wellbeing and resilience of the area.

This is reported in Section 4.2 below, with key issues summarised in the following table.

Table 1.3: Other Factors in Resilience from Consultations

Factor	Likely to be Resilient?	Comment
Nature of 'next best' land use with reduced water	X	Most consultation participants reported that existing irrigated properties lie fallow when there is insufficient water to grow cotton, especially during periods of low commodities prices for alternative crops. Some wheat may be grown depending on rainfall/ price. The 'next best' land use is historically dryland grazing, which accounts for most agricultural land use in the Shire and over half of the direct employment in agriculture in 2005/06. However, substitution of dryland grazing on land currently used for irrigated agricultural land is likely to lead to very little employment. Very limited opportunities for horticulture due to low water security and low rainfall, and most attempts to diversify into horticulture have failed during the recent drought (see Section 4.2 below).
Potential benefits of water trade	X	Reported to be limited potential for out of area trade due to the 'unsupplemented' nature and low reliability of the licenses held in the area on a largely unregulated river system in this part of the Basin. No opportunity to participate in Federal buyback to date due to the lack of a gazetted water sharing plan for the Barwon-Darling, with the exception of the purchase of land and water at Toorale Station under Water for the Future. The predominance of low security water and Bourke's location within the MDB system is reported as likely to limit future participation in trade of water on the open market. There are reported to have been significant impacts on local businesses in Bourke township and in smaller communities like Louth from the purchase of Toorale Station under Water for the Future, which is reported to have taken 10% of business from the town, had cumulative impacts including the scaling down and possible exiting of Clyde Agriculture from Bourke Shire, and impacts on the social life, school and services of Bourke and Louth. There are particular concerns regarding the loss of land for future productive uses (dryland farming) along with the water. Alternative views have also been put by other stakeholders regarding the value of the Toorale for use as National Park, including the employment of local Indigenous people and others in decommissioning infrastructure, land remediation, construction and renovation of the historic homestead.
Past responses to 'stressors' e.g. drought	√	Agriculture is reported to be highly resilient and flexible in the face of ongoing climatic variation. As noted by local graziers, dryland grazing has been highly adaptive, and production and employment levels have 'bounced back' after period of drought, fluctuations in commodities prices, etc, though longer-term technological change has significantly reduced overall employment numbers over the long-term. Irrigated agriculture is likewise reported to be highly adaptive, with growers varying crop mix, engaging in technological innovation, increasing land and water efficiencies and investing in higher value uses such as horticulture over the past few decades. Irrigated agriculture can also be seen as a contributor to community resilience, and has buoyed the labour market since its introduction as relative employment in dryland farming

Factor	Likely to be Resilient?	Comment
		has decreased with technological change. Such imperatives to increased efficiency have also reduced employment in irrigated agriculture recently, though employment levels and likely flow-ons to other sectors are still much higher than for dryland uses, with cotton employing around 6-7 people per 1,000 ha compared with around 0.2-0.4 people per 1,000 ha for dryland grazing. Irrigators have responded to severe drought since 2001/06 through growing reduced or no crops depending on financial assessment, and becoming 'opportunistic irrigators'. Where feasible, they have varied crop mix (e.g. grown sorghum or winter wheat). A number of larger and smaller irrigators also invested heavily in diversification into higher value uses (e.g. citrus, grapes) to 'make better use of water', but many ventures are reported to be in receivership or heavily in debt, and many have failed due to low security of the water licences held compared to the flow required. A range of on-farm water saving efficiencies have also been undertaken including improving storages, implementing 'no till' practices and installing more efficient irrigation infrastructure. However, evaporation from storages is reported to be the major potential efficiency gain, and this appears highly unlikely due to reduced income and high debt levels for the drought and recent Cap implementation. Uncertainty about future SDLs under the forthcoming Basin Plan means that such capital investment is not feasible for most. As well as the drought since 2000/01, Bourke Shire has coped with major reductions to water entitlements under the implementation of the Cap in 2007 (irrigators report a 66% reduction in historical levels of water availability from 523 Gl total annual diversion limit to 173 Gl/year). Low flow levels during the drought since the 2007 implementation have masked the potential effects of the Cap. Despite the fact that implementation of the Cap in 2007 was regarded as 'severe', it was accepted on the basis that it was said to provide 'certainly' for businesses about future water entitlements. However, at the time of writing, a further 17% reduction on entitlements to maintain compliance with the Cap (from 173 Gl/yr average annual diversions to 143 Gl/year) was recently announced. The effect of this further reduction, even with recently improved rainfall and storage conditions, is likely to be a significantly reduced opportunity for recovery to pre-drought levels of production, by taking away the 'good years' to average out the 'bad years' in the average business cycle, and the ability to make inroads into debt. This is reported to have been a 'tipping point' for a number of businesses.
Ability to make further efficiency gains	?	Reported to be very low due to previous on-farm efficiency gains that have been made in response to previous public policies and programs, low rainfall and low allocation years, and in accordance with good business practice. Agriculture businesses and CMA report that 'many of the gains that can be made have been made' in an area that has ongoing exposure to climatic variation and low water security. Further efficiency gains would require major capital investment, which seems unlikely with reduced income and significant uncertainty.

Factor	Likely to be Resilient?	Comment
Access to Other Economic Opportunities	X	Very limited alternative opportunities due to remoteness, and lack of an alternative resource base. The name 'Bourke' has an iconic status, and a healthy tourism industry, with visitations reported to have increased significantly in recent years. However, levels of employment in relevant sectors like 'food and accommodation' and 'recreation' are not high, and indicate that this is unlikely to lead to significant replacement of irrigation agricultural jobs lost.
Natural attributes	?	Nature of soils and very poor rainfall limit other high value agricultural alternatives. Bourke town is located at the intersection of three cross-country transport routes - the Kidman Way, Mitchell Highway and Kamilaroi Highway. Bourke has also recently lost its air service, which has 'symbolic' meaning for the town in terms of perceptions of isolation. However, the iconic status of Bourke, its history and its location on the Darling River Run is also a positive in terms the likelihood of continued increase in visitation. Its remoteness can also be seen as a plus in that it is likely to continue to act as a service centre for an even more remote region. This is likely to at least secure its survival in the longer term.
Leadership /Social Capital	√	Very strong community leadership evident from consultations, communication and co-ordination of action with regard to key community issues and threats. Strong co-ordinated promotion of Bourke (e.g. extensive branding of 'Back of Bourke' throughout town enterprises and promotional literature). Notable that a range of local people interviewed reported that Bourke was a very positive place to live, and found it 'safer, friendlier and better quality of life' than other areas in which they had lived, despite its status 'on paper'.
Other factors in vulnerability /resilience identified in consultations	X	Smaller villages like Louth are reported to have experienced significant impacts from the purchase of Toorale Station under Water for the Future, and are likely to be more seriously affected by further reductions in water than larger towns. Impacts of the purchase of Toorale Station are contested, however, as noted above.

2 Introduction

2.1 Overview

In June 2009, Judith Stubbs and Associates (JSA) were engaged by the Cotton Catchment Communities Co-operative Research Centre to undertake a significant research project investigating wellbeing and resilience of communities, particularly those engaged in irrigated agriculture including cotton, within the Murray Darling Basin (MDB). The study seeks to understand the likely social and economic impacts on communities at different scales arising from changes in government water policy, in particular, Water for the Future and the forthcoming Basin Plan, and projected climate change. This project included three research strategies and has so far produced three reports.¹⁰

2.2 Rationale

Given the findings from literature and the first three reports of this study, it is likely that the social and economic impacts related to changes in water availability will be experienced differently at different geographic scales (eg. farm, local community, region, MDB, national), and by different groups within a community (e.g. farmers, Aboriginal people, businesses). Key factors will include the existing wellbeing and resilience of these communities, and other mitigating factors such as access to the water market and alternative economic opportunities.

In order to understand the differential impacts upon areas and groups, we have carried out a cost-benefit analysis to determine impacts at the MDB and national levels and prepared eight case studies to explore the likely impacts at the farm, regional and local community levels. These documents comprise the fourth and final report for this study.

The eight case study areas were selected in order to represent different states, different CSIRO Sustainable Yields Regions, cotton and non-cotton producing areas, a diversity of irrigated agricultural uses and diversity across three key attributes including population size, remoteness and Indigenous population. The eight case study areas include Dalby-Wambo, Queensland; Balonne, Queensland; Moree Plains, NSW; Bourke, NSW; Griffith, NSW; Campaspe, Victoria; Mildura, Victoria; and Murray Bridge, South Australia.

¹⁰ JSA (2010) Report 1: Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Scoping Paper, JSA (2010) Report 2: Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Understanding Agricultural Employment, and JSA (2010) Report 3: Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Irrigated Agriculture and Socio-Economic Indicators.

2.3 Case study methodology

This case study is informed by JSA's extensive analysis of agriculture and population data; a review of policy, relevant document and reports; and a series of telephone and face-to-face interviews with individuals from a range of perspectives and organisations. These included a wide range of staff and elected or appointed representatives of the following agencies/ groups:

- Bourke Shire Council
- A range of individual irrigators and dryland farmers
- Agricultural and irrigation industry groups
- National Parks and Wildlife Service
- Commodity Broking Services
- NSW Outback Division of General Practice
- Western Research Institute
- Western Catchment Management Authority
- NSW Farmers Association
- Interested community members who attended workshops and report back sessions

Interviews and a field visit to the Bourke Shire area were conducted between January and May 2010 in order to understand how water availability, agricultural land use and agricultural employment has changed in recent years as a result of government policy and short term climatic change (eg, the recent drought), how these changes resulted in social and economic impacts at the farm and wider community levels, and therefore how more permanent reductions in irrigation water are likely to affect wellbeing and resilience at the farm and community level.

2.4 Case study overview

This case study provides:

- A description of the case study area including its location, land and water use, water policy, and relative social and economic wellbeing and resilience against key indicators;
- A prediction of impacts to community wellbeing and resilience based on hypothetical reductions in water availability of 10%, 25% and 50% from the most recent year for which comparative agricultural and population data is available (the 2005/06 growing year and 2006 Census);
- An exploration of the 'short term' social and economic impacts that have been experienced as a result of the recent drought, fluctuations in commodities prices, water market and other relevant factors affecting communities; and

- An analysis of how the attributes of the area and other factors have exacerbated and/or helped to mitigate the impacts already experienced as an indicator of the area's resilience, and how it may therefore respond to more permanent changes in water availability under the forthcoming Basin Plan, permanent trade out of area and the like.

3 Description of the Case Study Area

3.1 Location and Brief History



Bourke is a lovely historic town located approximately 800 kilometres from Sydney on the Darling River in northwestern NSW. It is an important service centre for a geographically large and remote hinterland, and for significant dryland grazing (wool and beef) and irrigated cotton agricultural industries. Dubbo is the nearest large regional centre, around 4 hours drive. Since 2008,

Bourke Shire is no longer serviced by air transport, and Dubbo is also the closest centre from which people can access such transport.

At the time of the first European settlement in the area, the Bourke area was home to the Ngemba people, part of the Wongaibon group of north Western NSW. Evidence of Aboriginal ownership from 32,000 years ago in the wider Murdi Paaki Region is found in burial sites at Lake Mungo, near Ivanhoe, and burials which are even older have been found at Lake Victoria. These are the oldest ritual burials discovered anywhere in the world, and point to Aboriginal people having a highly evolved culture. The Murdi Paaki Region also contains what may well be the oldest human structure in the world: the Ngunnhu (fish traps) at Brewarrina.

Bourke was formerly the largest inland port in the world for exporting wool along the Darling River, with the wool industry a central part of the regional economy since the 1860s. The more recent prosperity of the Shire is at odds with the early assessments of its potential by the first Europeans to travel through the area. When Charles Sturt passed through the district in 1828 and reached the Darling River, they had arrived during a period of drought. Although Sturt was to refer to the Darling as that 'noble river' he stopped his travels as, at the time, it was saline and very low, and returned to Sydney with quite unfavourable reports regarding prospects for European settlement. In 1835, Thomas Mitchell returned to the area and constructed a fort some 10 or so kilometres from the existing town site, largely due to poor relationships with the local Aboriginal inhabitants.

‘Fort Bourke’ established the possibility of European settlement, and over the next decade pastoralists moved into the area with mixed results. It was marginal land and few prospered. However the history of the district changed dramatically when, in 1859, Captain Randall sailed the Gemini up the Darling from South Australia. Bourke and Brewarrina and other centres along the Darling became vital transport nodes. For decades Bourke was the transport centre for the whole of south west Queensland and western NSW. Its port was the only efficient way to transport wool to the coastal markets and at its height in the late 1800s over 40 000 bales of wool were being shipped down the Darling annually. The river transport continued until the last commercial riverboat in 1931.

Bourke is considered to represent the ‘edge’ of the settled agricultural districts and the gateway to the ‘outback’, which lies north and west of Bourke. This is reflected in a traditional Australian expression ‘back o’ Bourke’, referring to the outback Australia.^{11\}

3.2 Water and Land Use Context

3.2.1 Overview of Current and Projected Water Use

The Bourke case study area is located in the **Barwon-Darling sustainable yield region (SYR)**,¹² which had a population of around 50,000 people in 2006 (2.5% of the MDB total) concentrated in the centres of Collarenebri, Walgett, Brewarrina, Bourke, Cobar and Wilcannia.¹³ The town of Bourke marks the point where the Barwon becomes the Darling River, with the various river systems that make up the north-eastern part of the MDB including the Bogan, Barwon and Culgoa Rivers converging to form the lower reaches of the Barwon a short distance to the east of the town.

The Barwon-Darling SYR covers 13% of the land area of the MDB, and accounts for 2.8% of the Basin’s runoff. The SYR is reported to use 3% of surface water diverted for irrigation in the Basin, while groundwater use is less than 1% of that used.¹⁴

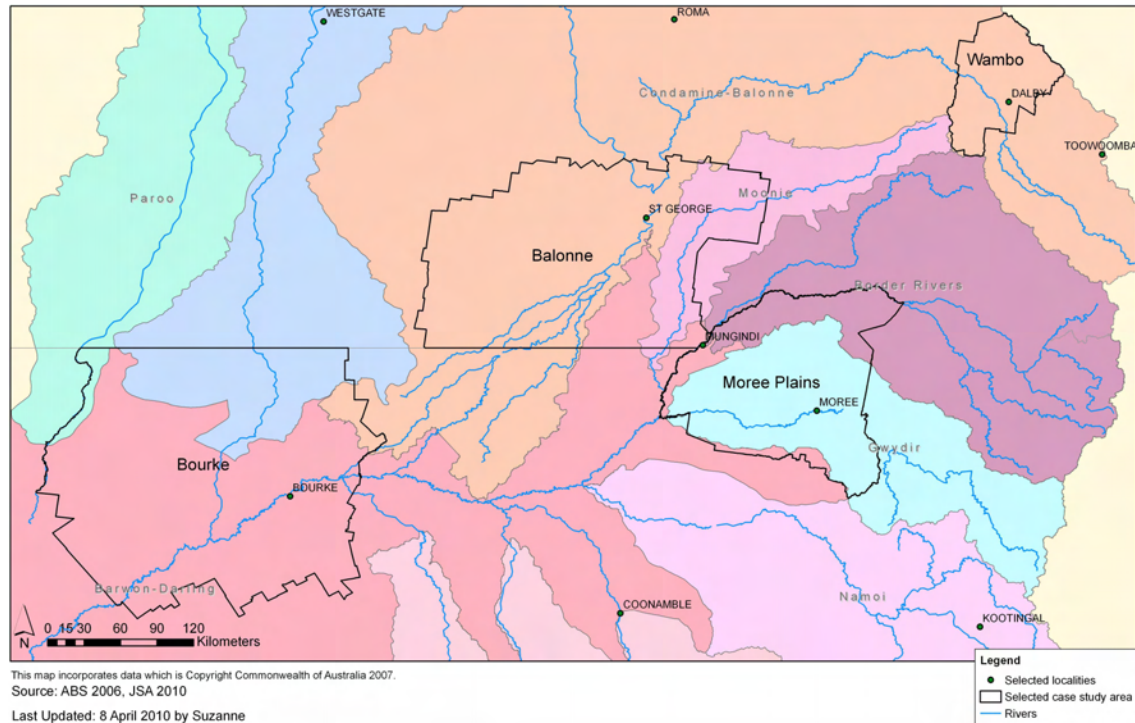
¹¹ <http://www.outbackarts.com.au>

¹² In 2008, the CSIRO completed a series of reports through the Sustainable Yields Project, which assessed the current and future water availability in the Murray-Darling Basin in terms of catchment development, changing groundwater extraction, climate variability and climate change. For more information on the CSIRO Murray-Darling Basin Sustainable Yields Project, see <http://www.csiro.au/partnerships/MDBSY.html>.

¹³ CSIRO (2008) *Water Availability in the Barwon-Darling, Summary Sheet from the CSIRO MDB Sustainable Yields Project*, p.1.

¹⁴ CSIRO (2008) *Water Availability in the Barwon-Darling, Summary Sheet from the CSIRO MDB Sustainable Yields Project*, p.1.

Map 3.1: Bourke Case Study Area



The average surface water availability for the entire **Darling Basin**¹⁵ is measured at the town of Bourke, and surface water usage in the Darling Basin at current levels of development is assessed by the CSIRO as 'high' (around 39%).^{16 17} Current average water use within the **Barwon-Darling sustainable yield region** itself is reported as 230 GL pa.¹⁸

Compared to other catchments in the Basin, the Murray Darling Basin Cap on diversions to 93/94 levels of development was implemented late for Barwon-Darling irrigators (in 2007). The Cap reduced the historic level of entitlement of unregulated flow licenses for the whole system from 523 GL to 173 GL per year.¹⁹ Further reductions to maintain compliance with the Cap of 17% were announced around the time of writing, further reducing average annual diversions from 173 GL/year to 143 GL/year.

¹⁵ The Darling River and all the river systems located upstream of it

¹⁶ CSIRO (2008) *Water Availability in the Barwon-Darling, Summary Sheet from the CSIRO MDB Sustainable Yields Project*, p.1.

¹⁷ Under the historical climate, surface water availability has been measured as 3515 GL per year, while current average surface water use across the Darling Basin under the current level of development has been calculated at 39% (that is, current total average surface water across the Darling Basin reduces stream flow at Bourke by 1365 GL per year).

¹⁸ CSIRO (2008) *Water Availability in the Barwon-Darling, Summary Sheet from the CSIRO MDB Sustainable Yields Project*, p.1.

¹⁹ Correspondence with NSW Office of Water, 07 June 2010.

The CSIRO's most likely estimate of **climate change** by 2030 projects a reduced surface water availability of 8%, but an increased surface water use of 2% within the region.²⁰ A growth in farm dams of 14% is expected by 2030, though this would decrease run off by less than 0.5%.²¹

The Great Artesian Basin (GAB) underlies much of the northern part of the Western Catchment,²² and groundwater reserves vastly exceed the volume of fresh surface water available. Groundwater use within the **Barwon-Darling sustainable yield region** is calculated at around 10 GL per year, or about 4% of water used within the region, which is reported to be a 'low' level of groundwater use.²³ However, CSIRO projections indicate that groundwater usage will increase to be over 50% of water used²⁴ in the SYR by 2030.²⁵

3.2.2 Key Environmental Assets

Downstream of Bourke, the **Talyawalka area** is a nationally important wetland located to the south of the region on the Darling Riverine Plains between Wilcannia and Menindee. The area is made up of the wetlands of the Talyawalka Anabranch of the Darling River and its distributary, Teryawynia Creek. It is representative of a semi-arid inland floodplain wetland system fringed by Black Box woodland.²⁶

The Paroo River Wetlands are partly located in Bourke Shire, and are reported to be important for large numbers of waterbirds in eastern Australia, including threatened species such as the Freckled Duck and the Australian Painted Snipe.²⁷ The Paroo River is a major tributary of the Darling River, and is the last remaining 'free-flowing' river in the northern part of the MDB.²⁸ In September 2007, the then Minister for the Environment and Water Resources, announced that the Australian government was adding the Paroo River Wetlands to those listed under the Ramsar Convention as wetlands of international importance, making them Australia's 65th Ramsar site. Relevant Water Policy and Regulation

²⁰ CSIRO (2008) *Water Availability in the Barwon-Darling, Summary Sheet from the CSIRO MDB Sustainable Yields Project*, p.1.

²¹ CSIRO (2008) *Water Availability in the Barwon-Darling, Summary Sheet from the CSIRO MDB Sustainable Yields Project*, p.1.

²² Western CMA (2008) *Annual Achievement Report 2007-08*, Australian Government.

²³ CSIRO (2008) *Water Availability in the Barwon-Darling, Summary Sheet from the CSIRO MDB Sustainable Yields Project*, p.1.

²⁴ Projected to around 240 GL per year by 2030

²⁵ CSIRO (2008) *Water Availability in the Barwon-Darling, Summary Sheet from the CSIRO MDB Sustainable Yields Project*, p.1.

²⁶ CSIRO (2008) *Water Availability in the Barwon-Darling, Summary Sheet from the CSIRO MDB Sustainable Yields Project*, p.1.

²⁷ Department of Environment and Water Resources (2007) *Paroo River Wetlands Fact Sheet*, p 1

²⁸ Department of Environment and Water Resources (2007) *Paroo River Wetlands Fact Sheet*, p 1

Overview

Administratively, Bourke sits within the **Western Catchment Management Authority (CMA)** area, which covers around one-quarter of NSW. The Western Catchment encompasses a series of river systems,²⁹ many of which originate in Queensland.^{30 31} The Barwon-Darling system is the largest unregulated river system in NSW. Although there are no major dams on the system, there are a series of weirs and private diversions that make water available for towns and irrigators. The characteristics of the Barwon-Darling system, similar to others in the Northern Basin, have limited the level and type of water trading that has been available to irrigators and has also determined the types of crops that are grown in the area. As such, crops that can be planted when sufficient water is available, like cotton, are grown in the area.

Private on-farm storages are used across the Northern Basin to capture local run-off to enable irrigation in areas where water is not necessarily ‘delivered’ to irrigators by a water provider through a regulated system. The process of pumping or diverting water from flows is referred to as ‘water harvesting’. In NSW, this water may be derived from general security licenses from regulated systems (where there is a major public storage), or from ‘supplementary’ water from river flows in unregulated systems and spills from dams. Irrigators in the Bourke case study area obtain their water from supplementary water access licenses for surface water diversions and floodplain harvesting.

Water Sharing and the Cap on Diversions

In 1995, the Murray-Darling Basin Ministerial Council introduced a Cap on diversions of water from the Basin. For NSW, the Cap is defined in terms of long term average diversions and represents the volume of water that would have been diverted under 1993/94 levels of development.³² The government also placed limits on the amount of water available in a valley in any given year.³³ In order to implement the Cap, water sharing plans that determine an appropriate share of water resources in a catchment between consumptive uses and the environment were developed in catchments across all of the Basin states.³⁴

²⁹ Including the Barwon-Darling, Culgoa, Paroo, Warrego, Narran, Bokhara, Birrie, Bulloo Overflow, and part of the Bogan Rivers

³⁰ Western CMA (2008) *Annual Achievement Report 2007-08*, Australian Government.

³¹ The Condamine-Balonne system contributing 20% and the MacIntyre and Border Rivers contributing 35% of the tributary flows entering the Barwon-Darling system

³² NSW Office of Water website, www.water.nsw.gov.au/Water-Management/Water-sharing/Environmental-rules/The-Murray-Darling-Basin-cap, accessed 08 June 2010.

³³ In response to these limits, the government also developed a set of Cap management rules that placed limits on the amount of water available in a valley in any given year by restricting the level of on-allocation and/or off- allocation access and/or the introduction of carryover using a Continuous Accounting allocation system.

³⁴ The two key pieces of legislation for water management in NSW are the Water Management Act 2000 and the Water Act 1912. Although some of its provisions are still in force, the Water Act 1912 is being progressively phased out and replaced by the Water Management Act 2000.

For NSW, Cap limits were included in the limits on annual water extractions established under the water sharing plans under the *Water Management Act 2000 (NSW)*. The *Act* recognised the right of the environment to water for the first time in NSW, and aims to create a system for “the sustainable and integrated management of the State's water for the benefit of both present and future generations”.³⁵ It also laid out a path for the separation of water licenses from land and the requirement for water sharing plans between users and the environment across different catchments and systems, and has been progressively implemented across NSW. As water sharing plans have been completed, licensing provisions and environmental rules of the *Act* have come into effect. The NSW government monitors annual extractions and, if growth is occurring, reduces the amount of water that can be taken by licence holders to bring extractions back into line with the Cap.³⁶

The Application of the Cap in the Barwon-Darling

There are gazetted water sharing plans in place for surface and groundwater in most of the NSW case study areas.³⁷ However, there is currently not a gazetted Water Sharing Plan for the Barwon-Darling system. In the absence of a gazetted plan, the federal and NSW state governments have determined and implemented the Cap to limit extractions for irrigation in the Barwon-Darling in consultation with irrigators directly. While the Cap was implemented in other areas across the Basin in the late 1990s and early 2000s, the process of determining the appropriate Cap limit for the Barwon-Darling was a much longer process. A Cap was implemented in 2007, with further revision and reduction of the Cap announced in 2010 at the time of writing this report.³⁸

Prior to the Cap, there was an estimated 523 GL of entitlements to licenses held by irrigators across the Barwon-Darling system. It is understood that many of these licenses were rarely activated and ‘only existed on paper’.³⁹ The amount of flow licensed was the only limitation on irrigators in terms of the water that was available to them. In 2007, when the Cap was finally introduced in the Barwon-Darling, it reduced the amount of annual average diversions to 173 GL per year across the system. As a result, irrigators say that the Cap reduced their entitlement by 67%. As a result of negotiations around the setting of the Cap, and in recognising the varied nature of the Barwon-Darling system, each year each irrigator’s account would be credited with

³⁵ NSW Office of Water website, www.water.nsw.gov.au/Water-management/Law-and-Policy/default.aspx, accessed 26 March 2010.

³⁶ NSW Office of Water website, www.water.nsw.gov.au/Water-Management/Water-sharing/Environmental-rules/The-Murray-Darling-Basin-cap, accessed 08 June 2010.

³⁷ Moree Plains (as per the Gwydir Regulated River Water Source, Border Rivers Regulated River Water Source, Lower Gwydir Groundwater), for surface and groundwater in Griffith (as per the Murrumbidgee Regulated River Water Source) and groundwater only north of the Bourke area in the Warrego Groundwater Area (as per the NSW Great Artesian Basin Groundwater Source).

³⁸ The process of setting and revising the Cap for the Barwon-Darling is described here based on correspondence with the NSW Office of Water (Telephone correspondence with NSW Office of Water, Manager for Surface Water Management, 07 June 2010).

³⁹ Interview with Bourke Shire Council, 11 February 2010.

their portion of the 173 GL for use. If flows were low in a year and an irrigator did not apply their allocation, credits could be carried over for use in future when a flow event did occur. Irrigators were allowed to carry over credits and use them, even if the total amount used from the system was in excess of the 173 GL for year, so long as the long-term adherence to the Cap was maintained. As a result, in some years the credits used and irrigation water applied has been in excess of 173 GL for the system.

Upon review of this method of implanting the Cap, the independent auditor for the Murray Darling Basin Ministerial Committee has determined that the Barwon-Darling has not been in compliance with the Cap and that a revised Cap should be put in place. As a result, a new Cap of 143 GL per year average annual diversion limit has been recently announced for the Barwon-Darling in April 2010. This represents a further 17% reduction in water available for irrigators. Moreover, further rules have been put in place regarding the amount and nature of carry over and use of unused credits from one year to the next. As much of the irrigation development in the Barwon-Darling, particularly around the Bourke area, occurred after 1993-1994 the application of the Cap and its most recent further revision have had a tremendous impact on the finances of irrigators and the 'stranding' of development assets that will never utilise their potential even when flows are good.

It is possible that the Basin Plan could apply further limits to annual diversions for irrigation in the Barwon-Darling. The establishment of a Water Sharing Plan for the Barwon-Darling remains a goal of the NSW government. It is imperative that a Water Sharing Plan be gazetted for the Barwon-Darling prior to implementation of the Basin Plan, as there can be no compensation for loss unless a plan is in place for a catchment.

3.2.3 Overview of Land Use & Water Use in Bourke Shire

Agricultural Land Use

The major landuse in the **Barwon-Darling region** is dryland pasture for cattle and sheep grazing. Approximately 63,000 ha of land were irrigated in 2000, including 57,900 ha for cotton production on the western plains.⁴⁰

In 2005/06, there were 3,804,149 ha of land under cultivation in **Bourke SLA**. The vast majority of land was used for grazing with a small proportion (but a significant area) used for broadacre crops, both irrigated and dryland, including cotton.

⁴⁰ CSIRO (2008) *Water Availability in the Barwon-Darling, Summary Sheet from the CSIRO MDB Sustainable Yields Project*, p.1.

Table 3.1: Agricultural Land Uses, Bourke

Agricultural Use	# Hectares	% of Agricultural Use Hectares
Vegetables	37	0.00%
Fruit	763	0.02%
Grapes	149	0.00%
Grazing	3,789,632	99.62%
Cereal, oilseeds, feed & other broadacre crops	7078	0.19%
Rice	0	0.00%
Cotton	6490	0.17%

Source: ABS (2006) and JSA (2009)

Agricultural alternatives in the Bourke case study area are reported to be far more constrained by low rainfall and relatively poor soils in much of the Shire than in other selected case study areas in the MDB.⁴¹ The ‘next best use’ in times of drought or reduced water allocations is dryland grazing, with few opportunities for dryland cropping. However, it was also reported during consultations with irrigators that often no crop is grown when cotton is not feasible due to lack of water due to cost structures associated with the business and other and use constraints. More recent attempts at diversification into higher value horticultural uses such as grapes and citrus are reported to have had a high rate of failure in the past 2 years, due principally to water insecurity, with at least two major horticultural enterprises in receivership.⁴² The small land use and employment associated with such horticulture in the above table may thus be largely obsolete at the time of writing.

Table 3.2 below indicates that over 65 Gl of water was used for irrigated crops in Bourke SLA case study area in 2005/06. Of this 90% was used cotton growing, with around one-third of agricultural employment in this sector, and at least one-half of employment in dryland grazing. The next largest user of water was grapes, though this was a fraction of water and employment in the Shire. As noted elsewhere, it is likely that these employment levels are a significant underestimate due to coding and under-reporting in the Census, the seasonal nature of some agricultural employment that may not be picked up (for example, seasonal grape or fruit picking, or cotton production where contractors may not report this as their primary work). Also note that water use and area under cultivation for cotton during the 2005/06 growing season was likely to be far lower than average due to low allocations in this year. Note also that the low level of employment in ‘cereals’⁴³ may also relate to the fact that very little wheat was grown in the dry conditions of this year.

⁴¹ Interviews with growers and other stakeholders, March 2010

⁴² Interviews with growers and other stakeholders, March 2010

⁴³ Includes cereals, oilseeds, feed & other broadacre crops Cereal, oilseeds, feed & other broadacre crops

Table 3.2: Irrigated Water Use and Employment in Bourke SLA 2005/06

Employment & Water Use	2005/06	% Ag Employment/ Water Use
Employment in Fruit	3	1%
Irrigation water use for Fruit	0 GI	0%
Employment in Grapes	11	3.5%
Irrigation water use for Grapes	3.3 GI	5%
Employment in Grazing	176	54%
Irrigation water use for Grazing	0 GI	0%
Employment in 'Cereals' ⁴⁴	3	1%
Irrigation water use in Cereal	0 GI	0%
Employment in Cotton	104	33%
Irrigation water use in Cotton	59.2 GI	90.5%
Employment (Balance Agriculture)	24	7.3%
Employment (Total Agriculture)	325	100%
Total Irrigation water used	65.4 GI	100%
Total Employment	1312	N/A

Source: JSA calculations based on 2005/06 Agricultural Census

3.3 Social and Economic Context

3.3.1 Overview of Bourke Case Study Area

The Barwon-Darling sustainable yield region had a population of around 50,000 people in 2006 or 2.5% of the MDB total, concentrated in the centres of Collarenebri, Walgett, Brewarrina, Bourke, Cobar and Wilcannia.⁴⁵ The area selected for more detailed study within this region is **Bourke SLA**, which comprises the main service and administrative centre of Bourke, and smaller urban areas including Louth, Enngonia, Byrock, Wanaaring (on the Paroo River), and Fords Bridge, and covers an area of over 40,000 km, making in one of the largest local government areas in NSW.

With just over 3,000 people at the time of the 2006 Census, Bourke SLA is the smallest, least urbanised and most remote case study area of the eight selected for more detailed analysis. Dubbo is the nearest large regional centre, around 4 hours drive. Since 2008, Bourke is no longer serviced by air transport, and Dubbo is also the closest centre from which people can access such transport.

⁴⁴ Includes cereals, oilseeds, feed & other broadacre crops Cereal, oilseeds, feed & other broadacre crops

⁴⁵ CSIRO (2008) *Water Availability in the Barwon-Darling, Summary Sheet from the CSIRO MDB Sustainable Yields Project*, p.1.

Bourke case study area experienced the second largest decline in population of the eight case study areas. Like the slightly less remote Balonne Shire in Queensland, it experienced almost 15% population loss from 2001-06 in contrast with average growth for the MDB of 1.1% and the much higher growth of Australia for the period (almost 10%). The significant population decline for the period also strongly contrasts with most of the case study areas in the Southern Basin, where Murray Bridge, Mildura and Campaspe grew by 2.4%, 4.3% and 5.4% respectively.

The trajectory of population growth and decline for Bourke Shire is shown in the following graph. Population tended to fluctuate from 1976 to 1991, related in part to waning employment in dryland agriculture with ongoing technological change as well as varying climatic conditions, as well as the growth in irrigated agriculture during this time. The population declined steadily from 1991 to 2001 (an overall decline of around 12.5% over 10 years). It was relatively stable during the late 1990s possibly due to quite favourable agricultural conditions reported during this time. However, the area experienced a significant drop in population from 2001 to 2006 (around 15% in 5 years) in all likelihood related to the length and severity of the most recent drought. The acceleration of population decline is evident during the last census period.

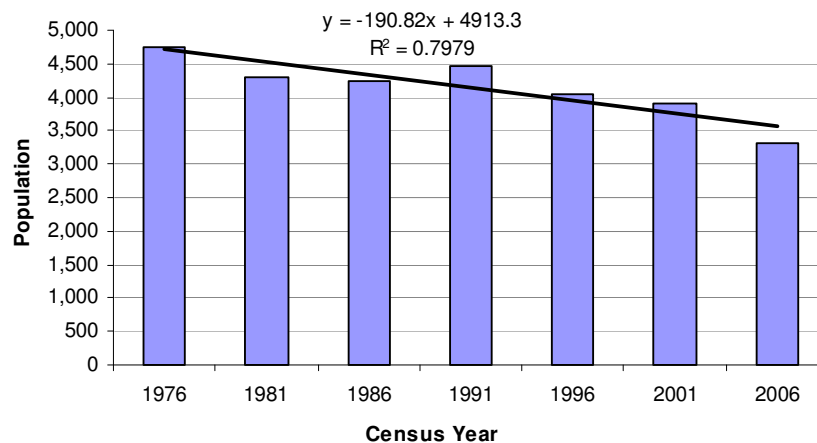


Figure 3.1: Population Change 1976-2006 for Bourke LGA

Source: ABS Census of Population and Housing, By Place of Enumeration

Households moving out of Bourke in net terms were mainly couples with children, with highest proportion moving to Sydney, and to a lesser extent to areas elsewhere in the western division (including a high proportion to Dubbo and other larger centres), and interstate. Aboriginal people, who make up around one-third of the population, were more likely to move within the western division, again generally to larger centres, and most likely to be lone parent families and couples with children.⁴⁶ Although this group also showed net outward migration for the period, Aboriginal people are projected to make up an increasing proportion of the local population due to their youthful profile (50% are aged less than 20 years) and tendency to have larger families.⁴⁷

⁴⁶ Stubbs, J. (2007) *Indigenous Housing Mismatch Study: Bourke Small Area Summary*, NSW Department of Housing.

⁴⁷ Stubbs, J. (2007) *Indigenous Housing Mismatch Study: Bourke Small Area Summary*, NSW Department of Housing.

The concentration would be even larger if non-Indigenous population declines, for example, if post-drought recovery is constrained.

3.3.2 Employment and Industry Profile

Overview

As well as the effects of remoteness, Bourke's relatively high level of reliance on agriculture, low rainfall, constraints on alternative landuses and lack of economic alternatives such as mining, energy or manufacturing make it particularly vulnerable to the effects of the prolonged drought, and to more permanent changes to water availability under the forthcoming *Basin Plan* and government water policy more generally. Its heavy reliance on public and community sector employment and high proportion in receipt of welfare payments⁴⁸ also make it particularly vulnerable to ongoing changes in government policies related to centralisation of services and administrative functions.

The significant decline in employment experienced by Bourke SLA from 2001-06 (around -16%) was equivalent to that of Moree and second only to Balonne Shire (-18%) among the eight selected case study areas. This was a far different trend to the employment growth experienced by the MDB (+ 1.2%), and a long way behind average national employment growth of almost 10% during this period. The significant decline in employment in most of the Northern Basin case study areas was also very different to employment growth experienced by Dalby-Wambo in Qld (+1.4%), and that of most of the Southern Basin case study areas, where employment in Murray Bridge grew by 7% and Mildura and Campaspe grew by around 4% during this period.

It is noted that employment loss in the Bourke SLA largely mirrored the quantum of population decline. It was somewhat different to Moree Plains and Balonne Shires in this regard, where employment loss was greater than population decline, and indicates that people losing jobs leave Bourke to a greater extent than these other drought-affected areas, probably for larger service centres. Population decline in the future may also be cushioned to some extent by projected growth of its large and youthful Indigenous population.⁴⁹ Nonetheless, it is noted that there was also a net out-migration of Aboriginal people from 2001-06⁵⁰ as employment in semi- lower skilled jobs declined during the drought and through ongoing technological change.⁵¹ The increasing disadvantage of remaining people⁵² indicates that those who are staying may be less able to find jobs elsewhere, and may be less able to adapt to the changing demands of the agricultural and other more high skilled industry in times when the economy recovers (also see interviews below).

⁴⁸ Stubbs, J. (2007) *Indigenous Housing Mismatch Study: Bourke Small Area Summary*, NSW Department of Housing

⁴⁹ Stubbs, J. (2007) *Indigenous Housing Mismatch Study: Bourke Small Area Summary*, NSW Department of Housing.

⁵⁰ Stubbs, J. (2007) *Indigenous Housing Mismatch Study: Bourke Small Area Summary*, NSW Department of Housing.

⁵¹ REF INTERVIEWS

⁵²

Employment

In 2006, there were 1,182 people employed in Bourke SLA. Of these, around one-quarter were employed in agriculture, which was slightly lower than the MDB average of areas (29%) but much higher than the national average of 3.5%. Of agricultural industries, grazing was the largest employer (159 people, 54% of all agriculture employment). Cotton also held a relatively high proportion of employees (94 people, 32% of all agriculture employment) reported at the time of the 2006 Census. Although dryland grazing is the predominant use, it employs far less people per 1,000 ha of land than irrigated agriculture (around 7 employed full time /1,000 ha compared with around 1.2 jobs /1,000 ha for dry land cropping and 0.4 jobs for dryland grazing). It is noted that this includes employment in activities directly identifiable as being related to agriculture, such as on-farm activities, ginning, storage, etc and does not include the flow-on employment. Such business multipliers (for example, related to plant and machinery purchase, hire and servicing, construction, consultancy and the like) are also likely to be higher for irrigated cropping uses such as cotton than the agricultural average (around 1.1 accounting for not stated).⁵³

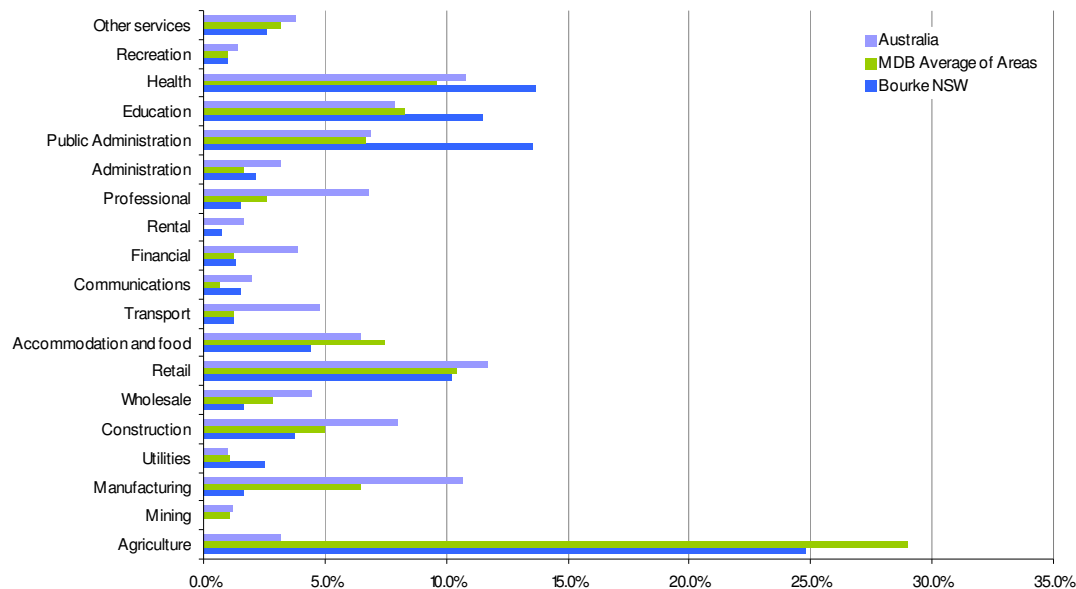


Figure 3.2: Employment Profile, Bourke NSW

Source: ABS (2006) Census of Population and Housing, JSA (2009)

Three other industries represent smaller but significant employers: health (14%), public administration (14%) and education (12%). The economy is thus highly reliant upon agriculture

⁵³ JSA (2010) Report 2: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Understanding Agricultural Employment*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri; and JSA (2010) Report 3: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Irrigated Agriculture and Socio-Economic Indicators*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri

and government employment (directly or government-funded agencies), with these four sectors accounting for 65% of employment in the case study area compared with 29% for Australia and 53% for the MDB. It is also noted that there is a strong 'welfare sector' in more remote towns like Bourke, which enables a growing population of more disadvantaged people to remain in the area without (or with periodic) paid employment.

Retail was also a significant local employer, which was quite similar to the national and MDB average at around 10% of the total labour force. A much lower than average proportion of the case study's labour force were employed in construction, professional areas, transport, finance, manufacturing and mining than the Australian and MDB average. However, employment is much higher in utilities, which is also likely to be quite strongly associated with public or quasi-public sector employment.

Bourke is reported to have a growing tourism sector, with strong leadership, promotional activity and 'branding' (e.g. 'Back O' Bourke) evident in a range of tourism related activities, and an active Tourist Information Centre. An undoubted strength lies in the name of 'Bourke' in the Australian imagination, and recent figures provided indicate strong growth in visitations.⁵⁴ High amenity environmental attributes including 'The Rivers' Run' (a 700 km dive along the Darling River from Bourke to Wentworth) are also reported to be a major attractor for 'grey nomads'.⁵⁵ Nonetheless, industries associated with tourism (accommodation, food and recreational services) employed around 6% of the local labour force in 2006 compared with around 8-9% for Australia and the MDB, and a similar or higher proportion of other case study areas (e.g. 8% for Mildura and Campaspe in the Southern MDB). Increased visitation may have had an impact on the local economy since 2006, but the extent to which reported increase in visitation translates to significant job creation remains to be seen.

Moreover, the heavy reliance upon agriculture and related industries and on public or quasi-public sector employment makes the Bourke case area more vulnerable to the impacts of government policy in relation, for example, to current or future water allocations and centralisation or withdrawal of government services, both of which were highlighted during local consultations discussed later.

3.3.3 Indicators of Community Wellbeing and Resilience

Comparative indicators for the eight case study areas are reviewed in detail in Report 4 of this study (JSA 2010 forthcoming), of which this case study will form a part. This section summarises these findings for Bourke Shire.

The effects of a far more remote location, much smaller size and lower degree of urbanisation, the lack of economic alternatives, as well as other locational or natural characteristics, are evident when looking at selected indicators of community wellbeing and resilience for Bourke.

⁵⁴ Interview with Bourke Tourist Information Centre, April 2010

⁵⁵ Interview with Bourke Tourist Information Centre, April 2010

A further important factor in its highly disadvantaged socio-economic status relative to national and MDB benchmarks is the presence of a large and youthful Aboriginal population that is predicted to grow significantly over the next 20 years. Currently 30% of the Bourke population identifies as Aboriginal compared with 5% for the MDB. Aboriginal people are predicted to make up at least 50% of the total population by 2031 due to its youthful age profile, larger families, and projected decline in the non-Aboriginal population through aging and out-migration.⁵⁶ Other areas of the Northern Basin also had large Aboriginal populations, including the case study areas of Moree Plains (19%) and Balonne Shires (15%).⁵⁷

The presence of a higher concentration of Aboriginal people, and particularly more remote Aboriginal populations, is also a significant predictor of a range of adverse socio-economic indicators when other factors are controlled for, as discussed in Report 3 of this study.⁵⁸ The high Aboriginal population is also a strong influence on the much lower median age of Bourke SLA (33 years compared with 40 for the MDB and 37 for Australia),⁵⁹ though this may also likely be due in part to the reportedly high turn over of young more transient professionals in public and community services). Bourke is not a prime retirement area and unlikely to attract large in-migration of older people as is happening in other higher amenity, more accessible 'tree change' locations (e.g. the case study area of Campaspe in Victoria).

A key issue in relation to the 'resilience' or adaptive capacity of a community is its ability to attract and retain population, and to expand or at least adapt its economic and employment base to changing conditions. As noted above, the Bourke case study area experienced a significant decline in both population and employment from 2001-06. This was strongly against the MDB and particularly the national trend. Bourke lacks the diversity of either agriculture or its general economic base to support employment and population retention during periods of prolonged stress, including the recent drought. A more gradual long-term decline in population is also evident, though there have also been periods of population and employment increase over the past 25-30 years, as noted above.

In terms of other selected indicators of resilience and community wellbeing, a less positive picture emerges. Bourke has a very high level of disadvantage as measured by the SEIFA Index of Socio-Economic Disadvantage. The crime rate is particularly high, and paints a picture of a community under severe stress. Bourke has more than 10 times the NSW average for domestic violence, more than 6 times the NSW rate for assaultive violence (non-domestic), and almost 5

⁵⁶ Stubbs, J. (2007) *Indigenous Housing Mismatch Study: Bourke Small Area Summary*, NSW Department of Housing.

⁵⁷ See Report 4 of this study (forthcoming) for all comparative demographic data for the 8 case study and benchmark areas referred to in this case study report.

⁵⁸ JSA (2010) Report 3: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Irrigated Agriculture and Socio-Economic Indicators*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri

⁵⁹ See Report 4 of this study (forthcoming) for all comparative demographic data for the 8 case study and benchmark areas referred to in this case study report.

times the rate of aggregate property crime⁶⁰ compared with NSW.^{61 62} Like the indicators of employment and educational disadvantage noted above, these trends are likely to be related to the high proportion of Aboriginal people, as well its remote location. Domestic violence and premature death (e.g. suicide) are also related to severe stress and would be expected to rise during the recent period of prolonged drought.

In terms of selected health and disability indicators, Bourke Shire also had a much higher rate of those receiving Disability Support Pension than Australia, which was also significantly higher than the MDB and most other case study areas in the Northern and Southern Basin. It also has a very high rate of premature death (around double the MDB and national average). Surprisingly, it also had a lower than average level of those with a profound or severe disability, though this appears likely to be a result of sampling error due to a very small sample size given other findings.⁶³

Both youth and general unemployment are very high relative to other case study areas and compared with the MDB and Australia more generally (17% and 8% respectively compared with around 10% and 5% respectively for the MDB average of areas). Participation in secondary education was low compared with the Basin and Australia, though not as low as several of the other case study areas, and the proportion of those with trade or tertiary qualifications was much lower than the national average and significantly lower than the MDB average, though this was on par with most of the other case study areas. The SEIFA Index of Education and Occupation was also much lower for Bourke than for other case study areas, though considerably lower than that for Australia, which may relate to the relatively high level of employment in public sector and publicly funded employment and the relatively skilled nature of much of the remaining employment in agriculture.⁶⁴ These types of human capital factors indicate a labour force that may be less adaptive to changes in the economic base, though it is also likely that more able or employable people leave during times of severe downturn as they have more options, and that a more residualised population remains.

On the more positive side, labour force participation of those 15 years and over who remain in Bourke is higher than the MDB and national average, and of most case study areas. Labour force participation of those 65+ years is very high (almost 3 times the national average and much higher than the MDB average or most of the case study areas).⁶⁵ Whilst the down side is the

⁶⁰ “Aggregate property crime” is a total value of rates per 100,000 for the following: Break and enter dwelling; Break and enter non-dwelling; Incidents of motor vehicle theft; Steal from motor vehicle; Steal from retail store; Steal from dwelling; Steal from person; and Malicious damage to property

⁶¹ Note that comparative national crime figures were not available.

⁶² See Report 4 of this study (forthcoming) for all comparative demographic data for the 8 case study and benchmark areas referred to in this case study report.

⁶³ See Report 4 of this study (forthcoming) for all comparative demographic data for the 8 case study and benchmark areas referred to in this case study report.

⁶⁴ See Report 4 of this study (forthcoming) for all comparative demographic data for the 8 case study and benchmark areas referred to in this case study report.

⁶⁵ See Report 4 of this study (forthcoming) for all comparative demographic data for the 8 case study and benchmark areas referred to in this case study report.

limited succession planning possible to farmers and others where there is a considerable exodus of younger people for employment and educational opportunities elsewhere, positive aspects of this were also reported in consultations where a number recent older arrivals to towns like Bourke commented that it was ‘far easier for someone my age to get a job in a town like this’, that it was a ‘positive place to buy a business – we could afford to buy in here and build things up’, or ‘I’ve come here [after having a career at a senior level] to give something back to a community that needs help’.⁶⁶ Such comments and the researchers’ observations in towns like Bourke highlight a far more positive aspect of the much older labour force participation than may be evident from the statistics. This includes the in-migration of those with experience, skills and commitment into an area that is in many ways struggling, and the opportunity for such people to contribute qualifications and skills gained over a lifetime. Such people are clearly adding to the existing social capital of an area, and those interviewed reported very positive experiences of life in a smaller rural community.⁶⁷ Relevantly, though community engagement through voluntary work was lower than the MBD average (24% compared with 28%), it was considerably higher than Australia (18%), and something that the Council was seeking to improve through improving voluntary networks.⁶⁸

Despite the crime rates reported above, a professional working in the town for several years commented that, *‘I love the lifestyle. To be honest, I feel far safer here than I did when I lived in Sydney. You go to the pub, and Aboriginal and non-Aboriginal people are together without distinction. I love kayaking on the River and going for a bike ride. And you feel that you can really make a difference in a place like Bourke. You can offer something. It’s a great place to be’*.⁶⁹ These are important factors in the resilience of a town and its ability to offer a positive quality of life to people living there. They are factors not obvious from an analysis of the statistics. These less observable factors are discussed further in the case studies below.

⁶⁶ Interview with Bourke residents during consultations, February 2010.

⁶⁷ Interviews with various stakeholders, February and April 2010

⁶⁸ Interview with General Manager, Bourke Shire Council, February 2010.

⁶⁹ Interview with young professional in National Parks and Wildlife Service, February 2010.

4 Potential Impacts of the Long-Term or Permanent Reductions in Water

4.1 Modelling and Quantification of Impacts

The impact on the Bourke case study area from permanent reductions in the availability of irrigation water that may occur under the forthcoming *Basin Plan* and permanent trade of water out of area (whether open market or government ‘buyback’) has been modelled using data from Research Strategies 1 and 2 of this study.⁷⁰

The impact on Bourke case study area from reductions in the availability of irrigation water has been modelled using data from Research Strategies 1 and 2. Such reductions may arise under the forthcoming Basin Plan, and have been experienced to some extent since Cap limitations were implemented 2007. The extent to which additional reductions in entitlements or allocations may occur under the Basin Plan is at the time of writing unknown. As such, we have modelled 10%, 25% and 50% cuts in irrigation water from that used in 2006. The results of that modelling in relation to the likely impact on employment, population and other key indicators of wellbeing and resilience are summarised here, and detailed in the table below.

4.1.1 Employment and Population Projections

The effects of cuts to irrigation water on Bourke are significant, although the *quantum* is small by comparison with other areas due to the small population and economy. This is because irrigated agriculture forms a large proportion of both agricultural industries and the total economy of Bourke and because job losses and hence outward migration will lead to further concentration of existing disadvantaged aged and Aboriginal populations.

The primary effect of reductions in the availability of irrigation water will be a loss of employment – a minimum decline of 7.9% in the 2006 employment level (or a loss of 103 jobs) predicted from a 50% reduction in irrigated water use based on 2006 data including direct and indirect employment in agriculture and multipliers. Given the job loss experienced during the recent drought and the fact that irrigated agriculture is anecdotally stated to have higher multipliers than the average for agriculture, and the likelihood that some agricultural jobs have not been identified in our analysis, this is almost certainly an underestimate.

Subsequent direct population loss is estimated at 9.4% (289 people). More cumulative impacts in a town or area of this size are also anticipated, as discussed below.

⁷⁰ JSA (2010) Report 1: Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Scoping Paper, JSA (2010) Report 2: Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Understanding Agricultural Employment, and JSA (2010) Report 3: Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Irrigated Agriculture and Socio-Economic Indicators.

4.1.2 Community Wellbeing and Resilience Projections

Socio-economic indicators of resilience and wellbeing are expected to be generally adversely affected as a result of changing water availability, largely as a result of an increasingly residualised population among those who stay, which is both older and has a greater proportion of disadvantaged Aboriginal people. Notable changes ⁷¹ are a decrease in median household income, and increase in disability support pension rates, an increase in profound or severe disability, an increase in unemployment and a less in-migration or population replacement in the Shire. It must be remembered that a number of these indicators already show a severely stressed community, for example in relation to the crime rate and level of disadvantage noted above. A further erosion of virtually all of the indicators measured is likely as shown in the table below.

Further decline in population Bourke Shire could also have an impact in a cumulative sense as service and business thresholds are reached. The progressive loss of population and employment is important under further reductions in water availability, whether through a further prolonged drought that comes on top of the previous one, or more permanent reduction in water availability related to government policy. As discussed below, early responses to recent rains indicate that some population and particularly employment ‘recovery’ or at the least stability could be expected if there were no further cuts to water availability on the 2006 levels, and the area has a few ‘good seasons’. Such population and employment fluctuations are evident in historical population data, and the drought appears to have a particularly severe impact as shown above.

However, ongoing reductions in water availability (climatic or human-induced) are likely to lead to cumulative impacts related further population declines and loss of services are also noted below, and are likely to lead to a downward spiral or ‘tipping point’ in a town the size of Bourke over the next decade which has clearly been experiencing ongoing stress as evidenced by ongoing population decline for the past 30 years or so as discussed above. It is likely that, without the introduction of irrigated agriculture, the town would have experienced even greater decline over this time. The comments regarding the ‘permanent drought’ that will be introduced under administrative changes to water availability and Cap limitations are also noted below.

Any action to arrest the further decline in population and the service base of the town are critical at this point to ensure that it remains viable as a service centre and does not reach the ‘tipping point’ and highly residualised point that former service centres like Wilcannia already appear to be reaching. Together with the very levels of disadvantage reported above, comments like those made by the local civic leaders that ‘We need to do everything we can to avoid a Northern Territory-style (Indigenous) Intervention here - because that’s where we’re heading if things get any worse’ appear to be quite reasonable concerns. Keeping Bourke above a population threshold is important for its future resilience and status as a district-level service centre.

The following table provides a summary of the statistical analysis in support of the above findings on likely quantifiable social and economic impacts of potential and/or actual changes to water availability under government policy.

⁷¹ More than 5% change

Table 4.1: Predicted 'long term' impacts of reduced water availability for Bourke NSW

Indicator	Base case	Predicted indicators for 2006 for reduction in irrigation water			
	2006	10% reduction	25% reduction	50% reduction	
irrigation water use (GJ)	65.4	58.9	49.1	32.7	
Employment (total) ⁽¹⁾	1312	1279	1243	1209	
% decrease in employment		2.5%	5.2%	7.9%	
Employment (Vegetables) ⁽²⁾	0	0	0	0	
irrigation water use (GJ)	0	0.0	0.0	0.0	
Employment (Fruit) ⁽²⁾	3	3	0	0	
irrigation water use (GJ)	0	0.0	0.0	0.0	
Employment (Grapes) ⁽²⁾	11	5	0	0	
irrigation water use (GJ)	3.3	3.0	2.5	1.7	appears to have been incorrectly coded to fruit
Employment (Grazing) ⁽²⁾	176	177	178	179	Assumed next best use
irrigation water use (GJ)	0	0.0	0.0	0.0	
Employment (Cereal) ⁽²⁾	3	3	3	3	
irrigation water use (GJ)	0	0.0	0.0	0.0	
Employment (Rice) ⁽²⁾	0	0	0	0	
irrigation water use (GJ)	0	0.0	0.0	0.0	
Employment (Cotton) ⁽²⁾	104	96	84	65	
irrigation water use (GJ)	59.2	53.3	44.4	29.6	
Employment (Balance Agriculture)	24	24	24	24	

Indicator	Base case	Predicted indicators for 2006 for reduction in irrigation water			
	2006	10% reduction	25% reduction	50% reduction	
Employment (Total Agriculture)	325	308	289	271	
Population ⁽³⁾	3095	3002	2902	2806	remains below 5,000 threshold
estimated % decrease in population		3.0%	6.2%	9.4%	
Indigenous population ⁽⁴⁾	29.4%	29.7%	30.1%	30.5%	
Number of indigenous people	910	892	873	855	
Dependent variables:					
SEIFA disadvantage	915	913	911	908	from changing age and indigenous structure
SEIFA Economic Resources	928	926	924	920	
Premature death	560.2	562.4	565.0	567.7	from changing indigenous structure
LFP 15+	62.4%	62.1%	61.7%	60.9%	from changing age and indigenous structure
Median Household income	\$ 821	\$ 815	\$ 804	\$ 784	from changing age and indigenous structure
Disability support pensioners	7.6%	7.7%	7.8%	8.0%	from changing age and indigenous structure
Profound or severe disability	3.3%	3.3%	3.4%	3.5%	from changing age structure
Chronic ill health	not known	not known	not known	not known	
LFP 65+	21.8%	21.8%	21.6%	21.1%	from changing age structure
Median Age	33	33.1	33.4	34.0	from change in agriculture and indigenous structure
Skills Base	28.5%	28.5%	28.4%	28.1%	from changing agriculture and age and indigenous structure
Education participation	60.5%	60.3%	60.2%	60.1%	

Indicator	Base case	Predicted indicators for 2006 for reduction in irrigation water			
	2006	10% reduction	25% reduction	50% reduction	
SEIFA Education and Occupation	965	965	965	964	
Polarisation	0.85	0.85	0.85	0.85	
Youth unemployment	16.9%	17.0%	17.2%	17.5%	from changing age and indigenous structure
Unemployment	7.9%	8.0%	8.1%	8.3%	from changing age and indigenous structure
Change of SLA five years ago	20.2%	20.0%	19.7%	19.2%	
Voluntary work	23.8%	23.8%	23.8%	24.0%	from change in agriculture and age
Assault (Non domestic violence)	3917	3954	3997	4042	
Assault (Domestic violence)	4010	4053	4102	4154	
Property Crime	22226	22343	22319	22238	

⁽¹⁾ Includes factor of 1.11 to account for census under reporting, and allows loss of 0.9 jobs for each lost agricultural job

⁽²⁾ Estimates using data from Table 3.1 of report two and using regression analysis data to account for dryland production, factor of 1.11 included)

⁽³⁾ Assumed one job per household, 2.8 people per household, unemployed households leave the area

⁽⁴⁾ In 2006, the Aboriginal LFP rate was 55%, compared to 73% for the non- Aboriginal population

We have assumed that job losses will therefore have a lesser effect on indigenous populations, leading to an increased proportion of indigenous people in the population, at the rate of the loss of one indigenous person for each 1.3 non-indigenous persons.

4.2 Field Work: Understanding Likely Impacts Through Responses to the Recent Drought and Other Stressors

4.2.1 Overview

Compared to a ‘long term’ or permanent reduction in water availability that may occur as a result of government policy and climate change, the recent drought represents a relatively short- or medium-term impact. Given its duration and severity, in many ways it represents a ‘real time simulation’ of what may happen if water for consumptive or productive uses is removed permanently from production, and how communities may experience the impacts and respond.

It also sheds some light on the way in which government policy and progressive deregulation of the water market is already affecting communities, the ‘winners and losers’ that may be created, and the way in which water policy is experienced and responded to in communities facing significant stress.

Moreover, an understanding of how farms, agricultural industries and the local community have responded to the ‘short to medium term’ stressor of the drought is necessary to better predict the likely impacts of ‘long term’ stressors like more permanent reductions in water availability in the context of other important issues facing communities.

4.2.2 Key Issues from Consultations

Permanent Water Reductions Under Existing Regulation and Policy Change

One of the major issues raised in consultations in both the first and second field visits to Bourke was the impacts on agriculture and the community from previous reductions of irrigations water under existing regulatory provisions, which imposed a more permanent constraint on post-drought recovery. Ongoing changes to government policy and the inability to plan in an environment of uncertainty were also of considerable concern.

The mood of the well-attended workshop hosted by Bourke Shire Council in early May 2010 on our second visit was bleak. A further reduction of 17% on the Cap had just been announced. This came on top of what irrigators and civic bodies reported as the loss of around two-thirds of irrigation water when the Cap was first implemented in 2007. This latest reduction was reported to be the tipping point for several smaller irrigators present, and further blow to larger irrigators, some of whom were already in receivership.

As one smaller citrus grower with other business operations in the town said,

This is it for me. I guess I’m in shock. We thought we’d just gotten through the drought. Things were just starting to pick up. Businesses are already putting people back on. But I can’t possibly operate with less trees –it’s just not viable

with the 17% cut on top of everything else. I really wish I hadn't just paid to fit out the shop [in town]. It's impossible to plan. We're all just exhausted.

The inability to plan with ongoing changes to government policy was a constant theme running through consultations in this part of the Barwon-Darling system in the first site visit as well. As noted by one large irrigator,

We all came to accept the Cap. It took 10 years to negotiate. We took the government's word for it that it was necessary for sustainability, though it was going to have a huge impact on business. We accepted it in exchange for certainty, which is critical in business. Until recently, the impact of the Cap has been masked by the drought, but it is going to have a huge impact on business [post-drought].

As another noted,

Before the Cap we could grow around 10-11,000 acres of cotton in a good season, maybe 7,000 acres on average. After the Cap, maybe we'll get 3,000 ha. And of course it's taken the equity out of the farm [with the loss of water]. It was estimated to be worth around \$120 million. Now we'd be looking at \$35-40 million...

Before the drought, we diversified - had a nursery, a cotton gin, diversified into horticulture. We had a school with 200 kids on the property that's now down to 17 kids... We had around 200 staff - 50 fulltime equivalents, plus seasonal workers and casuals. Now I can go into the office and I've got no-one to talk to. We made massive investments. You've got to remember that this was one of the last areas for expansion in irrigation, and there was no time to consolidate before the drought hit...

We had 4 years in 7 with no [cotton] crop. We structure our long-term business viability around an average year. Cotton has been critical to this - a full cotton crop even periodically allows us to make in-roads into debt. Now, our average year [with less permanent water] is not going to viable...

We're never going to trade our way out of this. We're here by the grace of God and the good will of the banks. The drought and the Cap have killed us, but this has been my life, and we're going to try to make sure they [the bank] get the best price possible for the business - show that we can get good returns and positive trading figures [with recent high rainfall in this part of the Basin].

We've got people ringing us all the time wanting to come back now that it's rained. We'll have no trouble attracting people back when we need to put on staff.

Asked about the impact of the most recent Cap adjustment some months later, he commented,

What can I say? You plan for one scenario and it's gone. It's just devastating. Everyone is reeling. We can calculate the risks of climate change. We can

probably even adapt. We've been adapting for years [to variable conditions]. But it's impossible to calculate or assess the risks associated with the constant change in government policy.

Considered in this context, there was a general feeling in the workshop that further reductions under administrative provisions of the forthcoming Basin Plan would be, as one participant commented, 'really too bad to contemplate'. As another noted, 'I'm not sure we can really get our heads around this right now'.

At the time of writing, the NSW Water Minister had recently announced a 12-month moratorium on the additional 17% reduction 'to allow for closer scrutiny of water usage following the two flood events' of early 2010.⁷² Bourke has again experienced further heavy rainfall in late July-early August.

A further issue frequently raised related to the impacts of the Federal government 'buyback' under Water for the Future, including the immediate and more cumulative impacts of this policy as it had been implemented in the Barwon-Darling system. Particular concerns related to the purchase of the former Toorale Station, a 91,000 ha grazing property at the junction of the Darling and Warrego Rivers with around 2,000 ha of irrigated production including sorghum, wheat, cotton and maize, where it was estimated that the purchase would return around 20 GL to the Darling system on average each year.⁷³ In particular, taking the dryland as well as irrigated uses out of production was seen to have significant social impacts on the town of Bourke and the smaller local community of Louth, in an immediate and a cumulative sense. As noted by a senior Council officer,

It's not often that a single government intervention has this magnitude of impact. The collective view of business is that it's taken 10% out of the economy straight off. Clyde agriculture [the former owners] are now putting their other properties on the market. We've heard that they are downsizing their operations and probably moving their headquarters to Sydney. This one intervention will have massive flow-on in terms of loss of families, skills, leadership, research and development investment. The removal of all the land from productive use is astonishing.

We're already struggling from the drought. We've already lost significant population and jobs. If you take out what has been a key pillar of resilience through removing even more permanent water and productive land from the economy, we're limiting our chance of recovery... We're going to go further and further down, and only the ones with no hope are going to remain.

In a town like Bourke, with a large agricultural sector buoyed in more recent years by irrigation, and very few alternatives due to low rainfall, poor soils, remoteness and

⁷² ABC National, 30 June 2010.

⁷³ Federal Government press release, 8 September 2008

existing social problems, any loss in productive capacity is very important. There's only so far an area like this can 'adjust'.

In Louth, an impromptu interview with the owners of the local hotel, who were former sheep graziers, also shed light on the impacts on a very small rural community.

We got out of farming because of the poor price of wool. Just couldn't make it work, though my husband still does contracting work. We loved Louth and wanted to stay, so when the pub licence came up 4 years ago, we bought it.

Louth is a very happy, very tightly knit community. We still have our primary school – they've agree to keep it open with just a few kids. We're getting a new family soon with 2 more kids, so we're very excited.

Commenting on the Toorale Station purchase, she noted,

The community was absolutely devastated. It took 6 adults and 13 kids out of our little community. Almost as bad, it took all the grazing and the irrigation land out of production. I'm not sure we need another national park – the one at Gundabooka has almost no infrastructure to support tourism or visitors.

A similar point was made by civic leaders and some involved in land management, with one officer noting,

This is a very complex property, with significant land management issues. It needs a big resource commitment, not just in the development phase but in the long-term to manage noxious weeds, feral animals. Government often doesn't put in sufficient resources in the long-term in my experience.

Alternative views were also heard from other stakeholders involved in environmental conservation and land management. As one National parks and Wildlife Service officer commented,

The conservation aspects of the Toorale purchase are important. The social and cultural aspects as well... We've been working with Aboriginal people on co-management of other parks that have been handed back to the traditional owners... There's a lot of consultation about what they want to see for these areas in the future.

There are benefits to Aboriginal people from the purchase of Toorale. We've now got 10 or 12 permanent staff employed there, lots of young Aboriginal people [in the construction or development phase], environmental trainees as well so there's long-term higher-level employment. And a lot of flow ons to the local community. We'll need grader drivers, fencers, catering...It's wrong to say that there won't be benefits to the community from the purchase of the station as well as to the environment.

Despite disagreement regarding the community costs and benefits of such government interventions, the critical need to maintain and increase employment opportunities for Aboriginal people was a key issue acknowledged by most local participants.

The Needs and Aspirations of Aboriginal People

One of the major concerns raised by Bourke Shire Council related to future education and employment of local Aboriginal people, seen to be ‘the real casualties of government policy’. As one senior Council officer commented,

We need to ask the Federal Government, ‘What is your vision, not just for the environment of the Murray Darling Basin, but for the people of the of the Murray Darling Basin, and specifically the Indigenous people. Most don’t want to leave the community – they’re attached to country – but sadly, people with the opportunity to leave, who’ve got a chance at other employment, leave. Whether we like it or not, the future of Indigenous people in these towns is still inextricably linked to the future of non-indigenous people. So where does that leave us when the water goes permanently? We’re all in it together. How long before we need a Northern Territory-style intervention?

Asked what mitigations may be appropriate to offset a permanent reduction in water, the officer commented,

There really is no compensation for the full effects of what we’re experiencing and what we may yet expect, depending on the Basin Plan. At the very least, we need a dollar for dollar investment by government in the social infrastructure of the community. \$24.0 million was spent on the purchase of Toorale. \$11.0 billion on Water for the Future. What about an investment of \$10.0 million for a goat abattoir that we now send away for processing. It’s a growing market, and it will take up a lot of the low skilled labour. There would also be benefits to the transport industry.

We’re not saying that there shouldn’t be environmental reform, but you can’t have environmental reform without social and economic reform, and that means an investment of dollars in a place like Bourke.

JSA also met with several Aboriginal community leaders and individuals who work closely with the Aboriginal community in the Bourke area in the areas of health, environment and justice during the first site visit. For this group, access and ownership issues related to land and water are paramount for the long-term health and wellbeing of the local Aboriginal community. In addition, the ability for Aboriginal people to work on the land and with the river is an important part of maintaining and strengthening connection to country. The group spoke about their frustration with the dominance of certain interest groups in the debate and discussion about the future of the Barwon-Darling. They feel that there should be greater engagement of Aboriginal communities in the region in decision-making, and the need for recognition of land and water rights.

Study participants talked about how the economy of Bourke has changed over the years and the population that remains,

We’ve had our farming, meatworks and railway that have all come and gone. Cotton has come and it is nearly gone. But Aboriginal people are still here because of our

connection to country. If you took all the Aboriginal people out of the town, the government wouldn't be here and you wouldn't have a town.

Creating employment opportunities for Aboriginal residents, particularly young people, was noted as the on-going goal and challenge for the community. However as one participant said,

Employment is important but it has to have a foundation to be built on. That foundation is the river and the land. We'll be the same twenty years on without a proper and equal say in what happens to it.

The group was optimistic about the possibility of increased employment opportunities for improving the catchment such as fencing projects, weed removal, re-seeding projects etc that Aboriginal people could be well suited for. Jobs that would bring people back in contact with their country and would be an investment in the future. The group acknowledged that they were uncertain how government or private industry would fund these jobs, but felt that it would be a good starting point for many in the community.

The Bourke Aboriginal Community Working Party, Outback Division of General Practice, Bourke Shire Council and a range of other organisations have been working creatively on a project to improve environmental health, sustainable water use and to foster enterprise development for the local Indigenous population through wastewater recycling. The aim of the project is to further treat and utilise the wastewater from the Bourke Sewerage Treatment Plant for local sporting fields, community green spaces, horticultural and bush food products and to rehabilitate contaminated land.⁷⁴ A key feature of the project is the training and employment of a local Aboriginal workforce, particularly an Indigenous 'green collar' workforce with contemporary skills and experience in natural resource management. With a feasibility study complete, the project is seeking further funding and commitments in order to commence.

Adapting to less water

A large local irrigator had attempted to diversify and spread risk through growing higher value crops such as fruit and vegetables. The experiment had ended in failure, because of lack of water security, the sheer size of crops to achieve economies and because of competition from other fruit and vegetable growing areas.

Drip irrigation was a disaster. The storages weren't big enough. Annual crops are OK, but big crops could flood the market depending on when the crop comes on the market. There is no room for unlimited growth.

'A Good Place to Live'

A strong theme from consultations was also that, despite Bourke's statistics 'on paper', it was a good place to live due to its strong sense of community, lifestyle and beauty of the river. This was

⁷⁴ NSW Outback Division of General Practice LTD (2008) Building a Stronger Healthier Bourke Community: Waste-water re-use feasibility report, October.

often noted as something that had attracted people to the area or ‘keeps me coming back’ (see also issues raised by Aboriginal stakeholders above).

The large service sector also attracts an ongoing turnover of young professionals to the town. A National Parks officer working in the town for several years commented that,

I love the lifestyle. To be honest, I feel far safer here than I did when I lived in Sydney. You go to the pub, and Aboriginal and non-Aboriginal people are together without distinction. I love kayaking on the River and going for a bike ride. There’s a lot of people at my stage of life... And you feel that you can really make a difference in a place like Bourke. You can offer something. Right now, it’s a great place to be.

Whilst an older work force is often viewed as a negative aspect of communities like Bourke in terms of limited succession planning for farming and local businesses, positive aspects of this were also reported in consultations where a number of recent older arrivals to towns like Bourke commented that it was ‘far easier for someone my age to get a job in a town like this’, that it was a ‘positive place to buy a business – we could afford to buy in here and build things up’. Others noted that, ‘I’ve come here [after having a career at a senior level] to give something back to a community that needs help’.

The level of commitment expressed by more mature workers who had made a conscious choice to come to Bourke was impressive. As a mature-age teacher who had recently arrived in Bourke commented,

To be honest, Bourke High School has got a bad name [in NSW ranking of schools], but it’s a much better place to work than where I was previously [in a regional school near the coast]. The kids aren’t nasty. There are social problems, but the kids are quite responsive to people who are genuinely there to help. When I came here [at the beginning of 2010], I thought I’d just do my 2 or 3 years and get out. Now I feel like I’d like to see a whole class go through from Year 7 to 12 – I feel like I want to make that commitment’.

A local tourism operator, enthusiastically promoting Bourke, also highlighted its attractions.

We’ve probably doubled our visitations in the past few years as more people hear about the how beautiful it is on this part of the River...Lots of people driving the [Darling] River Run. We’ll have more visitors after the rain. The name of ‘Bourke’ has an iconic status. I’ve lived away, but I always come back. Things have been bad, but you can’t kill Bourke. It’s part of the national psyche.

Whilst the experiences in a town like Bourke are likely to be quite variable, it was difficult to find anyone who did not have an attachment to the area among those who participated in consultations. It was noted quite often that this was not necessarily the view that was represented in the press nor of some visiting officials. As one civic leader commented,

I’ve heard [government officers] from Canberra say, ‘We know Bourke’s dying anyway. The Cap is just doing you a favour’. That’s insulting to the people who live here. It takes no account of how resilient the area has been...

There's a danger of the doom and gloom of statistics. We've got to be realistic about the issues this community is facing, especially Aboriginal people who are really at risk, but it's too easy to write an area like this off... Things are already bouncing back after the drought. We're not finished yet.

Appendix 3

Campaspe Case Study



Report 4: Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Social and economic impacts of reduced irrigation water

July 2010

This report has been prepared for



Cotton Catchment Communities **CRC**

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1. Key Findings

1.1. Background

The primary driver for long-term reductions in water availability for irrigation communities in the Murray Darling Basin will be government policy, including the purchase of water entitlements under *Water for the Future* and the setting of new Sustainable Diversion Limits under the forthcoming *Basin Plan*. Climate change is also projected to have an impact on reduced water availability by 2030. Whilst there are likely to be benefits from increased water for the environment, reduced water for irrigation will result in a range of social and economic impacts on agriculturally dependant communities across the Basin. It is important in this regard to distinguish between short-term stressors such as rainfall variation and fluctuating commodities prices, to which agricultural communities have been adapting over many years, and more permanent impacts from a long-term policy-driven and climatic reduction of water for consumptive uses.

In the face of possible permanent reductions in water availability and the associated impacts, this part of the study aims to answer the question, ‘how resilient are communities likely to be to change?’ A number of factors were found to predict changes in indicators of wellbeing and resilience in earlier stages of this study¹ including changes in employment and population. Our findings for the MDB were generally in line with other research on rural and regional communities, with key indicators that predict wellbeing and resilience including degree of remoteness, degree of urbanisation (population size), proportion of Indigenous people particularly remote populations, and age of the population.² Degree of economic diversity and opportunities to diversify were also relevant factors identified in the literature,³ though our findings indicate that these factors are largely a function of other more endogenous factors like remoteness, proximity to a large urban centre or to other economic resources like extractive industries. Though things like community leadership and collaborative initiatives are important, it can be difficult for communities to respond to major stressors where they have characteristics that work against their ability to adapt to change.

To explore the likely social and economic impacts and degree of resilience to more permanent changes in water at different geographic scales, JSA has researched eight case studies across the Murray Darling Basin in different types of irrigated agricultural communities. The eight case study areas are Dalby-Wambo, Queensland; Balonne, Queensland; Moree Plains, NSW; Bourke,

¹ JSA (2010) Report 2: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Understanding Agricultural Employment*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri; and JSA (2010) Report 3: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Irrigated Agriculture and Socio-Economic Indicators*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri

² JSA (2010) Report 2: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Understanding Agricultural Employment d*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri; and JSA (2010) Report 3: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Irrigated Agriculture and Socio-Economic Indicators*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri

³ JSA (2010) Report 1: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Scoping Paper*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri

NSW; Griffith, NSW; Campaspe, Victoria; Mildura, Victoria; and Murray Bridge, South Australia. These are augmented by an overview of the regional context, or of smaller communities within these areas, to illustrate some of the impacts that are likely at different scales.

This report presents the findings of the Campaspe, Victoria case study. The key findings from the study, particularly the area's current status against a range of wellbeing and resilience indicators is presented first, and is followed by a detailed discussion of quantitative and qualitative findings from the research. It is important to note that, although we have only been able to focus on eight areas, it is hoped that the case studies will provide information for communities within the Basin facing similar challenges, and draw out the characteristics that are likely to mitigate or exacerbate the impacts of permanent reductions in irrigation water.

1.2. How Resilient is Campaspe LGA Likely to be to Permanent Reductions in Water?

1.2.1. Overview of Findings

The Campaspe case study area has a number of positive attributes and indicators of community wellbeing and resilience such as its proximity to large regional and urban centres, location on the river and associated amenity values which make it attractive as a 'tree change' location, and positive outcomes for some health, education and employment indicators. As we learned through consultation, there are also many support services and programs through the Victorian Department of Primary Industries, Centrelink and other organisations that are working to assist farmers with adverse individual, family and social impacts that they have experienced in recent years due to the combination of drought and market shocks within the dairy industry.

Despite these positive attributes that are likely to assist some individuals and the community to be more resilient in the face of change, there are other attributes about the area that indicate vulnerabilities. These potential vulnerabilities include its moderate population size, its reliance on agriculture and related industries, its location outside a major transport route unlike other nearby large centres (such as Shepparton) that are more likely to be able to diversify into other industries, the older age profile of the population and its future requirements, and that population growth in Echuca is due to decline in the hinterland. As a result of these potential vulnerabilities, impacts of reduced water availability for irrigation are likely to be more significantly felt in the smaller and more agriculturally dependent towns within the LGA. These areas are more likely to have experienced adverse impacts, including employment and population loss, due to the drought and downturn of the dairy industry in recent years. The extent to which the opportunities available in Echuca are able to off-set the declines and losses in the smaller towns throughout the LGA, not to mention replace opportunities for those who cease farming, is uncertain. However, the high degree of dependence on agriculture and related activities as well as the relatively limited opportunities for industry diversification apparent from the current employment profile, indicate that this is area that would be vulnerable to such changes.

1.2.2. Campaspe LGA's Resilience 'Report Card'

The following provides an overview of key factors that have led to this assessment of how resilient Campaspe is likely to be in the face of further permanent reductions in water availability. Key factors are reviewed as a 'report card' on resilience, and include:

- Projected changes in employment, population, and indicators of community wellbeing modelled for 10%, 25% and 50% cuts in irrigation water on the 2005/06 growing season;
- Degree of reliance upon agriculture and in particular irrigated agriculture and related industries;
- Factors that have a statistically significant relationship to wellbeing and resilience;
- The current status of Campaspe in terms of existing socio-economic indicators; and
- Factors which are likely to mitigate or worsen projected impacts identified during field research.

Each of these is looked at in turn below. This is followed by detailed data and information from desktop analysis and fieldwork undertaken by JSA from January to May 2010.

Population and Employment Impacts Forecast

The 'long term' impacts of reduced water availability on Campaspe LGA are likely to be significant, particularly with regard to employment and population change. This is because irrigated agriculture forms a large proportion of both agricultural industries and the total economy of the area.

The primary effect will be a loss of employment, ranging from at least a 2.2% loss (339 jobs) predicted from a 10% reduction in water availability, 5.4% loss (847 jobs) predicted from a 25% reduction in water availability, to a 10.9% loss (1694 jobs) predicted from a 50% reduction in water availability, including direct and indirect employment in agriculture and multipliers. Given the job loss experienced during the recent drought (prior to 2005/2006) and the fact that irrigated agriculture is anecdotally stated to have higher multipliers than the average for agriculture, and the likelihood that some agricultural jobs have not been identified in our analysis, this is almost certainly an underestimate. Subsequent population loss is estimated as at least a 2.6% loss (949 people) predicted from a 10% reduction in water availability, a 6.6% loss (2,372 people) predicted from a 25% reduction in water availability, to at least a 13.1% loss (4,744 people) predicted from a 50% reduction in water availability.

Predicted Changes in Indicators of Wellbeing and Resilience

Modelling of impacts on indicators of community wellbeing and resilience for Campaspe from reduced water availability also indicates impacts on such indicators will accompany employment and population loss. Notable changes⁴ are projected to be an increase in youth unemployment and a decrease in Assault and Property Crime associated with loss of population.

⁴ More than 5% change

Factors Affecting Wellbeing and Resilience

Campaspe LGA has a number of positive indicators of wellbeing and resilience including its proximity to larger urban centres such as Bendigo and Melbourne, size, and low level of Indigenous residents suggest that it is likely to experience less adverse impacts on indicators of wellbeing than some areas with populations that are more remote and perhaps residualised. However, its population size has not reached the critical mass of a large regional centre⁵ that makes it independent of the fortunes of its agricultural base, and its employment remains reliant on irrigated agriculture and associated industries, particularly dairy. Reduced capability, output and employment in these industries will likely have an impact on total employment, population and resilience due to this reliance. The following table provides an overview of the key factors for the Campaspe case study area, and are discussed in more detail in the body of the case study report.

Table 1.1: Key Factors in Community Resilience

Statistically Significant Factors	Likely to be Resilient	Comment
Remoteness	√	Much less remote than MDB average with 'Regional Centre' ABS status
Degree of Urbanisation:	√ ?	Campaspe LGA at 36,000 residents has not reached a 'critical mass' of 50,000, but is reported to be getting larger retail stores that would previously have attracted people to Bendigo and Shepparton. However, it would probably not want to lose population at this stage.
• Population Size		
• Proximity to a large regional centre	√	Reasonable proximity to Melbourne and Bendigo so advantage for 'tree change' and tourism.
Indigenous Population	√	Much lower than MDB average, lowest of the case study areas.
Age	X ?	Equal to MDB average but much older than Australia, and oldest of case study areas. Older farmers and smaller rural communities, as well as reported 'tree change' relocation to area. Issues of succession planning and future workforce.
% of employment by industry compared with Australian benchmark	X	Lower than MDB and national averages for economic diversity. Remains highly reliant on agriculture and related industries. Decline in agriculture would need to be offset by new or expanded industries. Tourism is perceived to be strong but employment in key sectors such as accommodation, food and recreation are average or below average. Therefore, visitation does not necessarily seem to be translating into jobs.

⁵ JSA (2010) Report 3: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Irrigated Agriculture and Socio-Economic Indicators*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri.

Current Status on Community Resilience Indicators

The current status of Campaspe LGA regarding key socio-economic indicators is necessary to understand its resilience or vulnerability to changes in employment related to reduced water availability. The following provides a 'report card' on the extent to which the current status of Campaspe LGA compares with the MDB and National benchmarks. Findings show a community that has prospered from its agricultural base and likely proximity to other centres in terms of lower levels of disadvantage, low unemployment rates and higher school participation rates. The older age profile of the community is likely related to its performance against health and disability indicators, which likely signifies the influx of retirees to the area as well as the ageing of the existing population.

Table 1.2: Current Status Report on Indicators of Community Resilience

Proxy Indicator of Resilience	Likely to be Resilient	Comment
Community Wellbeing:		
SEIFA Disadvantage	√	Less disadvantaged than MDB average, though more disadvantaged than Australia. Became more disadvantaged since 2001, though this likely related to an ageing population.
SEIFA Economic Resources	√	Higher value than the MDB average, and lower than Australia. Residents have greater access to economic resources than MDB, which indicates higher incomes and higher level of home ownership than lower incomes and low rents.
Median Household Income	√	At \$791 per week, its median household income is much lower than Australia (\$1027) but higher than MDB average of areas (\$779).
Social Capital:		
Volunteering rate	√	Just above MDB average, and much higher than Australia.
Disability Support Pension	√?	On par with MDB but higher than Australia. Likely related to older population.
Premature Death	√	Lower than MDB but higher than Australia.
Profound or severe disability	X	Higher than MDB and Australia. Likely related to older population.
Chronic Ill Health	√?	Equal to MBD average but higher than Australia, again likely related to older population.
Economic Growth:		
Change in Total Employment 2001-06	√	At 3.9%, three times the MDB average but only one-third of national growth. However, reported to be job losses since 2006 arising from closure of a number of enterprises and downturn in dairy.
Labour force participation 15+ years	X	Slightly lower than MDB and Australia. Possible early retirement, but also note higher school retention rate.

Proxy Indicator of Resilience	Likely to be Resilient	Comment
Labour force participation 65+ years	√	Much lower than MDB average and low for a rural area. Likely influenced by early retirement, with farmers likely to be older – as demonstrated by age profile of the Lockington hinterland.
Post-school qualification (skills base)	√?	On par with MDB but much lower than Australia. Highest of the case study areas.
School participation at 16 years	√	Much higher than MDB average and higher than Australia. Reported that may be related to few entry-level jobs in agriculture and related industries and encouragement to stay at school.
SEIFA Index of Education and Occupation (brings together relevant Census variables on the general level of education and occupation-related skills of people within an area)	X	Well below MDB average and much lower than Australia. Reflects overall human capital resources, the nature of employment and possibly an ageing population.
GINI co-efficient of household income distribution/polarisation	X	Like other areas of the MDB, the Campaspe shows quite a high level of polarisation between the 'haves' and 'have nots' based on household income.
Youth unemployment rate	√	Lower than MDB and Australian averages, may also reflect higher school retention rate. Perception that this may have worsened with reduced agricultural production since 2006.
General unemployment rate	√	Lower than average, but perception that this may have worsened with reduced agricultural production since 2006.
Amenity:		
Population Growth /Retention	√	Reasonable population growth at double the MDB average but only half the national rate. ⁶ Population growth of Echuca likely to be coming equally from small towns and hinterland within LGA and from outside the LGA. Some smaller towns and villages likely to be more vulnerable to reduced water and resultant population loss than Echuca.
In-migration	√?	Same as MDB average. Likely equally due to 'tree changers' arriving from outside LGA, and also from those Campaspe residents moving into Echuca from the hinterland and smaller towns.

⁶ Note that there is a discrepancy between population change for Campaspe LGA between the two ABS measurements by 'place of usual residence' and 'place of enumeration'; this is discussed further at section 3.4.3.

Other factors that indicate vulnerability or resilience from consultation

Fieldwork and other consultations have provided valuable insights into other aspects of current and future vulnerability or resilience, as well as other factors that are likely to mitigate or worsen projected impacts. See **Section 5** for a detailed discussion of fieldwork findings.

Agriculture and communities in the Campaspe area have shown resilience and adaptability in the past. The population of Echuca and the LGA has grown steadily over the years, and during the recent period of drought. A range of on-farm and system-wide gains in irrigation efficiency have been made, and are currently being undertaken across the Goulburn-Murray irrigation system. However, the combination of low water allocations and a dramatic drop in the milk price in 2008 has been a devastating blow to the dairy industry and communities in the region. The number of dairy farms that have gone out of production has spiked compared to average rates of closure in a number of recent seasons, with these losses hitting some families and communities hard. As one study participant said, *“We can live with low water or with low commodities prices, but we can’t live with both.”*

The ability to make further efficiency gains and the nature of future water trade will to some extent determine how resilient the area is to more permanent loss of water through permanent out of area trade, reductions in SDLs and/or climate change. Smaller and more agriculturally dependent communities within the LGA and in the region are likely to be far more exposed than perhaps Echuca.

Table 1.3: Other factors of vulnerability and resilience relevant to Campaspe

Factor	Resilient?	Comment
Nature of ‘next best’ land use with reduced water	X?	Next best use without water has so far been to continue dairying, but buying in feed rather than irrigating feed on-farm. This scenario could continue as long as the feed costs remain economical. Horticulture (e.g. tomatoes) could expand or contract, depending on input costs of water and market.
Potential benefits of water trade	√?	Since trading was introduced through the 2005-2006 season, the Rochester-Campaspe and Central-Goulburn irrigation areas have consistently been net importers of annual allocations through temporary trading. There was significant permanent trading out of Rochester, while temporary trading into the area has off-set this loss in terms of available water in the district. Likely to continue to be an area active in trading both in and out, though cuts to entitlements will limit the amount of water available to be traded.
Ability to ‘recover’ from drought	√?	Likely that areas out of production could come back with improved rainfall and allocations, and the right market conditions. Permanent reductions in irrigation water will reduce this capacity. Some further consolidation likely depending on adjustments in land values, commodities prices and resolution of water uncertainty which could change use or bring land back into production.

Factor	Resilient?	Comment
		Council and State Government planning policy does not favour further fragmentation of agricultural land for rural residential or subdivision. Some critical decision points in next 12 months may see some industry leaders leave the area, there are concerns that the 'face' of agriculture could look different.
Ability to make efficiency gains	?	On-farm and system-wide efficiency gains have been, or are currently being made. Improved metering and monitoring has improved flow management. Study participants indicated that will be 'a lot harder' to gain further on-farm efficiencies, and will require capital investment. It will also 'depend on commodity prices and how seasons treat us' as to whether further investment is made. Such capital investments are less likely if farms are less profitable with reduced entitlements, and a climate of uncertainty. Federal infrastructure program may not necessarily translate into audited water savings for irrigators, but rather improve supply for cities which is controversial for regional communities.
Access to Other Economic Opportunities	X?	Larger retail outlets reported to be in the planning stage for Echuca, and such opportunities may increase if area continues to grow. Opportunities in residential construction, but skills shortage in trades is reported. Other opportunities for industry diversification appear to be more limited compared with other nearby regional centres such as Shepparton and Bendigo, which are better located regarding major transport routes. Closure of a number of dairy related enterprises in some of the smaller towns within the LGA in last few years noted.
Natural attributes	√	Echuca-Moama has a high level of amenity related to the junction of the Campaspe and Murray Rivers, and the preservation of its heritage precincts and assets (e.g. Paddle steamers). Its close proximity to Melbourne facilitates both tourism and 'lifestyle' relocation.
Leadership	?	Study participants indicated that local civic leaders may not be as proactive in understanding the potential impacts of reduced water availability, and in actively seeking diverse new industry opportunities. There was some concern regarding complacency regarding the importance of communication, co-ordination and planning for change. Concerns regarding loss of the 'good operators' as community leaders with recent stress, rapid change, and uncertainty about future allocations – 'When the ones everyone looks up to lose confidence, what happens to the rest?'
Other factors in future resilience from consultations	√	Well integrated irrigation system that facilitates ability to trade. Significant public investment in system-wide efficiency upgrades that are hoped to benefit irrigators in the long term.
Other factors in future	X	Small towns that are reliant on dairy and agriculture are

Factor	Resilient?	Comment
vulnerability from consultations		particularly vulnerable to permanent reductions in water availability. Regional impacts will be experienced by Campaspe LGA due to value-adding processing and related industries, particularly where produce and products are sourced from areas affected by reduction in irrigation water.

2. Introduction

2.1. Overview

In June 2009, Judith Stubbs and Associates (JSA) were engaged by the Cotton Catchment Communities Co-operative Research Centre to undertake a significant research project investigating wellbeing and resilience of communities, particularly those engaged in irrigated agriculture including cotton, within the MDB. The study seeks to understand the likely social and economic impacts on communities at different scales arising from changes in government water policy, in particular, *Water for the Future* and the forthcoming *Basin Plan*, and projected climate change. This project included three research strategies and has so far produced three reports.⁷

2.2. Rationale

Given findings from the literature and the first three reports of this study, it is likely that the social and economic impacts related to changes in water availability will be experienced differently at different geographic scales (eg. farm, local community, region, MDB, national), and by different groups within a community (e.g. farmers, Aboriginal people, businesses). Key factors will include the existing wellbeing and resilience of these communities, and other mitigating factors such as access to the water market and alternative economic opportunities.

In order to understand the differential impacts upon areas and groups, we have carried out a cost-benefit analysis to determine impacts at the MDB and national levels and prepared eight case studies to explore the likely impacts at the farm, regional and local community levels. These documents comprise the fourth and final report for this study.

The eight case study areas were selected in order to represent different states, different CSIRO Sustainable Yields Regions, cotton and non-cotton producing areas, a diversity of irrigated agricultural uses and diversity across three key attributes including population size, remoteness and Indigenous population. The eight case study areas include Dalby-Wambo, Queensland; Balonne, Queensland; Moree Plains, NSW; Bourke, NSW; Griffith, NSW; Campaspe, Victoria; Mildura, Victoria; and Murray Bridge, South Australia.

2.3. Case study methodology

This case study is informed by JSA's extensive analysis of agriculture and population data; a review of policy, relevant document and reports; and a series of telephone and face-to-face interviews with individuals from a range of perspectives and organisations.

⁷ JSA (2010) Report 1: Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Scoping Paper, JSA (2010) Report 2: Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Understanding Agricultural Employment, and JSA (2010) Report 3: Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Irrigated Agriculture and Socio-Economic Indicators.

Interviews, workshops and field visits to the Campaspe area were conducted from February to May 2010 in order to understand how water availability, agricultural land use and agricultural employment has changed in recent years as a result of government policy and short term climatic change (eg, the recent drought); how these changes resulted in social and economic impacts at the farm and wider community levels; and therefore how more permanent reductions in water availability (eg, new SDLs through the MDBA Basin Plan) are likely to affect wellbeing and resilience at the farm and community level.⁸

2.4. Case study content overview

This case study provides:

- A description of the case study area including its location, land and water use, water policy, and relative social and economic wellbeing and resilience against key indicators;
- A prediction of impacts to community wellbeing and resilience based on hypothetical reductions in water availability of 10%, 25% and 50% from the most recent year for which comparative agricultural and population data is available (the 2005/06 growing year and 2006 Census);
- An exploration of the 'short term' social and economic impacts that have been experienced as a result of the recent drought, fluctuations in commodities prices, water market and other relevant factors affecting communities; and
- An analysis of how the attributes of the area and other factors have exacerbated and/or helped to mitigate the impacts already experienced as an indicator of the area's resilience, and how it may therefore respond to more permanent changes in water availability under the forthcoming Basin Plan or permanent trade out of area.

⁸ Participants included Campaspe Shire Council; Cedenco Foods regarding tomato production across the region; Centrelink - Rural and Climate Change Branch – Echuca; North Central Catchment Management Association, Victorian Department of Planning and Community Development, Loddon Mallee; Victorian Department of Primary Industries, Farm Services, Dairy Team; Irrigated cereal grower (feed for dairying) in the Goulburn-Broken catchment; Dairy farmer in the Goulburn-Broken catchment; Victoria Farmers Federation; and Lockington Business Centre volunteers.

3. Description of case study area

3.1. Location

The Campaspe Victoria case study area, in the southern basin, is bordered to the north by the Murray River and the Goulburn River to the north-east with the Campaspe River flowing north towards the Murray River through the heart of the area.



Figure 3.1: Campaspe River at Echuca, Victoria

Source: JSA, March 2010

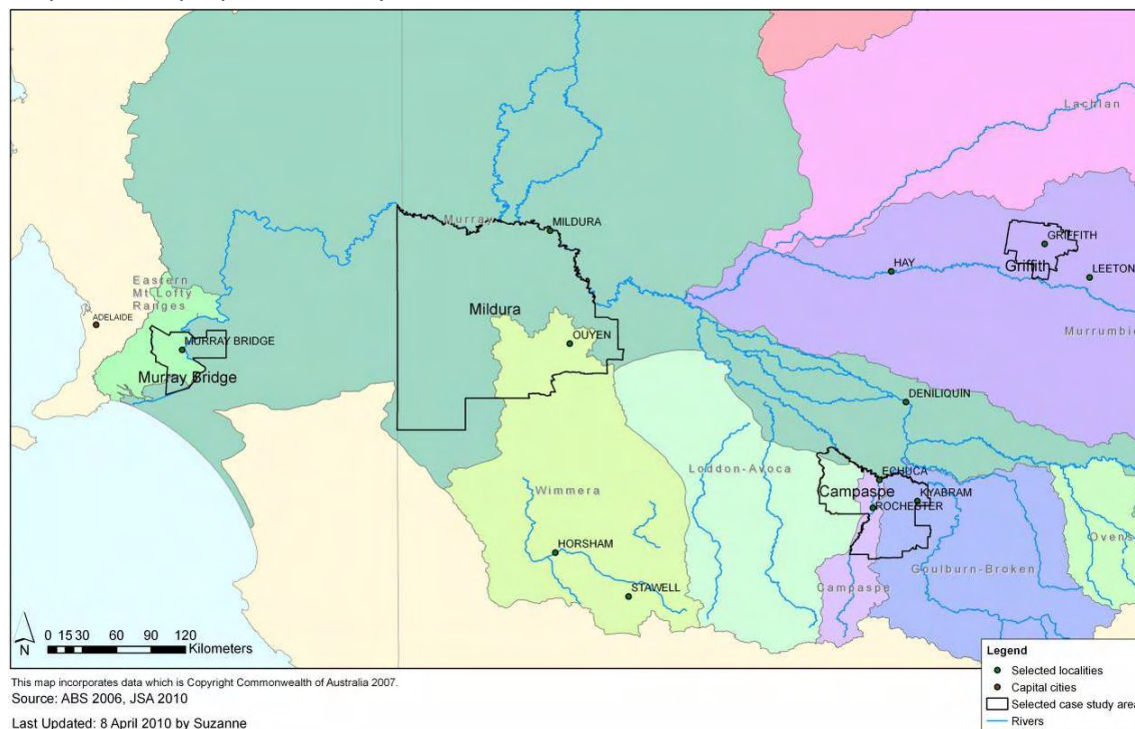
The twin towns of Echuca in the Campaspe Shire, Victoria and Moama in the Murray Shire, NSW straddle the Murray River and form the primary population centre for the area. Echuca is known as the ‘Paddlesteamer capital of Australia’ and is the closest town on the Murray River to Melbourne. Other service centres within the Campaspe Shire include Kyabram, Rochester, Rushworth and Tongala.



Figure 3.2: Paddlesteamers on Murray River at Port of Echuca, Victoria

Source: JSA, March 2010

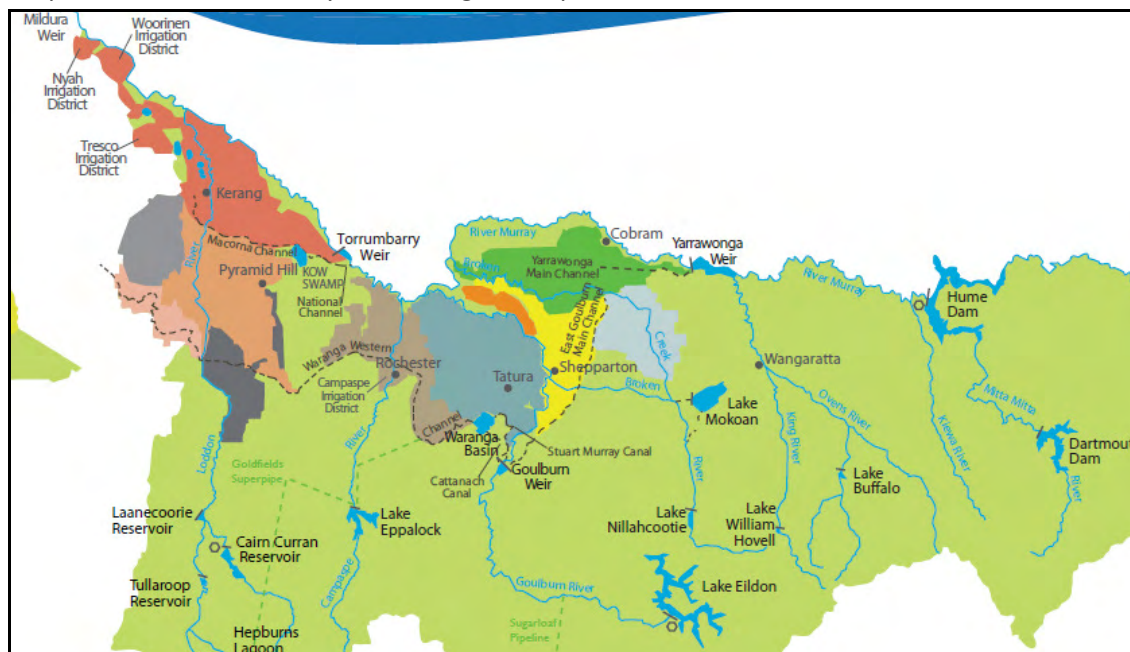
Map 3.1: Campaspe Case Study Area



3.1.1. Goulburn-Murray Water Region

Goulburn-Murray Water services the Rochester-Campaspe and the Central Goulburn irrigation areas in the Campaspe case study area, as shown in the brown and grey/blue coloured areas in the image below.

Map 3.2: Goulburn-Murray Water Region Map



Source: Goulburn-Murray Water, 2010

Central Goulburn Irrigation Area

Goulburn-Murray Water services more than 2,800 irrigated holdings in the Central Goulburn Irrigation Area which covers 173,053 hectares (113,106 hectares irrigated) through an extensive network of distribution channels (1,460 km) and drains (882 km). The irrigation area extends south and westwards from the Goulburn River and includes the towns of Kyabram, Stanhope and Tongala within the Campaspe case study area. 'Water Right' in the area equals 385,000 megalitres, and is supplied mainly from the primary storage at Lake Eildon.⁹

Rochester-Campaspe Irrigation Area

The Rochester-Campaspe Irrigation Area was developed in 1964 after the storage at Lake Eppalock was completed. Original land holdings were around 40 hectares with 160 megalitres of water entitlement.¹⁰ Goulburn-Murray Water services 1,290 customers in the Rochester-Campaspe Irrigation Areas via 664 km of distribution channels and 476 km of drains. The primary sources of supply for the system are Lake Eildon and Lake Eppalock, with supplementary supplies from Greens Lake. The total area is 117,050 hectares with 66,710

⁹ Goulburn-Murray Water website, www.g-mwater.com.au/water-resources/surface-water/irrigationareas/centralgoulburn, accessed 23 March 2010.

¹⁰ Frontier Economics et al (2007) The Economic and Social Impacts of Water Trading: Case Studies in the Victorian Murray Valley, Case Study C. Report for the Rural Industries Research and Development Corporation, National Water Commission and Murray-Darling Basin Commission.

hectares of irrigated area. ‘Water Right’¹¹ in the areas is 207,598 ML.¹² Water supply to the Rochester-Campaspe Irrigation Areas is supplemented by both the Goulburn River system and the Campaspe River.

3.2. Water and Land Use Context

The Campaspe case study area covers a diverse landscape. The Murray River forms the area’s north-western border, the Goulburn River forms its north-eastern border and the Campaspe River flows in a northerly direction towards the Murray River through the heart of the area. Primary agricultural enterprises in the area include dairying, horticulture such as tomatoes, and mixed farming including summer cropping, sheep and cattle grazing. The Campaspe case study area falls within parts of four CSIRO Sustainable Yield Regions including the Campaspe, Goulburn-Broken, Loddon-Avoca and Murray.



Figure 3.3: Murray River at Moama NSW

Source: JSA, March 2010

3.2.1. CSIRO Sustainable Yield Regions and Projections

In 2008, the CSIRO completed a series of reports through the Sustainable Yields Project which assessed the current and future water availability in the MDB in terms of catchment development, changing groundwater extraction, climate variability and climate change.¹³ The project is based on 18 regions or catchments that comprise the MDB. For the purposes of this case study we will look at the CSIRO findings and predictions for the Campaspe, Loddon-Avoca and Goulburn-Broken Sustainable Yield Regions (SYR).

¹¹ Goulburn-Murray Water still uses the term ‘water right’ in its information. According to the Northern Region Sustainable Water Strategy (2009) ‘water rights’ are previously rights to water held by irrigators. As a result of unbundling, these have now been separated into a water share, delivery share and water use license, pg 202.

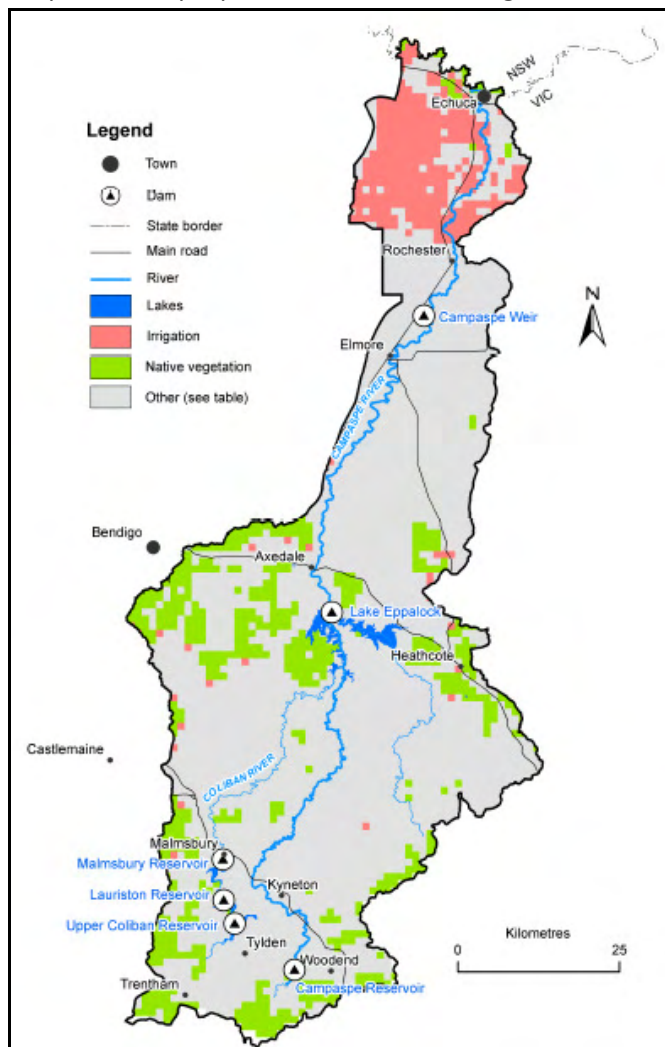
¹² Goulburn-Murray Water website, www.g-mwater.com.au/water-resources/surface-water/irrigationareas/rochestercampaspe, accessed 17 March 2010.

¹³ For more information on the CSIRO Murray-Darling Basin Sustainable Yields Project, see <http://www.csiro.au/partnerships/MDBSY.html>

Campaspe Sustainable Yield Region

The Campaspe SYR extends for 150km from the Great Dividing Range in the South to the Murray River. Lake Eppalock is the region's major water storage with a capacity of 312,000 ML, and was developed to secure water for the Rochester-Campaspe Irrigation Area.¹⁴ Goulburn-Murray Water is the water storage operator, bulk entitlement holder and distributor of rural water for the Campaspe SYR. Coliban Water and Goulburn Valley Water are also bulk entitlement holders and the regional urban water suppliers for the region. The following map shows the CSIRO Campaspe Sustainable Yield Region.

Map 3.3: Campaspe Sustainable Yield Region



Source: CSIRO (2008) Murray Darling Basin Sustainable Yields Project

¹⁴ North Central Catchment Management Authority (2009) Environmental Watering Plan for the Campaspe River Downstream of Lake Eppalock, pg 5.

The Campaspe SYR covers 0.4% of MDB land area, utilises 0.2% of surface water diverted for irrigation in the MDB and 1.7% of all groundwater used in the MDB. Major towns within the Campaspe SYR include Echuca, Rochester, Elmore and Kyneton. There are no internationally or nationally significant wetlands within the Campaspe SYR.¹⁵ The region generates approximately 0.9% of total runoff in the MDB. Based on the historical climate (1895-2006), 36% of available surface water (275 GL/yr) is used under current development.¹⁶ In addition to surface water generated from runoff in the region, additional transfers from the Goulburn-Broken region via the Waranga Western Channel also support use. On average 264 GL/yr pass through the Campaspe region to the Loddon-Avoca from the Goulburn-Broken, although this use is accounted for at the point of diversion and not at the point of use.¹⁷ Groundwater represents approximately 9% of total water use (29 GL/yr), 88% of which in 04/05 came from the Campaspe Deep Lead Groundwater Management Unit.

Campaspe CSIRO SYR 2030 Climate Change Projections

Under the CSIRO's best estimate 2030 climate, runoff is projected to reduce by 16%. As a result average surface water availability would reduce by 16%, end-of-system flows at Echuca would decrease by 27%, diversions would reduce by 5% and transfers via the Waranga Western Channel would reduce by 5%, whilst relative surface water use would increase by 42%. Likely future development of farm dams and groundwater extractions are projected to have minimal impacts on stream flow and surface water use.¹⁸

Goulburn-Broken Sustainable Yield Region

The Goulburn-Broken SYR covers 2.1% of MDB land area, utilises 14% of surface water diverted for irrigation in the MDB and 5.4% of all groundwater used in the MDB. The Goulburn and Broken Rivers are the focus of this SYR; major towns include Shepparton Nagambie, Benalla, Kyabram and Tatura. There are two nationally significant wetlands in the region (lower Goulburn River and floodplain downstream of Loch Garry), and flows from the area influence the Ramsar listed wetlands on the Murray River of the Barmah-Millewa and Gunbower Forests.¹⁹ The region generates approximately 11% of total runoff in the MDB. Based on the historical climate (1895-2006), 50% of available surface water (1606 GL/yr) is used under current development.²⁰ Groundwater represents approximately 10% of total water use (92 GL/yr), 87% of which in 04/05 came from the Shepparton Groundwater Management Unit.

¹⁵ CSIRO (2008) Water Availability in the Campaspe, Summary of a report to the Australian Government from the CSIRO MDB Sustainable Yields Project, pg 11.

¹⁶ CSIRO (2008) Water Availability in the Campaspe, Summary of a report to the Australian Government from the CSIRO MDB Sustainable Yields Project.

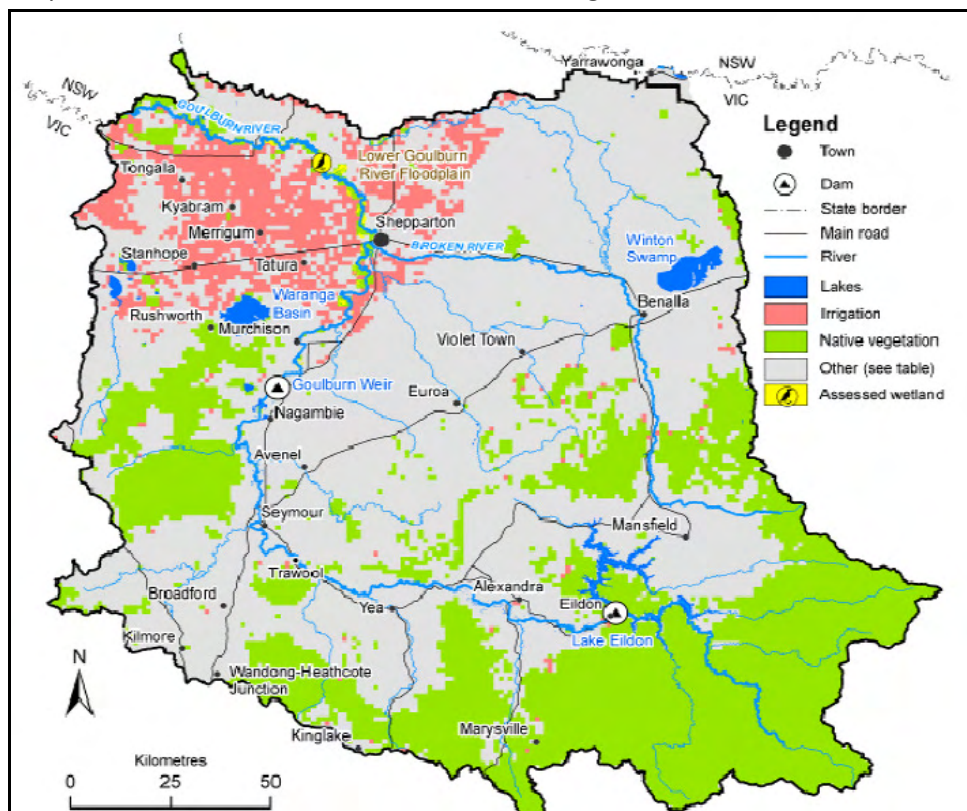
¹⁷ CSIRO (2008) Water Availability in the Campaspe, Summary of a report to the Australian Government from the CSIRO MDB Sustainable Yields Project.

¹⁸ CSIRO (2008) Water Availability in the Campaspe, Summary of a report to the Australian Government from the CSIRO MDB Sustainable Yields Project.

¹⁹ CSIRO (2008) Water Availability in the Goulburn-Broken, Summary of a report to the Australian Government from the CSIRO MDB Sustainable Yields Project, pg 11.

²⁰ CSIRO (2008) Water Availability in the Goulburn-Broken, Summary of a report to the Australian Government from the CSIRO MDB Sustainable Yields Project.

Map 3.4: Goulburn-Broken Sustainable Yield Region



Source: CSIRO (2008) Murray Darling Basin Sustainable Yields Project

Goulburn-Broken CSIRO SYR 2030 Climate Change Projections

Under the CSIRO's best estimate 2030 climate, runoff is projected to reduce by 13%. As a result average surface water availability would reduce by 14%, end-of-system flows would decrease by 22%, diversions would reduce by 5% and transfers via the Waranga Western Channel would reduce by 5%, whilst relative surface water use would increase by 54%. Likely future development of farm dams and groundwater extractions are projected to have minimal impacts on stream flow and surface water use.²¹

Loddon-Avoca Sustainable Yield Region

The Loddon-Avoca SYR covers 2.3% of MDB land area, utilises 0.8% of surface water diverted for irrigation in the MDB and 1.7% of all groundwater used in the MDB. Major towns within the Loddon-Avoca SYR include Bendigo, St Arnaud, Charlton and Boort. This SYR is focused on the Loddon and Avoca Rivers. The Kerang Wetlands is an internationally significant and

²¹ CSIRO (2008) Water Availability in the Goulburn-Broken, Summary of a report to the Australian Government from the CSIRO MDB Sustainable Yields Project.

Ramsar listed site.²² The region generates approximately 1.7% of total runoff in the MDB. Based on the historical climate (1895-2006), 32% of available surface water (285 GL/yr) is used under current development.²³ Groundwater represents approximately 9% of total water use (29 GL/yr), 64% of which in 04/05 came from the Mid-Loddon Groundwater Management Unit.

Loddon-Avoca CSIRO SYR 2030 Climate Change Projections

Under the CSIRO's best estimate 2030 climate, runoff is projected to reduce by 16%. As a result average surface water availability would reduce by 18%, end-of-system flows would decrease by 27%, diversions would reduce by 6% and transfers from the Waranga Western Channel would reduce by 4%, whilst relative surface water use would increase by 35%. Likely future development of farm dams and groundwater extractions to 2030 are projected to have minor to minimal impacts on stream flow and surface water use.²⁴

3.2.2. Water and land use in the case study area for a model year

We have used 2005/2006 as a model year for our analysis of social and economic indicators and agricultural land and water uses, and our predictive modelling of likely long term impacts of reductions in water availability due to the availability of census data by small area.

According to the ABS, in 2005/2006 443,646 megalitres of water were applied to irrigated crops and pastures in the Campaspe case study area. The table below shows the proportion of total irrigation volume applied in the area by each type of crop or pasture. Pasture for grazing was the dominant use of irrigation at 81.3%, followed by pasture for hay and silage at 12% and vegetables for human consumption at 2.5%.

Table 3.1: Irrigation water applied to crops and pastures in Campaspe LGA, 2005/2006

Pastures and Crops Irrigated	Irrigation volume applied (Megalitres)	% of irrigation volume applied
Pasture for grazing	360,836	81.3%
Pasture for seed production	214	0.1%
Pasture for hay and silage	52,609	11.9%
Cereal crops cut for hay	4,437	1.0%
Cereal crops for grain or seed	4,447	1.0%

²² CSIRO (2008) Water Availability in the Loddon-Avoca, Summary of a report to the Australian Government from the CSIRO MDB Sustainable Yields Project.

²³ CSIRO (2008) Water Availability in the Loddon-Avoca, Summary of a report to the Australian Government from the CSIRO MDB Sustainable Yields Project.

²⁴ CSIRO (2008) Water Availability in the Loddon-Avoca, Summary of a report to the Australian Government from the CSIRO MDB Sustainable Yields Project.

Pastures and Crops Irrigated	Irrigation volume applied (Megalitres)	% of irrigation volume applied
Cereal crops not for grain or seed	2,547	0.6%
Rice		
Other broadacre crops	1,620	0.4%
Fruit trees, nut trees, plantation or berry fruits	2,108	0.5%
Vegetables for human consumption	11,098	2.5% ²⁵
Vegetables for seed		
Nurseries, cutflowers or cultivated turf		
Grapevines	2,089	0.5%
Other crops	226	0.1%
Total	443,646	100.00%

Source: ABS (2008) Water Use on Australian Farms, 2005-06: Estimates for Local Government Areas, 4618.0.

In 2005/2006, there were approximately 334,246 hectares of land under cultivation in the Campaspe case study area. The primary land use was for grazing at 65.4% (generally irrigated dairy), followed by cereals, oilseeds and other broadacre crops at 33% of cultivated land. Horticulture crops make up the remainder of cultivated land, with vegetables the largest at 0.63%.

Table 3.2: Agricultural Land Uses, Campaspe

Agricultural Use	# Hectares	% of Agricultural Use
Vegetables	2,104	0.6%
Fruit	481	0.1%
Grapes	1,349	0.4%
Grazing	218,724	65.4%
Cereal, oilseeds, other broadacre	111,505	33.4%
Rice	83	0.02%
Cotton	0	0%
Total	334,246	100%

Source: ABS (2006) and JSA (2009)

Note: See JSA (2010) Report 2 Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Understanding Agricultural Employment, Appendix 2: Data sources and methods used, for an explanation of how each agricultural use has been determined.

²⁵ Study participants noted that this value seemed low considering the expansion of irrigated tomato cropping in the LGA.

3.3. Water Policy Context

The Victorian *Water Act 1989* gives the State Government the overall right to the use, flow and control of all surface water and groundwater; and provides a framework for how water for consumptive purposes can be ‘taken’ and ‘used’ through a set of entitlements.²⁶ Under the Act, a water entitlement is defined as the amount of water authorised to be stored, taken and used by a person under specific conditions, with associated entitlements that set conditions for delivery or use.²⁷ There are four types of entitlements to ‘take’ water including bulk entitlements, environmental entitlements, water shares and water licences. There are also provisions in the Act for the ‘take’ of water for ‘domestic and stock’ purposes from surface and groundwater sources without an issued entitlement.

Bulk entitlements are held by water corporations and provide them with the right to water for system operations, seasonal allocations and other rights and obligations.²⁸ The ‘environmental water reserve’ is a legally recognised amount of water set aside to meet environmental needs and objectives to preserve values and ecosystem health. In practice reserves are met by rules on passing flows that water corporations and licensed diverters are required to provide out of a storage or past a diversion, and through ‘above cap’ water that is water that is extra or left over after limits on diversions have been reached and unregulated flows cannot be kept in storage.²⁹

‘Water rights’ in northern Victoria were unbundled in July 2007 into a water share, delivery share and water use license.³⁰ A water share is a legally recognised, secure share of the water available to be taken from a water system and may be ‘high-reliability’ or ‘low-reliability’.³¹ For the entire Northern Victoria region (which includes Victoria’s share of the River Murray and its major Victorian tributaries including the Kiewa, Ovens, Broken, Goulburn, Campaspe and Loddon Rivers) high-reliability water shares total 2,288 GL and low-reliability water shares total 772 GL.³² A water allocation is the amount of water that can be used under an entitlement to water, each year. The allocation depends on the conditions during the year and in a dry year an allocation will be reduced.

The forecast reliability of ‘high’ and ‘low’ reliability shares can differ significantly between catchments, particularly for ‘low reliability’ shares. Based on the long-term average climate for the Campaspe catchment, a ‘high reliability’ water share would expect 100% allocation for 97 out of every 100 years, while a ‘low reliability’ water share would expect 100% allocation for 78 out of every 100 years. In contrast for the Goulburn catchment, a ‘high reliability’ share would expect

²⁶ Victorian State Government Our Water Our Future website, www.ourwater.vic.gov.au/allocation/water_allocation_framework accessed 23 March 2010.

²⁷ State of Victoria DSE (2009), Pg 10.

²⁸ State of Victoria DSE (2009), Pg 10.

²⁹ State of Victoria DSE (2009), Pg 10.

³⁰ State of Victoria Department of Environment and Sustainability (2009) Northern Region Sustainable Water Strategy, Pg 202.

³¹ State of Victoria DSE (2009), Pg 25.

³² State of Victoria DSE (2009), Pg 25-26, citing State Government of Victoria (2009) Victorian Water Register.

100% allocation for every 96 out of 100 years, and a ‘low reliability’ share would expect 100% allocation for only 8 out of every 100 years.³³

3.4. Social and Economic Context

This section of the case study explores population trends, employment and industry profiles and how the Campaspe case study compared with the other case study areas and the MDB across a range of wellbeing and resilience indicators.

3.4.1. Population Profile

Echuca and the Campaspe LGA have grown steadily over the last 20 years. Campaspe Shire Council staff report that the growth of Echuca and the LGA may mask a decline across all of the smaller towns in the area in recent years due to the declining dairying industry. In fact, the Echuca Statistical Local Area (SLA) grew by around 13% from 2001-2006, while the other three more rural SLAs that make up the LGA each experienced declines of around 2%. Therefore, while the LGA increased over the period this growth was concentrated in Echuca and is partially the result of movement from farms and the hinterland into town.

Echuca Township

From 1976 to 2006, the population of the Echuca township increased by 57% from 7,873 to 12,365. The population increase over the last 30 years is most likely influenced by a strong agricultural and related service sector base, and the increasing attractiveness of the town as a ‘tree change’ location as a result of its scenic beauty, history and proximity to larger centres such as Shepparton, Bendigo and Melbourne.

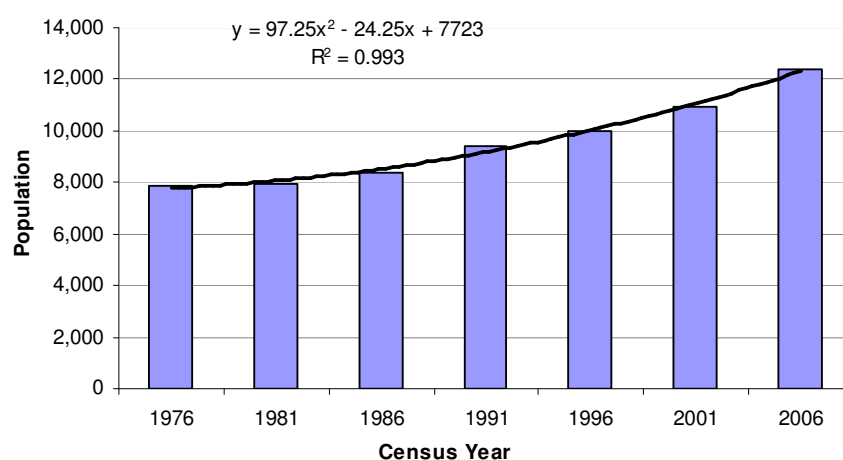


Figure 3.4: Population Change 1976-2006 for Echuca

Source: ABS Census of Population and Housing, by Place of Enumeration

³³ State of Victoria DSE (2009), Pg 25-26.

Campaspe LGA

The overall population of Campaspe LGA has also grown steadily since 1976, increasing by 5,555 people or nearly 19%. The growth of the LGA is not nearly as dramatic as that of the Echuca township, which reflects the movement of residents from smaller towns and hinterland within the LGA to the larger town centre.

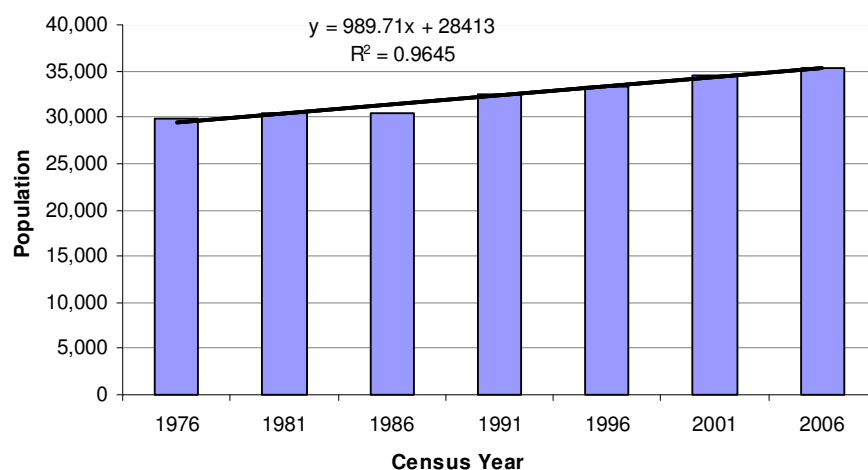


Figure 3.5: Population Change 1976-2006 for Campaspe Shire

Source: ABS Census of Population and Housing, by Place of Enumeration

3.4.2. Employment and Industry Profile

In 2006, there were 15,566 people employed in the Campaspe case study area. Around 23% were employed in agriculture (16% grazing, 2% vegetables and 1.5% fruit of total local employment). This was almost seven times the Australian average (3.5%), although the area was less dependent on agricultural production and associated industries than the MDB average (29%). Dairy farming and processing is a significant employer in the Campaspe LGA at around 43% of all agricultural jobs and 10% of all jobs in the area.

Other significant employment sectors were retail, health and manufacturing at 14%, 11% and 10% respectively. Manufacturing and wholesale in the area is just under the Australian average but well above the MDB average. Employment in retail and health exceed both the MDB and Australian averages, indicating the importance of Echuca as a district service centre. In other respects, Echuca does not appear to be playing this role, having lower engagement in education, public administration, administration, utilities and transport than the MDB and national averages and well below the national average for professional, communication, construction and financial services.

Despite promotional literature that indicates a strong tourism sector, this does not necessarily appear to be translating to local employment opportunities. Jobs in relevant sectors ('Recreation' and 'Accommodation and food') were below average in 2006 (6.6% in total for Campaspe LGA compared with 8.5% for the MDB and 7.9% nationally). The following graph shows this in more detail.

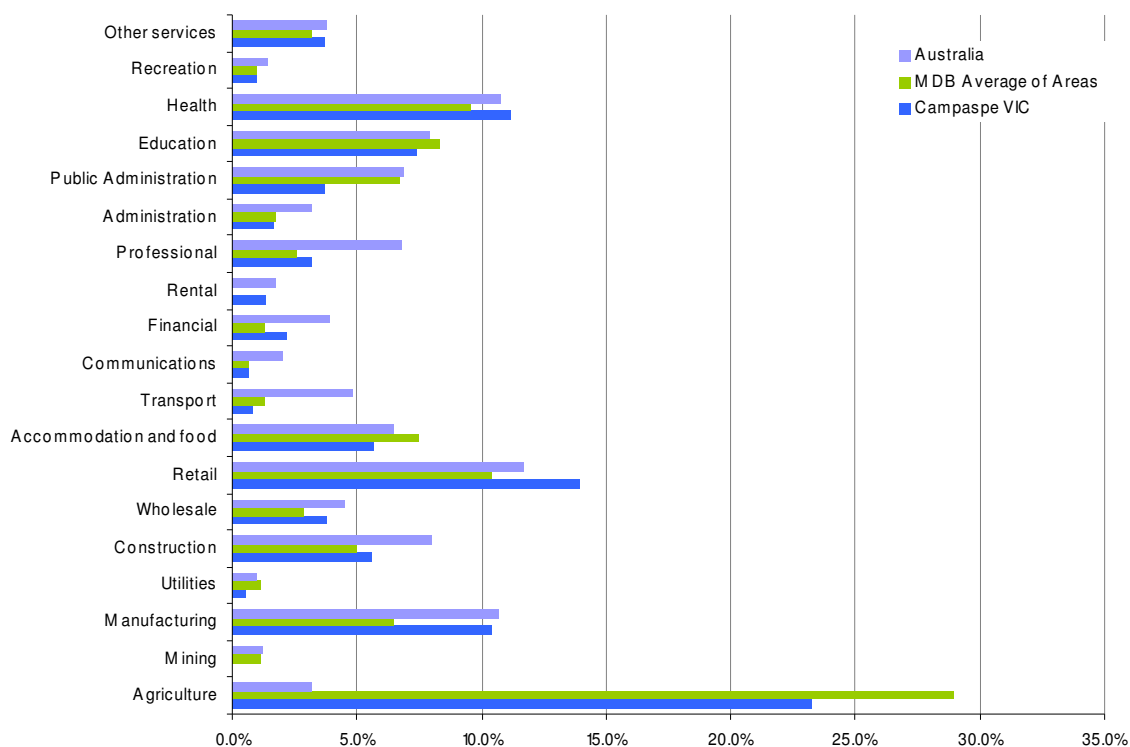


Figure 3.6: Employment Profile, Campaspe VIC

Source: ABS (2006) Census of Population and Housing, JSA (2009)

Agricultural Employment

In addition to the diverse agricultural base, there are a number of processing plants and operations in the Campaspe case study area including dairy plants located in Rochester (Murray Goulburn Co-operative Ltd), Stanhope (Fonterra Brands) and Tongala (Nestle); horticultural operations run by Heinz, Simplot, Cedenco and SPC; and two abattoirs.



Figure 3.7: Murray Goulburn Dairy Plant at Rochester, Victoria

Source: JSA, March 2010

Campaspe Shire Council staff report that the strong mix of value-added products has kept agriculture relatively stable in the area, and in turn the wider community has remained stable. Nonetheless, these industries will be vulnerable to permanent removal of water from the region to the extent that agricultural products are sourced locally and from other areas that experience permanent reductions in water availability.

The case study area experienced a 3.9% increase in employment from 2001 to 2006. Growth in jobs slightly outpaced population growth for the area. To an extent, this growth was enabled by reasonably full allocations during the early stages of the drought, unlike other areas of the MDB with lower water security.

However, there are recent reports of job losses in the area due to the continued decline of the dairy industry amid significant cuts to water allocations since 2006 (in Campaspe Irrigation Area since 2004) and industry restructuring. In February 2010, Murray Goulburn announced the closure of its cheese factory at Leitchville (around 50km west of Echuca and just slightly outside the Campaspe Shire in neighbouring Gannawarra Shire), which affected 80 workers in a town of around 300 people. This would represent the majority of jobs in this town if those living there worked locally. In the media, Murray Goulburn stated that the decision was regrettable but was their only option due to declining milk supply in northern Victoria and the company's resultant inability to keep four plants operating in the region.³⁴

Based on interviews conducted, there is a perception that the growth and prosperity of Echuca may 'mask' in a statistical sense the hardship and declines of smaller towns in the area that are heavily reliant on dairying and other forms of agriculture that have occurred due to the exceptionally low allocations (i.e. since 2006). The extent to which the opportunities available in Echuca are able to off-set the declines and losses in the smaller towns throughout the Shire, not to mention replace opportunities for those who cease farming, is uncertain. However, the high degree of dependence on agriculture and related secondary activities as well as the relatively limited opportunities for industry diversification apparent from the current employment profile, indicate that this is area that would be vulnerable to such changes.

3.4.3. Indicators of Community Wellbeing and Resilience

The relatively close proximity of Campaspe to large cities like Melbourne and Bendigo, its size and degree of urbanisation, and positive lifestyle opportunities related to amenity are evident in the indicators of community wellbeing and resilience for the case study area. However, there is considerable ageing of the LGA population which is being driven by an ageing of the rural population of the Shire most likely due to an out-migration of young people out of the area. Similar to other regional and rural areas, the loss of young people (and likely in this case young families moving off-farm) is a concern for communities and a likely indicator of future vulnerability.

³⁴ Long, W (2010) Murray Goulburn closes cheese operations at Leitchville in Victoria's North West, ABC News: Swan Hill/Kerang, February 3, accessed online at www.abc.net.au/local/stories/2010/02/03/2809271.htm.

The Campaspe LGA had a population of 36,201 in 2006, and is the second largest of the eight selected case study areas after Mildura. However, it has not reached the 'critical mass' of nearby large regional centres such as Shepparton at 57,000 residents. Between 2001 and 2006 the area experienced positive population and employment growth at 2.4% and 3.9% respectively. This was much higher than the MDB population and employment growth, but much lower than that of Australia during this time (around 6% population and 10% employment growth nationally).

It is noted that there is a difference in population growth when different ABS measurements are applied. For the purposes of this study, we have used ABS *Time Series Profile* data by 'place of enumeration' to calculate the population change from 2001 to 2006. This measurement refers to the number of people counted in an area on Census Night. By this measure, there was a population change of +2.4%. By the ABS measurement using 'place of residence' data there was a population change between 2001 and 2006 in the Campaspe LGA of +3.0%. While the trend is similar, the primary quantum difference in the two measurements appears to be some 747 people who are counted as 'residents' of Campaspe were not counted in Campaspe or 'at home' on Census Night. Further research would be required to ascertain why such a large number of 'residents' were not at home at this time. Possible reasons may include a large number of people working away from home due to drought pressures or a large number of retirees travelling away from the area.

Positive population and employment growth is consistent with most other Southern Basin case study areas, but is in stark contrast to many of the Northern Basin case study areas which experienced dramatic declines in both employment and population over the same period. In the Northern Basin, lower levels of water security and low allocations from the early 2000's have contributed to the decline by contrast with the relatively high level of water security experienced by most of the Southern Basin until a few years later. However, it is likely that more vulnerable areas of the Southern Basin will show quite different trends in the 2011 Census.

Despite the perception that many people are moving into the area, the rate of residents who changed SLA from 5 years ago is relatively similar to the MDB average. However, at 22.3% of residents, this is the highest rate of any of the southern basin communities and the third highest of all the case study areas after Dalby-Wambo and Balonne. Interviewees pointed out that this indicator could be slightly skewed by residents who move between Echuca and Moama. Whilst the twin towns are in two different states, the community reportedly sees little distinction.

The area has the lowest proportion of residents that are Indigenous for any of the case study areas at 1.8%, much lower than the MDB average of 4.9% and the Australian average at 2.3%. In terms of disadvantage, the area is among the least disadvantaged of the case study areas, with a higher SEIFA Disadvantage value than the MDB though this is still lower than the Australian value (974 compared with 1000 nationally). The absence of a significant Indigenous population compared with most northern basin case study areas is also likely to contribute to lower levels of disadvantage.

Campaspe has the highest median age of any of the case study areas at 40 years. Interestingly, changes in median age from 2001 to 2006 by smaller area within the LGA show that there has been relatively little age change in Echuca while the areas around Rochester and Kyabram aged

significantly during the period. This is likely to be a result of the older age profile of farmers, older singles and couples moving into the area for a ‘tree change’, as well as the retention of the retirement age population including those moving into Echuca from the surrounding smaller towns and hinterland. It may also be that this is a result of young adults moving out to seek employment, education and lifestyle opportunities in Melbourne. The relatively stable age of Echuca also suggests that younger and more mature families with children are also moving into the area, which supports what was reported in consultations.

The labour force participation rate for those 65 years and older is relatively low at 10.3% compared to the MDB average of 15.4% and particularly the northern basin case study areas all with rates well in excess of 15%. This figure shows that fewer older people are still working, and suggests that the area has a higher proportion of retirees, many of whom may be relative newcomers to the area. Further research would be required to verify this perception.

The area has a relatively low rate of premature death compared to the other case study areas and the MDB. The rate of Disability Support Pension recipients is the same as the MDB average and average for the 8 case studies, though the proportion of the population with a profound or severe disability is slightly higher than the MDB average and the second highest of the case study areas. This is likely to be a reflection of the older age profile of the area.

The 2006 median household income of \$791 per week for Campaspe was among the lowest of the case study areas, with the communities in the Northern Basin all reporting higher median household incomes than the Southern Basin communities apart from Griffith NSW. Regardless, Campaspe was still above the MDB average.

The SEIFA index of education and occupation was very similar to most of the other case study areas and only slightly below the MDB average. The proportion of the population in Campaspe with trade or better qualifications was the highest of the case study areas at 31.7% and just above the MDB average. The area also reported the highest level of participation in secondary education at age 16, exceeding both the MDB and Australian averages. This high rate of participation in schooling relates to the relatively low rate of youth unemployment at 9.3%, which is just below the MDB and Australian averages. The overall unemployment rate and the labour force participation rate for those aged 15+ were also relatively low when compared to the other case study areas, and the MDB and Australian averages.

In terms of change between 2001 and 2006 in key indicators, there is evidence of a somewhat more advantaged profile, with an increasing median income³⁵ and declining unemployment rate,³⁶ although the SEIFA disadvantage value had declined from 1002 to 974 in this period.³⁷ It is likely that a higher retirement age population accounts for some of this difference, with the median age increasing from 37 to 40 years³⁸ in the inter-censal period.

³⁵ Increasing from \$773 to \$791 in 2006 dollars (ABS Census 2001 and 2006)

³⁶ Decreasing from 5.4% to 4.7% general unemployment and from 11.3% to 9.3% for young people (ABS Census 2001 and 2006)

³⁷ ABS Census 2001 and 2006

³⁸ Decreasing from 5.4% to 4.7% general unemployment and from 11.3% to 9.3% for young people (ABS Census 2001 and 2006)

The rate of voluntary work for an organisation or group was the second highest of the case study areas at 28% and just below MDB average of 29%. An example of exceptionally strong civic leadership and a high level of community engagement is evident in the small community of Lockington, where the efforts of volunteers have worked to retain and provide key services for local residents for years in the face of continued challenges related to drought and decline of dairying in the region.

3.4.4. Profile on a small town in the region: Lockington, Victoria

Lockington is a small town within the Campaspe LGA approximately 35 km southwest of Echuca. The township had a population of 420 residents in 2006, an increase of around 5% from 2001. When the area that is taken as a representation of its hinterland (as shown in the map below) is added to the population of Lockington town, there was a decrease in population between 2001 and 2006 of around 1.4%, likely due to people moving off-farm and either into town or outside the district. If the hinterland is looked at on its own, we see that its population declined by around 7.8% between 2001 and 2006.

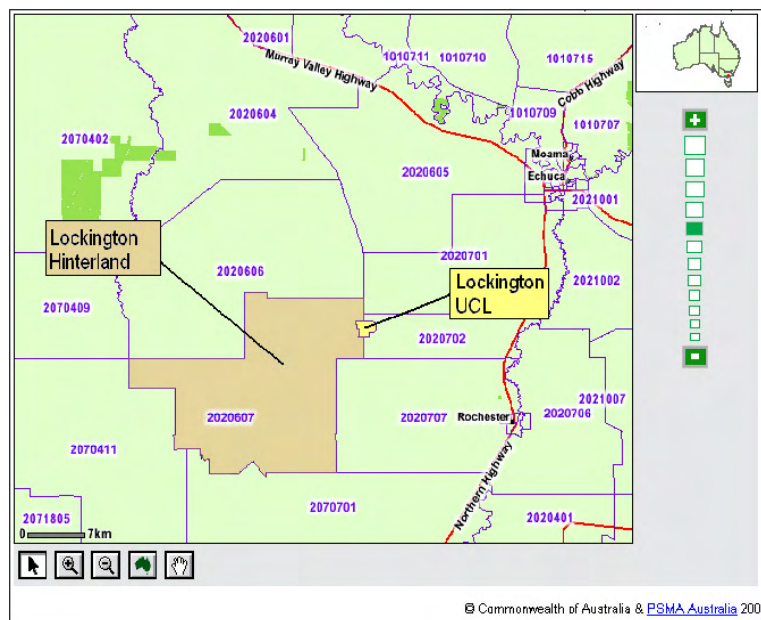


Figure 3.8: Map – Lockington UCL & Hinterland

Source: ABS Website 2010

Agriculture in Lockington (UCL & Hinterland) makes up almost 40% of all jobs, which is well above the LGA and MDB averages. Other prominent employers include retail, manufacturing and construction. Relatively few people in the area were employed in public administration, health, communications and wholesale trade.

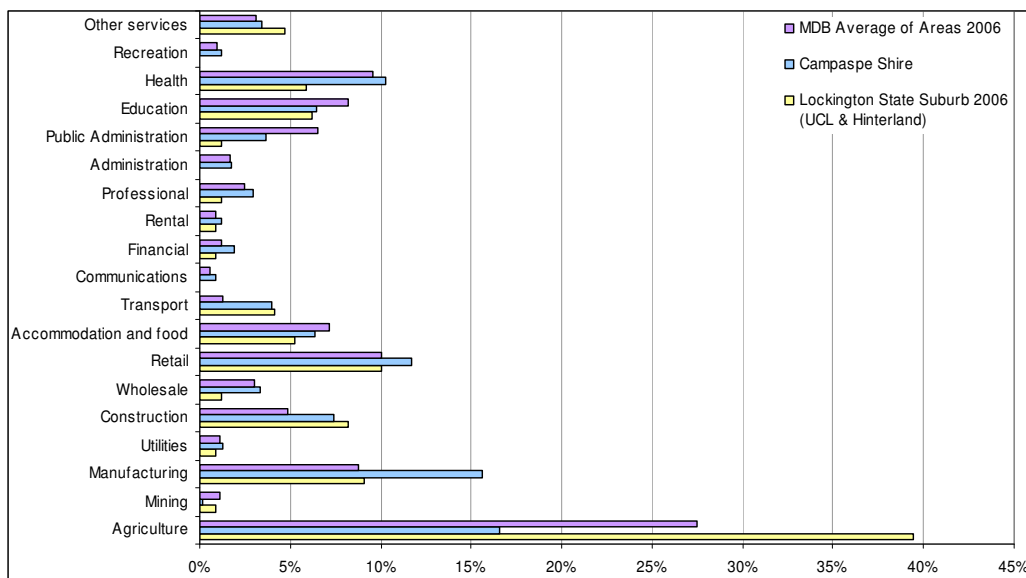


Figure 3.9: Employment Industry Breakdown – Lockington UCL & Hinterland 2006
Source: ABS 2001 / 2006 Census

The number of people employed in agriculture in Lockington dropped significantly between 2001 and 2006, from 181 to 134, representing a 26% decline. This was to some extent offset by a large increase in the number of persons working in accommodation and food, manufacturing, construction, transport and other services. These figures support findings from interviews where people reported that farmers and farm families went off-farm for work often at jobs with local manufacturers and/or other services.

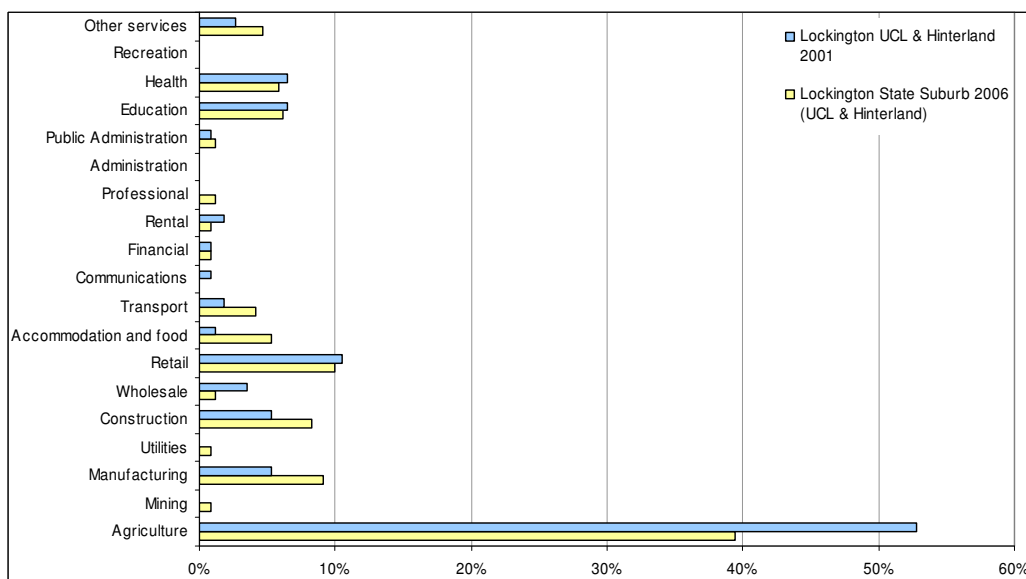


Figure 3.10: Employment Industry Comparison – Lockington UCL & Hinterland
Note: 2001 Census did not include the categories for 'Professional' and 'Administration'
Source: ABS 2001 / 2006 Census

The table below shows the status of Lockington against a selection of wellbeing and resilience indicators for 2001 and 2006.

Table 3.3: Lockington UCL & Hinterland Key Indicators

	2006				2001		
	Lockington UCL	Lockington UCL & Hinterland	Campaspe Shire	MDB Average of Areas	Lockington UCL	Lockington UCL & Hinterland	Campaspe Shire
Population	420	784	36,210	2,004,560	400 ³⁹	795 ⁴⁰	34,611 ⁴¹
Persons Employed	161	354	15,957	921,300	133	349	14,972
Labour Force Participation of persons aged 65+ (%)	14.1%	18.5%	11.2%	15.4%	16.5%	21.0%	10.9%
Youth Unemployment (%)	0.0%	0.0%	9.2%	10.4%	33.3%	13.0%	11.3%
General Unemployment (%)	6.9%	3.8%	4.7%	5.0%	4.3%	2.5%	5.4%
Tertiary Qualification, Certificate or Higher (% of persons aged 15+)	22.0%	27.4%	31.8%	34.1%	19.3%	25.2%	27.0%
Median Age	42	40	40	38	40	37	37
Median Weekly Household Income (CPI Adjusted for 2001)	\$610	\$810	\$790	\$780	\$575	\$765	\$775
Voluntary Work Participation (%)	37.3%	43.2%	28.0%	29.0%	Data not available	Data not available	Data not available
SEIFA: Disadvantage	911	971	974	953	941	1094 (Hint. only)	1,002
SEIFA: Education-Occupation	885	957	938	953	886	984 (Hint. only)	941

Source: ABS Census of Population and Housing (2006) by Place of Usual Residence, ABS Census of Population and Housing (2001) by Place of Enumeration.

The labour force participation rate of persons aged 65+ years in Lockington (UCL & hinterland) was much higher than the LGA average, indicative of ageing farmers that are working well into their sixties and seventies. Youth unemployment in Lockington (UCL + hinterland) dropped dramatically between 2001 and 2006, from 13% to 0%, while the actual labour force size in the

³⁹ Note that the 2001 population was based on place of enumeration on the census night, whereas the 2006 population was based on place of usual residence. Small area data in 2001 is not available by Place of Usual Residence. The 2001 population includes 13 visitors to the area.

⁴⁰ Includes 25 visitors.

⁴¹ Includes 1,496 visitors.

15-24 year increased. The trend in general unemployment in Lockington was the opposite to youth unemployment, rising from 2.5% in 2001 to 3.8% in 2006.

The change in median age from 2001 to 2006 shows a significant ageing of the Lockington (UCL + hinterland) population from 37 to 40 years, mirroring of the LGA change. The Lockington area had a similar household income to the whole of Campaspe, as well as the MDB, although for the township it was about \$200 lower per week – likely an indication of the older age profile of town residents are no longer working and may be in receipt of an aged pension.

Lockington (UCL + hinterland) residents are much more likely to participate in voluntary work than the LGA, at 43% of residents compared with 28%. This confirms findings from our fieldwork about the resilience of the Lockington community in the face of change, and is detailed further below.

4. Predicted ‘long term’ impacts of reduced water availability

JSA has modelled three scenarios to predict the likely short and long term impacts of reduced water availability on community wellbeing and resilience in the Campaspe case study area. Changes in ‘water availability’ have been assessed relative to irrigation water applied within the case study area during the 2005/2006 season, as reported in the ABS Agricultural Census. Reductions in water availability may arise from:

- **government policy** (such as through the buyback of permanent entitlements and setting of new Sustainable Diversion Limits under the Murray Darling Basin Plan),
- **short term climatic variations** (such as the recent drought), and/or
- **long term climate change** (such as per the CSIRO 2030 best estimate projections).

The extent to which the effect of these factors will reduce water availability is unknown. We have modelled three scenarios of 10%, 25% and 50% reductions in irrigation water applied in the local area on the variables of population, total employment, employment in key agricultural industries, and other indicators of community wellbeing and resilience. These are indicative scenarios only. We recognise that the ‘irrigation water applied’ in the model year is a reflection of seasonal allocations, carryover water, on-farm water storage, groundwater extraction and any water purchased into the area.

We have selected 2005/2006 as the model year for this analysis, as it is the most recent data available by small area. We have assumed it represents a relatively ‘average’ season in terms of water availability and irrigation use, although employment and water usage in some instances may have been reduced because of the drought. The aim of the modelling is to predict the likely long term impacts of potential reductions that may arise from government policy and climate change in the context of an ‘average’ water availability and use scenario. We recognise that there have been considerable short term impacts experienced since 2005/2006 as a result of the drought, with these impacts and responses by farmers and the local community explored below. However we have taken the view that, all other things being equal, the agricultural sector will recover from the drought to achieve previous levels of production with the return of irrigation water. The challenge when considering these predicted long term impacts is to remember that they are based on a snapshot of an ‘average’ year, and to ignore the impacts that may have already been experienced since that time due to the drought. However some responses to the drought, such as modernisation and efficiency gains, will not be available as responses to future reductions in water availability.

4.1. Predicted ‘long term’ impacts on Campaspe

The impact on Campaspe case study area from reductions in the availability of irrigation water has been modelled using data from JSA Research Strategies 1 and 2.

The long term impacts of reduced water availability on Campaspe are likely to be significant, particularly with regard to employment and population change. This is because irrigated agriculture forms a large proportion of both agricultural industries and the total economy of Campaspe. The effects are probably understated, as Campaspe contains a number of processing jobs, probably servicing a wider regional economy, and these jobs would be expected to be adversely affected by loss of irrigated agriculture jobs in the wider region.

4.1.1. Employment and Population

The primary effect of reductions in the availability of irrigation water will be a loss of employment, ranging from a 2.2% loss (339 jobs) predicted from a 10% reduction in water availability to a 10.9% loss (1,694 jobs) predicted from a 50% reduction in water availability, including direct and indirect employment in agriculture and multipliers. Given the job loss experienced during the drought (prior to 2005/2006), the fact that irrigated agriculture is anecdotally stated to have higher multipliers than the average for agriculture, and the likelihood that some agricultural jobs have not been identified in our analysis, this is almost certainly an underestimate. Subsequent population loss is estimated to range from 2.6% (949 people) predicted from a 10% reduction in water availability to 13.1% (4,744 people) predicted from a 50% reduction in water availability. Due to the high proportion of irrigation water applied to grazing (irrigated dairying) and the subsequently high proportion of employment related to the industry, a reduction in water availability would have a significant impact on this industry and the community. The ability of water trading to mitigate employment and population declines is less likely than for example, the Griffith case study, due to the dominance of irrigated dairy in the region and the small size of the vegetable, fruit and grape sectors.

4.1.2. Community Wellbeing and Resilience

Socio-economic indicators of wellbeing and resilience are expected to be largely unchanged as a result of changing water availability. Notable exceptions⁴² are projected to be:

- an increase in **youth unemployment**, and
- a decrease in **Assault and Property Crime** associated with loss of population.

The table below shows the predicted impacts for each of the three water availability reduction scenarios across all population, employment, and community wellbeing and resilience variables.

⁴² More than 5% change at 50% reduction in water availability.

Table 4.1: Predicted 'long term' impacts of reduced water availability for Campaspe VIC

Indicator	Base case 2006	Predicted impacts for reduced irrigation water scenarios			
		10% reduction	25% reduction	50% reduction	
Irrigation water use (GJ)	442.0	397.8	331.5	221.0	
Employment (total) ⁽¹⁾	15566	15227	14719	13872	
% decrease in employment		2.2%	5.4%	10.9%	
Employment (Vegetables) ⁽²⁾	344	325	297	250	most of these jobs are in processing
irrigation water use (GJ)	11.1	10.0	8.3	5.6	
Employment (Fruit) ⁽²⁾	221	217	212	203	most of these jobs are in processing
irrigation water use (GJ)	2.1	1.9	1.6	1.1	
Employment (Grapes) ⁽²⁾	107	103	97	87	most of these jobs are in processing
irrigation water use (GJ)	2.1	1.9	1.6	1.1	
Employment (Grazing) ⁽²⁾	2514	2362	2134	1754	Assumed next best use
irrigation water use (GJ)	360.8	324.7	270.6	180.4	
Employment (Cereal) ⁽²⁾	151	151	151	151	Likely to reduce but estimates are unreliable
irrigation water use (GJ)	65.9	59.3	49.4	33.0	
Employment (Rice) ⁽²⁾	1	1	1	1	
irrigation water use (GJ)	0	0.0	0.0	0.0	
Employment (Cotton) ⁽²⁾	0	0	0	0	
irrigation water use (GJ)	0	0.0	0.0	0.0	
Employment (Balance Agriculture)	273	273	273	273	
Employment (Total Agriculture)	3611	3433	3165	2719	
Population ⁽³⁾	36201	35252	33829	31457	remains above 10,000 threshold
estimated % decrease in population		2.6%	6.6%	13.1%	

	Base case	Predicted impacts for reduced irrigation water scenarios			
Indigenous population ⁽⁴⁾	1.8%	1.8%	1.8%	1.9%	
Number of Indigenous people	652	640	622	593	
Dependent variables:					
SEIFA Disadvantage	974	974	974	974	
SEIFA Economic Resources	928	928	928	928	
Premature death	280.9	281.0	281.2	281.5	
LFP 15+	58.9%	58.8%	58.7%	58.6%	
Median Household income	\$ 791	\$ 791	\$ 791	\$ 792	
Disability support pensioners	6.8%	6.8%	6.8%	6.8%	
Profound or severe disability	4.9%	4.9%	4.9%	4.9%	
Chronic ill health	206.7	206.6	206.4	206.0	
LFP 65+	10.3%	10.2%	10.1%	9.9%	from changes in agriculture
Median Age	40	40.0	39.9	39.8	
Skills Base	31.7%	31.7%	31.7%	31.7%	
Education participation	75.2%	75.1%	74.9%	74.6%	
SEIFA Education and Occupation	938	937	935	933	
Polarisation	0.84	0.84	0.84	0.84	
Youth unemployment	9.3%	9.4%	9.6%	9.8%	from changing age structure
Unemployment	4.7%	4.7%	4.7%	4.7%	
Change of SLA five years ago	22.3%	22.3%	22.3%	22.2%	
Voluntary work	28.0%	28.0%	27.9%	27.9%	
Assault (Non domestic violence)	759	752	742	726	2006 value estimated
Assault (Domestic violence)	427	427	427	427	2006 value estimated

	Predicted impacts for reduced irrigation water				
	Base case	scenarios			
Property Crime	4608	4566	4502	4400	2006 value estimated

Notes:

- (1) Includes factor of 1.11 to account for census under reporting, and allows loss of 0.9 jobs for each lost agricultural job
- (2) Estimates using data from Table 3.1 of report two and using regression analysis data to account for dryland production, factor of 1.11 included)
- (3) Assumed one job per household, 2.8 people per household, unemployed households leave the area
- (4) In 2006, the indigenous LFP rate was 53%, compared to 62% for the non-Indigenous population. We have assumed that job losses will therefore have a lesser effect on Indigenous populations, leading to an increased proportion of Indigenous people in the population, at the rate of the loss of one Indigenous person for each 1.2 non-Indigenous persons.

5. Evidence of ‘short term’ impacts of reduced water availability

Compared to a long term reduction in water availability that may occur as a result of government policy and climate change, the recent drought represents a short term reduction in water availability. The reduction in water availability that has been experienced throughout the drought has prompted changes across agricultural industries and has resulted in significant impacts at the farm and community levels. This section of the case study documents the changes, responses and impacts that have been experienced from the drought in Campaspe. An understanding of how farms, agricultural industries and the local community have responded to the ‘short term’ impact of the drought is necessary to better predict and understand the likely impacts of ‘long term’ reductions in water availability.

5.1. Reduced water availability experienced

The Northern Region Sustainable Water Strategy reports that rainfall in Victoria has been in decline since the 1970s, with the most recent 12 years being particularly dry (1997-2009). Allocations for irrigation and urban uses have been restricted since 2002/2003 when storage levels reached low levels.⁴³ The following figure shows historical allocations for high reliability shares in each of the catchment areas from 2002/2003 to the present. Allocation of high reliability shares have been dramatically reduced across all areas since the 2006/2007 season, with the Campaspe and Loddon areas being allocated very little since.

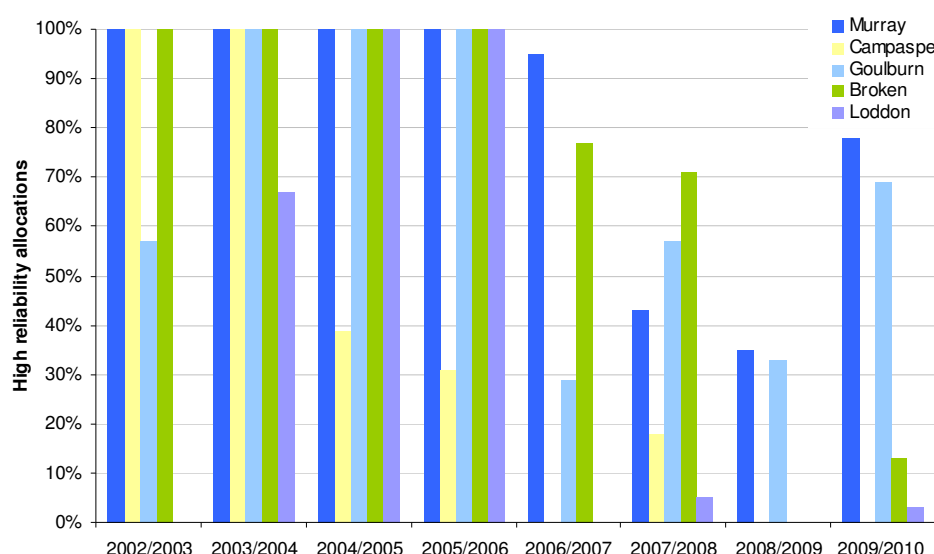


Figure 5.1: Historical ‘high reliability’ allocations

Source: Goulburn-Murray Water (2010)

⁴³ State of Victoria DSE (2009), Pg 16.

Reduced water availability for irrigation in recent years has had a tremendous impact on farmers across Northern Victoria and irrigators in other parts of the basin who have either bought water from, or sold water to, farmers in the area on the temporary or permanent water market.

5.2. Agricultural responses to reduced water availability

This section of the case study explores agricultural responses including uses of land, irrigation modernization and practices that have occurred in recent years due to reduced water availability. The primary agricultural industries described include dairying, irrigated cereals for feed and horticulture, with input primarily provided from interviews conducted in March 2010.

5.2.1. Government sponsored infrastructure modernization

The Northern Victoria Irrigation Renewal Project (NVIRP) is a state body established in late 2007 to plan, design and deliver a \$2 billion program of works to modernise and upgrade ageing irrigation infrastructure in Northern Victoria. The project area covers 86% of the Goulburn-Murray Irrigation District and 6,200km of channels and aims to recover water lost through leakage, seepage, evaporation and inefficiencies through some channel lining and pipeline construction, automation of channels, metering upgrades, and reconfiguration of channel layout. NVIRP claims that modernisation will increase irrigation water use efficiency from 70% to at least 85%. NVIRP also claims that 80% of the water savings will be shared by irrigators and the environment in northern Victoria, with 20% going to Melbourne via the Sugarloaf Pipeline.⁴⁴ The sale of permanent water rights and ageing infrastructure are cited as the drivers for the project, as remaining customers must bear the cost of distribution and maintenance to a more fragmented system.

NVIRP has also been developing options for the future of the Campaspe Irrigation District.⁴⁵ Irrigators and other community stakeholders have been engaged in the planning and review of options for the future of the irrigation district. At the time of writing, news reports indicate that a fully upgraded system for the Campaspe Irrigation Area is no longer a possible option. As a result, irrigators will either have to cease irrigated farming and sell their entitlements to the government or rely on groundwater from the Campaspe deep lead aquifer and possible alternative supply options from the Campaspe River or the Waranga Channel.⁴⁶

The impact of irrigation modernisation initiatives across Northern Victoria, particularly the Campaspe case study area, regarding the water savings that are possible, and how savings will

⁴⁴ NVIRP website www.nvirp.com.au, accessed online 24 March 2010.

⁴⁵ NVIRP states, "The irrigation infrastructure has served the development of this area well, however with the rapid developments in agriculture, freeing up of the water market, and the significant impacts that drought and subsequent low allocations are having in the Campaspe Basin the time has come for a review into the future of this irrigation district". NVIRP website, www.nvirp.com.au/modernisation/campaspeirrigationdistrict1.aspx, accessed 17 March 2010.

⁴⁶ ABC News (2010) Irrigators to sell water rights, March 16; ABC News (2010) VFF offers Campaspe irrigation assurance, March 17; and ABC News (2010) Meeting to map out irrigation future, 24 March 2010 all accessed online at www.abc.net.au/news on 24 March 2010.

actually be shared between irrigators, the environment and Melbourne is continually developing. A widespread cessation of irrigation in the Campaspe portion of the wider Rochester-Campaspe system will have an impact at the farm and small community level in the case study area as more farmers decide to further scale back or consolidate their production based on available groundwater or access to another part of the system, or exit the industry as a result of the loss of the irrigation infrastructure.

5.2.2. Utilisation of the Temporary Water Market

In Victoria, temporary trade of water began in 1987, followed by permanent trading in 1991.⁴⁷ The water market developed further through the 1994 COAG agreement and the 2004 National Water Initiative. The unbundling of water from land allowed for further development of the temporary and permanent water market across different states and regions. Due to concerns about trade of permanent water outside of a region, each state agreed on an annual 4% limit on trade of permanent entitlements outside of an irrigation area.

Since trading was introduced through the 2005-2006 season, the Rochester-Campaspe and Central-Goulburn areas have consistently transferred (net) annual allocations into the regions through temporary trading.⁴⁸ There was significant permanent trading out of Rochester, while temporary trading into the area has off-set this loss in terms of available water in the district. In 2008-2009, Victoria was a net importer of water with the Murrumbidgee Valley in NSW the primary supplier of inter-state trades in allocations.⁴⁹ Exemptions to the 4% limit on trade out of irrigation areas have been introduced in the 2009/2010 season, with a phasing out of the limit planned to begin in 2011 and be fully removed by 2014.⁵⁰ One interviewee stated that while there was fear when water trading was introduced about the sale of water out of the area, people are not as focused on keeping water in the area as they were to accept that people with higher value uses need the water and are willing to pay for it.

Profile: Irrigated Cereals for Feed

Drought in Northern Victoria has hurt not only 'pasture based' dairy farms but also irrigated cereal farmers who grow additional feed for dairy cattle. Drought has taken away the demand for feed as dairying is "moving towards an annual pasture basis and trying to extract the most dry-matter per megalitre of water possible". Annual pasture crops require significant water at the beginning of each season. If water is not allocated at the right time, then it is not possible or worthwhile to sow a crop. For one irrigated cereal farmer with 240 hectares of irrigated cropping on the Murray Valley Irrigation district just slightly outside the case study area, the 2005/2006 season was the last decent year they experienced to grow corn and wheat for feed. The utilisation of the water market has been the primary practice change for this business. For the last three

⁴⁷ RMCG (2009) Ibid, pg 4.

⁴⁸ Frontier Economics (2007) Ibid, pg 147.

⁴⁹ National Water Commission (2009) Australian Water Market Report 2008-2009: Victoria, pg 85.

⁵⁰ National Water Commission (2009) pg 76.

years this farm has decided not to irrigate any crops but sell their full allocation of high reliability water on the temporary market to those with permanent plantings further down the system who are ‘paying a premium’ for the water.

5.2.3. Response to drought: Dairy

In response to reduced water availability, many dairy farmers have bought in feed, scaled back operations, bought or sold water either temporarily or permanently, converted to dryland farming or exited the industry entirely. Many farmers with high debts have been more likely to explore their options to sell their land and water; while others who are committed to the industry are exploring entrepreneurial options for the future and have responded with a range of land use and agricultural practice changes including farm consolidation, changing what crops are irrigated and when, calving patterns, reducing the number of cows milked, installing more efficient irrigation infrastructure, utilising the water market and making a complete shift away from a ‘pasture based’ system through the development of ‘feed pads’ and ‘freestalls’. Many farmers and farming families have also turned to off-farm income to keep their operations going.

Exacerbated by falling prices, milk cattle numbers declined by 14% between 1993-94 and 2007-08 and milk production declined from 2.8 million litres in 2005-06 to 2.2 million litres in 2007-08, with further declines expected in 2008-09 across the Lower Murray-Darling Basin region.⁵¹ Dairy farmers across the Lower Murray Darling Basin (and in the case study area) have actively engaged in water trading through the purchase of temporary water to maintain pasture production, by selling temporary water to finance grain purchases and by selling permanent water entitlements to service debt.⁵² The Department of Primary Industries Dairy Team estimates that of those dairy farmers remaining in Northern Victoria approximately 40% want to ‘stay’ and are committed to continuing dairying, 40% are unsure about whether to ‘stay’ or ‘go’ and 20% are planning to ‘go’ or exit the industry in the short term. No matter which of these three ‘groups’ a farmer is in, all have had to assess their business position. A DPI Dairy Team representative articulated the difficulty many farmers have had with making decisions about the future of their business amid an increasingly complex policy environment, falling commodities prices and increasing drought.

“For a number of people the decision to exit the industry is a very painful and foreign one, and something they will put off as long as possible. If there is the slightest glimmer that it is worth rolling the dice again, like a bit more rain or a little improvement in allocation, they’ll do it. Even if we have a reasonable season, it doesn’t mean that individual businesses have replaced equity that has been eroded over many years. It would take a few years of good seasons for people to crawl out of debt, really consolidate and progress. When the drought started in 2002/2003 it was like a war was declared. People responded to it with vigour like it was a challenge. No one ever expected it would

⁵¹ Allen Consulting Group (2009) Ibid, pg 62.

⁵² Allen Consulting Group (2009) Ibid, pg 67.

last so long. Now they are just knackered and many are worn down by the complexity of decisions they have to make.”

Consolidation

With low water and market changes there has been an increasing consolidation of farms in Northern Victoria. According to the DPI, prior to the drought dairy farm numbers in Northern Victoria declined between 5-7% annually. Spikes in farm losses of between 12-14% occurred at multiple points during the recent drought including the 2002/2003, 2006/2007 and likely the 2008/2009 seasons.

A common scenario would be that one farmer sells their permanent water entitlement to one buyer (possibly outside the immediate catchment area) and sells the land to a neighbouring or nearby farm is able to utilise it based on their existing water entitlement, which may require the conversion of part of the property to dryland farming. One interviewee estimated that a dryland dairy farm has the capability to produce 20% of the gross value compared to an irrigated system. There also appears to be an increase in corporate dairy farms and development applications for large scale operations such as those with greater than 1000 head.

Efficient infrastructure

Throughout the period of low allocation many farmers have changed how water is used on the property. There has been a significant move towards subsurface drip irrigation and sprinklers, which some say has improved efficiency from 10 ML/ha/yr to 5-6 ML/ha/yr usage. There have also been great strides made in on-farm effluent reuse, with very little water now leaving a farm through drains.

Move from traditional ‘pasture based’ system

What appears to be the most significant change from the traditional way that a dairy farm operated in the area is the shift from a ‘pasture-based’ system to a more intensive system where feed is bought in and delivered to the animals.



Figure 5.2: Bought-in feed in paddock

Source: JSA, March 2010

Low allocations and periodic announcements of allocations have not allowed farmers to plan and make decisions about how much feed they are able to grow for each season. To sustain production they have had to import feed, often at high cost. Many have adopted a ‘feed pad’⁵³ or ‘freestall’⁵⁴ system, where the farmer invests in the development of a permanent or semi-permanent infrastructure to house and feed their animals, “in order to facilitate a sustained production through the increased importation of supplementary feeds”.⁵⁵ The capital investment for ‘feed pad’ development is significant, with a system to accommodate a typical 200 animal farm costing between \$250,000 to \$300,000.

5.2.4. Response to drought: Tomatoes

Cedenco Foods is a New Zealand and Australian based food company supplying fruit and vegetable powders, purees, pastes, retorted and frozen vegetables to domestic and international markets.⁵⁶ In 1997, Cedenco Foods moved a factory from New Zealand to Australia and established its operations at Echuca specialising in production of tomato paste and diced tomatoes.



Figure 5.3: Tomato paste containers at Cedenco Foods, Echuca Victoria

Source: JSA, March 2010

The company has its own farming arm (SS Farms), that leases instead of owns land and water licenses through contract arrangements with farmers and grower groups in the region. Due to pest and disease, tomatoes are unable to be grown on the same ground year after year. The company approaches pasture or irrigation farmers to lease their farms for a period of 3 or 4 years, and will establish a tomato farm on a property with its own irrigation infrastructure. Currently, Cedenco processes around 220,000-230,000 tonnes of tomatoes annually, with just over half coming from SS Farms.

⁵³ A feedpad is an enclosed area where dairy cattle are provided with a portion of their daily feed requirement as hay, silage, grain or mixed feed for all or part of the year.

⁵⁴ A freestall is a type of permanent feedpad that also includes a bedding area for cattle to lie down. It is generally covered and may also include a loafing area for cattle to stand, ruminate or idle.

⁵⁵ Department of Primary Industries Victoria (2010) Guidelines for Victorian Dairy Feedpads and Freestalls, First Edition, pg 4.

⁵⁶ Cedenco Foods website, www.cedenco.com, accessed 18 March 2010.

Despite reduced water availability, Cedenco has been able to grow its tomato crop and subsequently its labour force in the Campaspe region during the recent drought period. In 2000, the company had 90 hectares cultivated with tomatoes. In 2010, there are 1250 hectares cultivated. The company has achieved this growth due to its high value crop, ability to increase scale through consolidation and rationalisation, efficient water use, utilisation of the water market and an ability to pass on high water costs to its customers.

Efficient Infrastructure

90% of Cedenco's tomato crops in the region are irrigated with subsurface drip infrastructure, with the remainder furrow irrigated. Water supply is secured from Goulburn-Murray Water and groundwater accessed via bores. The industry average for tomatoes is around 14-15 tonnes per megalitre of water, with furrow irrigation yielding around 8-10 tonnes per megalitre. The use of subsurface drip irrigation has tremendously improved water efficiencies and outputs, with tomatoes grown in the good soils of the Rochester Irrigation Area on subsurface drip yielding around 20-22 tonnes per megalitre. According to Cedenco, the tomato industry in Australia is as water efficient as it can be due to subsurface drip irrigation systems, targeting areas of optimal soil types, and utilising capacity probes and other 'real time' on-farm data to determine exactly how much water each plant needs.

Utilising the Water Market

Cedenco has actively worked with their growers to purchase water throughout the drought period to secure water supply for their crops. In some seasons when water allocations were insufficient and the price of temporary water was too high for the company's contract farmers, the company bought water and sold it back to their farmers at a reduced rate. Cedenco was able to pass on this cost to their Australian customers who were prepared to pay a premium for 'Australian grown' tomatoes as opposed to the main competitors from California and China. As a large company they were able to negotiate with their customers, and recognise that this would not be possible for a small grower. However, the company recognises that passing along the cost of high priced water to customers is not a sustainable position.

5.3. Community response to reduced water availability

Based on reduced water availability and the resultant agricultural changes there have been significant social impacts experienced by farms, small and large communities across Northern Victoria and the Campaspe case study area. While a significant event in itself, the recent drought provides a real-time simulation of the likely effect of permanent reductions in water availability. Some important themes gathered from our consultations regarding the impacts that have been experienced from the drought included:

- Increased stress related to financial pressures, complexity of decision making required and uncertainty about the future for farmers and their families;

- Loss of ‘farming leaders’ that other farmers and members of the community look up to, has resulted in increased stress and concern for the future; and
- Adverse impacts experienced by the small towns and more rural areas of the LGA compared to Echuca.

Echuca is thought to have reached somewhat of a ‘critical mass’ due to its growth and qualities such as its proximity to Melbourne, amenity values, tourism and the perceived in-migration of all types of people particularly families and older people. Due to these attributes, Echuca appears to have been buffered from the worst impacts of the drought unlike smaller towns in the area.

However, the ‘crisis’ that has occurred within the dairy industry in the Lower Murray-Darling Basin due to a range of factors has been felt acutely by farmers in the Campaspe case study area. Many dairy farmers who have decided to ‘stay’ claim that they are more resilient now, as they have been forced to make difficult decisions and adjustments. Some admit that they are actually in a better position than prior to the drought. While there are success stories of farmers who have been able to ‘stay’ in the industry, there are many who have had to ‘go’ and exit the industry. Many more are ‘unsure’ and fatigued by indecision regarding their future and the equally challenging prospect of either ‘staying’ or ‘going’. Many who probably should ‘go’ are unable to make the decision to do so. As a result as one interviewee described, while the declines in farm numbers, tonnes of milk produced and other factors are quantifiable, the cost to ‘human capital’ is much less easily measured but in many ways a more significant impact on people and communities. As he put it, *“people are tired, confused and worn out as each year the past is becoming less of a guide for the future.”* Rural counselling and financial counselling services have seen the strain expressed from farmers and farm families across all age ranges through relationship breakdown, communication problems, financial hardship and the accumulation of stress to mental health issues.

The dairy industry has reportedly experienced a decline in the availability of skilled labour, with many positions remaining continually unfilled. This decline in skilled labour is said to be the result of loss to other industries (eg, mining) and a decline in family labour as farmers and family members have sought off-farm employment opportunities in order to retain income.⁵⁷ Interviewees report that there have been opportunities to access additional work in the Campaspe area due to the presence of agricultural processing industries. In addition, the combination of drought and market conditions has resulted in many dairy farmers exiting the industry. Study participants report that conditions have been so bad that, *“We’re now biting into the ones you would have said were farmers for life, the very good farmers, the leaders, the one we all looked up to. We’re also losing the next generation with them. When the good operators have got no confidence, the others look at them and wonder, ‘Can I make it through this?’.”*

Older farmers reportedly have a strong sense of responsibility for the future of their communities and concern for their reliance on a weakened dairy industry. Farmers across all age groups are

⁵⁷ Allen Consulting Group (2009) Ibid, pg 68.

reportedly very aware of their role in keeping services in small communities within the case study area. There is also concern for the next generation of dairy farmers, often the children of farm families, who may be less likely to choose to farming as a career after witnessing the stress and hardships experienced by their parents.

The additional stress on dairy farmers and other growers has reportedly increased ‘community fragmentation’ particularly in the smaller towns where people have less time to devote to community activities due to on-farm requirements and pressure. Others feel that, overall, the districts have been quite resilient to the recent shocks and changes, and will continue to evolve in the face of continued change. The community of Lockington provides an example of community leadership and resilience in the face of change.

Profile: Lockington, Victoria

Lockington is approximately 35km to the southwest of Echuca and 25 km northwest of Rochester and within the Campaspe Shire. According to the CSIRO, it is just inside the Loddon-Avoca Sustainable Yield Region. Irrigation services are provided to the area by Goulburn-Murray Water as part of the Rochester Irrigation Area. At the time of the 2006 census, the town’s population was 421 with the state suburb population 784 people.



Figure 5.4: Welcome to Lockington

Source: JSA, March 2010

Lockington is an interesting example of a small community that has demonstrated significant initiative, leadership and energy to maintain and foster growth of the community despite declines in agriculture that have been experienced over many years and particularly recently due to the drought and reduced allocations. However, as the drought continues and allocations remain low there are concerns for the future of the district.

Lockington was founded in 1915, and grew through the introduction of ‘soldier settlement’ and the Rochester Irrigation Area after World War II. It has been a service centre for surrounding farms for many years, with a variety of services and facilities including health services, post office, library, primary school, preschool, retirement village, churches, swimming pool, heritage museum, parks and sporting fields. The town also has retail services including a supermarket,

hardware, bakery, butcher, takeaway food, DVD rental, hairdresser, pub, café and a few agricultural support services.



Figure 5.5: Lockington town centre

Source: JSA, March 2010

Whilst residents report that the town of Lockington is thriving (“there’s no trouble selling a house in town!”) due to migration of district farmers to town and from ‘tree changers’ from further afield, there is a perception that the population of the surrounding farms and district has declined in recent years due to drought and decline of the dairy industry.

However, declines in the area have been something that residents have been concerned with for many years. In the early 1990s, the Lockington Community Care Committee and Progress Association obtained Municipal Association of Victoria funding to develop units for aged and disadvantaged residents. The group received funding for two units and built four. The project was a success and in 2006 the group was able to garner additional funding and utilise their own capital (through rental and sale of ‘right to occupy’) for 12 additional units to grow the complex. This project demonstrates the sustained engagement of many in the community to maintain and improve services for the town.

In 1993, Lockington’s only bank closed its doors. Members of the community decided to actively pursue a community bank to locate services in Lockington. The project took many years, an unsuccessful campaign in 1999 and proposals to the Federal Government Rural Transaction Centre Program. In 2003, the Lockington and Elmore communities joined in partnership to attract a community bank. A six-week campaign by the communities raised \$200,000 in pledges for the initiative. Ultimately the project was successful with Bendigo Bank agreeing to open branches in Elmore and Lockington.

The secured agreement with Bendigo Bank required the community to provide premises to house the branch. While the Lockington community had purchased a block of land for the branch, around the same time the last fuel pump outlet in Lockington went up for sale. Realising that the loss of the fuel pump would have a much more profound impact than gaining a bank, a group of 20 residents each contributed \$10,000 (through unsecured loans) and bought the fuel outlet. Within a few months of purchasing the outlet, upwards of 70 community volunteers worked to get the Lockington District Business Centre ready for to house the Bendigo Bank and provide fuel services. The community was able to complete the transformation of the space without

interrupting fuel services! It was not long before the Bendigo Bank was operating from the centre.



Figure 5.6: Lockington District Business Centre

Source: JSA, March 2010

In the years that followed, the centre has continued to be staffed solely by community volunteers. The centre now not only offers fuel, some automotive products and the Bendigo Bank, but also a car wash, laundrette, opportunity shop, Traveller's Rest Caravan Park, Men's Shed and 'Neighbourhood House' which runs a range of classes and activities from computer courses to scrapbooking for children and adults. Centre activities are staffed by 80 volunteers from the community, and also through active grant writing to local, state and federal governments. The centre estimates that the community contributes \$80,000 of voluntary hours each year. In 2009, the centre received funding from the Victorian Department of Planning and Community Development Neighbourhood House Co-ordination Scheme to employ a part-time centre manager for 10 hours a week. The business centre has played a vital role in strengthening the community. The many opportunities it provides people to contribute effectively to the community also gives locals a sense of pride.⁵⁸

Despite the tremendous efforts of local residents, the pressure on the district from continued drought, declines in agriculture and long term trends are taking their toll. The Foodworks-Thriftylink supermarket and hardware store in town has been for sale for the past 12 months with little to no interested purchasers. The store reports selling 6-7 pallets of green groceries per week and employs 12 full time and 25 part time positions. The majority of the part time employees are local high school students, who manage a 2-3 hour shift after school. The store's turnover has reportedly dropped by approximately 72% from \$900,000 in 2002 to \$250,000 in 2009. The current owners feel that "where we've lost our business we are not going to get it back." For the past two years, the Essendon Rotary Club in Melbourne has sponsored farm families with \$250 vouchers through the Lockington Foodworks. This donation program has kept money in the community, as opposed to encouraging shopping outside of Lockington, and has provided some welcome assistance to struggling farming families.

⁵⁸ Correspondence from Centre Manager, Lockington District Business Centre, July 2010.



Figure 5.7: Dairying in Lockington

Source: JSA, March 2010

Although residents expressed strong concerns for the future of the district, and particularly the wellbeing and resilience of farming families in the area, there is a continued energy towards the future and thinking about what the community can do to attract visitors and new residents to the area. There is interest in capitalising on the town's close proximity to Echuca to potential to capture tourist traffic coming and going from Bendigo and Melbourne, particularly those interested in local food products. There is also an initiative to start a 'commercial kitchen' to make local cheese products.



Figure 5.8: Providore on Hopetoun, Lockington

Source: JSA, March 2010

6. Predicted ‘long term’ impacts

The primary driver for long term reductions in water availability in the short term will be government policy, such as through the setting of new Sustainable Diversion Limits under the Basin Plan. Reduced water availability for high and general security license holders will have an impact on agricultural production and the amount of water available to be traded.

As our modelling shows, with a permanent reduction in water availability (ranging from 10% to 50% of irrigation water applied in a model year) Campaspe could lose between 949 to 4,744 people and 339 to 1,694 jobs. Water trade within the area is less likely to be a significant mitigation for job losses compared to some other areas, due to the high proportion of employment associated with grazing (irrigated dairying) which is also the predominate water user. Impacts to other indicators of community wellbeing and resilience that are predicted include an increase in youth unemployment and a decrease in assault and property crime.

Our research also shows that **population size, remoteness, Indigenous population size and median age** account for much of the variation in community wellbeing and resilience across the MDB. How these attributes are expressed in Campaspe provides insight into the community’s resilience to future reductions in water availability.

Campaspe has a relatively large population at around 36,000 residents, which is likely to contribute to its resilience however it has not reached the size of a major regional centre such as Shepparton at 57,000 residents. The fact that Echuca grew by around 13% from 2001 to 2006 is related to its amenity, role as a regional centre and the availability of relatively high water security during the period. It is also one of the least remote of the case study areas, due to its proximity to Bendigo and Melbourne, which is likely to contribute to its resilience. Campaspe has the lowest Indigenous population rate of the case study areas, especially compared to other northern basin communities. As areas with larger Indigenous populations were found to have lower levels of wellbeing and resilience as per the indicators, this does not appear to be a risk factor for Campaspe. Older populations were found to have lower levels of wellbeing and resilience across some variables. Campaspe has the oldest age profile of the case study communities, and has experienced considerable ageing of the more rural parts of the LGA between 2001 and 2006, which is an indicator of future vulnerability. The ageing of the resident population as well as an in-migration of retirees is likely to provide impetus for service sector growth, though there is limited evidence of a major growth in employment opportunities in other sectors at the present time.

6.1. What can the ‘short term’ experience tell us about likely ‘long term’ impacts?

Echuca appears to have been buffered to the most severe impacts of the drought compared to other areas, as evidenced by its population and employment growth. This is likely to be related to attributes described above as well as other factors such as:

- Amenity aspects of the area to attract tourism and ‘tree change’ migrants from other areas,
- The presence of a diversity of agricultural industries that draw from the wider region, and
- Ability of irrigators to actively trade on the water market enabling their survival in the short term.

However, smaller communities across Campaspe that are more directly dependent on agriculture, particularly dairying, have suffered. As reported by the DPI, the rate of dairy farmers exiting the industry in recent years has increased significantly with many others uncertain about what to do next in the face of continued stress and adjustment. Across the wider area irrigators and industries have responded to the drought through consolidation, infrastructure modernization, utilisation of the water markets and other adjustments. The recent decommissioning of the Campaspe Irrigation Area is likely to have significant impacts at the farm and local community level for those directly affected. There is likely to be tremendous capacity for resilience among some small towns, as has been demonstrated in Lockington.

For all of these reasons, we find that our hypothesis – *that the impacts of changes in water availability will be differentially distributed at different scales and in line with key attributes and mitigating factors identified in the research* – is supported through our exploration of Campaspe as a case study.

The Campaspe LGA as a whole is likely to be more resilient than other communities in the Basin in the face of reduced water availability in the future. Nonetheless, its population has not yet reached the critical mass of 50,000 for a major service centre and remains quite heavily reliant upon primary agricultural production and related processing and distribution. While Campaspe may experience less adverse impacts compared to other basin communities with less favourable indicators of wellbeing and resilience, such as many of our northern basin case studies, there will undoubtedly be differential impacts experienced between Echuca and the wider Campaspe area. Impacts are likely to be felt more acutely by relevant groups and in smaller communities that are more directly dependent on irrigated agriculture and its associated industries.

Appendix 4: Dalby-Wambo QLD Case Study



Report 4: Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Social and economic impacts of reduced irrigation water

July 2010

This report has been prepared for



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1 Key Findings

1.1 Background

The primary driver for long-term reductions in water availability for irrigation communities in the Murray Darling Basin will be government policy, including the purchase of water entitlements under *Water for the Future* and the setting of new Sustainable Diversion Limits under the forthcoming *Basin Plan*. Climate change is also projected to have an impact on reduced water availability by 2030. Whilst there are likely to be benefits from increased water for the environment, reduced water for irrigation will result in a range of social and economic impacts on agriculturally dependant communities across the Basin. It is important in this regard to distinguish between short-term stressors such as rainfall variation and fluctuating commodities prices, to which agricultural communities have been adapting over many years, and more permanent impacts from a long-term policy-driven and climatic reduction of water for consumptive uses.

In the face of possible permanent reductions in water availability and the associated impacts, this part of the study aims to answer the question, ‘how resilient are communities likely to be to change?’ A number of factors were found to predict changes in indicators of wellbeing and resilience in earlier stages of this study¹ including changes in employment and population. Our findings for the MDB were generally in line with other research on rural and regional communities, with key indicators that predict wellbeing and resilience including degree of remoteness, degree of urbanisation (population size), proportion of Indigenous people particularly remote populations,² and age of the population.³ Degree of economic diversity and opportunities to diversify were also relevant factors identified in the literature,⁴ though our findings indicate that these factors are largely a function of other more endogenous factors like remoteness, proximity to a large urban centre or to other economic resources like extractive industries. Though things like community leadership and collaborative initiatives are important,

¹ JSA (2010) Report 2: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Understanding Agricultural Employment*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri; and JSA (2010) Report 3: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Irrigated Agriculture and Socio-Economic Indicators*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri.

² JSA (2010) Report 2: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Understanding Agricultural Employment*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri; and JSA (2010) Report 3: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Irrigated Agriculture and Socio-Economic Indicators*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri.

³ JSA (2010) Report 2: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Understanding Agricultural Employment*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri; and JSA (2010) Report 3: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Irrigated Agriculture and Socio-Economic Indicators*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri.

⁴ JSA (2010) Report 1: *Scoping Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Scoping Paper*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri.

it can be difficult for communities to respond to major stressors where they have characteristics that work against their ability to adapt to change.

To explore the likely social and economic impacts and degree of resilience to more permanent changes in water at different geographic scales, JSA has researched eight case studies across the Murray Darling Basin in different types of irrigated agricultural communities. The eight case study areas are Dalby-Wambo, Queensland; Balonne, Queensland; Moree Plains, NSW; Bourke, NSW; Griffith, NSW; Campaspe, Victoria; Mildura, Victoria; and Murray Bridge, South Australia. These are augmented by an overview of the regional context or of smaller communities within these areas to illustrate some of the impacts that are likely at different scales.

This report presents the findings of the Dalby-Wambo, Queensland case study. The key findings from the study, particularly the area's current status against a range of wellbeing and resilience indicators is presented first, and is followed by a detailed discussion of quantitative and qualitative findings from the research. It is important to note that, although we have only been able to focus on eight areas, it is hoped that the case studies will provide some information for communities within the Basin facing similar challenges, and draw out the characteristics that are likely to mitigate or exacerbate the impacts of permanent reductions in irrigation water.

1.2 How Resilient is Dalby-Wambo likely to be to permanent reductions in water availability?

1.2.1 Overview of Findings

The Dalby-Wambo case study area lies within the Western Downs Regional Council and is part of the Darling Downs region of southern Queensland, an area known for its long-established agricultural and food processing industries. The area is also part of the wider Surat Basin, which includes the regional council areas of Toowoomba, Western Downs and Maranoa. The Surat Basin is rapidly growing due to the development of the region's energy reserves including coal, coal seam gas and liquefied natural gas.

Whilst there is tremendous optimism about the potential development and future of industry and communities in the region, there are also concerns about inadequate planning for growth and insufficient mitigation of adverse and cumulative impacts.⁵ Based on consultations we conducted in the Dalby-Wambo case study area, primary concerns amongst growers and other irrigators are mainly related to the array of impacts to agriculture that the development of the mining and energy sectors across the Surat Basin may bring, with the possibility of reduced water availability under the forthcoming Basin Plan a lesser concern at the present time. The Queensland Government has recognised the significant challenges and cumulative impact that several energy

⁵ Queensland Government (2010) Surat Basin Future Directions Statement.

projects are likely to create, as well as the land use conflicts between agriculture and mining that have already occurred and are likely to continue.⁶

At the same time, the community appears to be quite resilient, with very low level of unemployment, relatively stable population base over the past 30 years, a small amount of recent population and employment growth and a diverse, and an expanding economic base. It is also less disadvantaged than most other case study areas, and compares quite favourably on most indicators of wellbeing. It is relatively close to the major service centres of Toowoomba, Brisbane and the coast, which is likely to be an attractive location for relocation of younger and older people. Dalby has the critical mass of services and facilities to support a population of 15,000 in town and its immediate hinterland. These attributes are likely to mitigate the loss of agricultural employment to some extent, particularly in the short-to medium-term, if water availability for agriculture were to decline significantly. They indicate that the area is far less vulnerable to the short-term shocks and long-term stress than more remote case study areas in the Northern Basin like Moree Plains, Bourke and Balonne Shires, which have a far less diverse economic base and less favourable locational attributes.

Based on our consultations, impacts from reduced Sustainable Diversion Limits (SDLs) under the Basin Plan to either surface or groundwater are overshadowed by concerns regarding the adverse impacts to groundwater quality and supply as a result of coal-seam gas extraction. Growers and other agricultural industries in the Darling Downs are concerned about the potential for coal seam gas production and management of its 'associated water' to damage waterways, crop land and groundwater resources. They note the long-term sustainability and resilience of the agricultural sector in this regard, and are extremely concerned about potential threats to the sustainability of this sector and the longer-term impacts on related communities.

1.2.2 Dalby-Wambo's resilience 'report card'

Overview

The following provides an overview of key factors that have led to this assessment of how resilient Dalby-Wambo is likely to be in the face of further permanent reductions in water availability. Key factors are reviewed as a 'report card' on resilience, and include:

- Projected changes in employment, population, and indicators of community wellbeing modelled for 10%, 25% and 50% cuts in irrigation water on the 2005/06 growing season;
- Degree of reliance upon agriculture and in particular irrigated agriculture and related industries;
- Factors that have a statistically significant relationship on wellbeing and resilience;
- The current status of Dalby-Wambo in terms of existing socio-economic indicators; and

⁶ Queensland Government (2010) Surat Basin Future Directions Statement, pg 20.

- Factors which are likely to mitigate or worsen projected impacts identified in fieldwork and other research.

Each of these is looked at in turn below. This is followed by detailed data and information from desktop analysis and fieldwork undertaken from January to May 2010.

Population and Employment Impacts Forecast

The effects of cuts to irrigation water on Dalby-Wambo are small by comparison with other case study areas. This is because irrigated agriculture forms a small proportion of agricultural industries in the area and there are important non-agricultural industries in the area.

The 'long term' impacts of reduced water availability on Dalby-Wambo are predicted to be a loss of employment, ranging from a 0.1% loss (8 jobs) predicted from a 10% reduction in water availability, 0.3% loss (23 jobs) predicted from a 25% reduction in water availability, to a 0.7% loss (49 jobs) predicted from a 50% reduction in water availability, including direct and indirect employment in agriculture and multipliers. This is likely to be an underestimate as we do not have reliable data to estimate job losses associated with loss of irrigation water to cereal production. Based on data for cotton, job losses could be expected to be of the order of an additional 20 jobs at a 50% level of reduction. Subsequent population loss is estimated at a 0.2% loss (23 people) predicted from a 10% reduction in water availability, a 0.4% loss (66 people) predicted from a 25% reduction in water availability, to a 0.9% loss (137 people) predicted from a 50% reduction in water availability.

Predicted Changes in Indicators of Wellbeing and Resilience

Modelling of impacts on indicators of community wellbeing and resilience for Dalby-Wambo from reduced water availability predict that these indicators are expected to be generally unchanged.

Factors Affecting Wellbeing and Resilience

Dalby-Wambo is well positioned against the key factors found to affect community wellbeing and resilience. The area's location on primary transport routes and its close proximity to a larger regional centre (Toowoomba) and a capital city (Brisbane) are key strengths. While its population is around 15,000, not yet achieving the critical mass of larger regional centres, it services many more remote and smaller communities further to the west for particular products and services related to agriculture and mining. While agriculture plays a dominant role in the local economy, it is also reasonably diverse with value adding industries as well as significant employment in manufacturing, mining and energy. Moreover, as the mining and energy sectors further develop in the coming years this diversity and strength in other areas beyond agriculture is likely to continue.

As such, though there may be adverse impacts on agriculture from permanent reductions in surface water through existing and forthcoming Federal policy, the fortunes of Dalby-Wambo are not as tied to its agricultural base as other smaller, more remote and less economically diverse case study areas in the Northern or Southern Basin. In any case, as noted earlier, these are overshadowed currently by potential groundwater and landuse impacts related to expansion of extractive industries. The following table provides an overview of these key factors, which are discussed in more detail in the body of the case study report.

Table 1.1: Key Factors in Community Resilience

Statistically Significant Factors	Likely to be Resilient?	Comment
Remoteness	√	One of the least remote case study areas under the ABS Remoteness Classification, and less remote than MDB average.
Degree of Urbanisation: Population Size	√?	Dalby-Wambo has over 15,000 people, and services a wider amalgamated LGA of around 30,000 people. It is also a service centre for a wider hinterland for mining and agriculture related products and services.
Proximity to a large regional centre	√	Within commuting distance to Toowoomba (< 1 hr) and to Brisbane and the coast (2.5 hrs).
Indigenous Population	√	Equivalent to MDB average (4.9%), but higher than Australia. Limited impacts on indicators of wellbeing and resilience expected (2.3%).
Age	√	Younger than the MDB and Australian median age. Likely to attract and retain a younger workforce including in entry-level jobs in agriculture, mining and related sectors. The strong agricultural sector is also reported to be leading to greater retention of younger people than some areas.
% of employment by industry compared with Australian benchmark	√?	Reasonably diverse economic base compared with MDB, but not as diverse as Australia. Some benefits of being a district service centre, and having other opportunities in manufacturing, mining and energy. Remains relatively dependent upon agriculture and related industries (e.g. value-adding and services to agriculture).

Current Status on Community Resilience Indicators

The current status of Dalby-Wambo regarding key socio-economic indicators is necessary to understand its resilience or vulnerability to changes in employment related to reduced water availability. The following provides a 'report card' on the extent to which the current status of Dalby-Wambo compares with the MDB and National benchmarks.

In summary, the following shows a community that has prospered from its agricultural base and related industries, its proximity to a larger regional centre and capital city in terms of lower levels of disadvantage, higher levels of economic resources, low levels of unemployment and steady employment and population growth. However, there are some indicators of vulnerability

including relatively low education and occupation index, low skills base, low level of school participation at 16 years and mixed health indicators. The adaptive capacity of the workforce may be an issue if there is a change in availability of lower skilled jobs, or significant structural economic change. There also appears to be significant turnover in the population with a high level of in-migration yet modest overall growth, which may reflect a more transient and less stable community. Moreover, the inter-censal statistics indicates an areas that is not 'booming' but rather 'holding its own'.

Table 1.2: Current Status Report on Indicators of Community Resilience

Proxy Indicator of Resilience	Likely to be Resilient?	Comment
Community Wellbeing:		
SEIFA Disadvantage (includes indicators related to people's access to material and social resources, and their ability to participate in society)	√	Less disadvantaged than MDB, though more disadvantaged than the Australian value.
SEIFA Economic Resources (including income, housing expenditure and assets of households)	√	Higher than the MDB, but lower than the Australian average. Residents have greater access to economic resources than MDB, indicates higher incomes and higher level of home ownership, higher value assets, better incomes, etc
Median Household Income	√	Lower than Australian median, but much higher than the MDB average, likely due to increased diversity of jobs including in construction, manufacturing and mining and those associated with a regional centre including professional services.
Social Capital /Volunteering rate	√?	Slightly lower than MDB average, but much higher than Australia and higher than many of the case study areas.
Disability Support Pension	√	Slightly lower than MDB average but higher than Australia, in part likely to be due to the range of services available as a regional service centre.
Premature Death	X	Slightly higher than MDB and Australian average, may be due to a higher level of industry-related accident and injury, and suicide, and possibly disadvantaged populations including Indigenous people.
Profound or severe disability	√	Lower than both the MDB and equivalent to Australia, likely due to a lower median age.
Chronic Ill Health	X	Higher than both the MDB and Australian averages, potentially due to some industry and demographic effects, and being a better-serviced centre.
Economic growth/Human Capital :		
Change in Total Employment 2001-06	√?	Equivalent to MDB at 1.5%, but much lower than Australia's total growth (almost 10%). Not 'booming' but 'holding its own', with construction and development associated with mining, energy and residential sectors occurring, and some buffering against drought effects experienced in other parts of the Northern Basin probably

Proxy Indicator of Resilience	Likely to be Resilient?	Comment
		due to grater economic diversity.
Labour force participation 15+ years	√	Slightly higher than MDB & national average. Likely influenced by opportunities for entry-level and higher skilled jobs in agriculture, mining and related sectors.
Labour force participation 65+ years	X	Slightly higher than the MDB, and double the national average. Likely associated with an older farming work force, though also reported to be reasonable retention of younger people in more profitable sectors like cotton.
Post-school qualification (skills base)	X	10% lower than MDB and 28% lower than the national average, likely related to availability of entry-level job opportunities and the nature of industry sectors. Raises issues related to adaptive capacity of the local workforce in relation to structural change.
School participation at 16 years	X	10% lower than MDB and 15% below Australia, again likely related to availability of entry-level jobs, and low youth unemployment rate. Again raises issues related to adaptive capacity of the local workforce in relation to structural change.
SEIFA Index of Education and Occupation (brings together relevant Census variables on the general level of education and occupation-related skills of people within an area)	X	Well below MDB average and much lower than Australia, likely reflecting underlying lower level of human capital resources related to the nature of local employment. Indicates there may be many people with few qualifications, or unemployed or in low skilled occupations; and few people with a high level of qualifications or in highly skilled occupations. Again, the adaptive capacity of the workforce may be an issue if there is a change in availability of lower skilled jobs.
GINI co-efficient of household income distribution/polarisation	X	Like other areas of the MDB, Dalby-Wambo shows quite a high level of polarisation between the 'haves' and 'have nots' based on household income.
Youth unemployment rate	√?	Lower than average youth unemployment, this is reported to be lower since the post-2006 expansion of mining and energy. Reports of recent labour and skill shortages for agriculture and other industries, and impacts on cost and supply of labour through competition with mining and energy sector.
General unemployment rate	√?	Lower than average unemployment, which is again reported to be lower since the post-2006 expansion of mining and energy. Reports of recent labour and skill shortages, and again increased competition for labour.
Amenity:		
Population Growth /Retention	√?	At 1.4%, growth was higher than the MDB average of areas, but around one-quarter of the average growth for Australia. Not an obvious 'tree change' location, though consultations indicated that the area is advertised as such.

Proxy Indicator of Resilience	Likely to be Resilient?	Comment
		Again, not 'booming' but holding its own.
In-migration	√?	30% moved in from outside the SLA, which was much higher than the MDB and Australia. Relatively low total population growth signifies high turnover of population indicative of more transient industries like mining and construction.

Other factors that indicate vulnerability or resilience from consultation

The Darling Downs has a long history and reputation as a productive agricultural area. In consultations, growers and industry peak bodies described the benefits of the area in terms of its soil type and climate compared to other areas. As one grower said, *'We can grow anything here. Our only limiting factor is water.'* The reduction in rainfall experienced in recent years has had a tremendous impact on water security for irrigators in the area. While irrigation in the Upper Condamine catchment is 'regulated' by dams and weirs in certain areas, there are many other irrigators in areas that rely on groundwater and water harvesting when flows are available. As a result, there has been more limited access and ability to trade, as well as ability to participate in the federal buyback of permanent water entitlements to date. Increased access and use of groundwater to supplement surface water flows in recent years has raised concerns about the long-term sustainability of the aquifer. While the Queensland State Government is reviewing the sustainable yield limits of the aquifer, with reductions to current entitlements expected to be significant, there remains concerns about the relationship between groundwater accessed for agriculture and groundwater associated with coal seam gas extraction accessed at deeper levels.

The mixed industry profile of the area, particularly the development of the mining and energy sectors, adds to the area's resilience in terms of economic opportunities and prospective growth. However, the traditional economic and social base of the area is strongly agricultural and could experience increased vulnerability both from permanent reductions to water availability from government policy and climate change, but also from the development and expansion of extractive industries in the region. Growers and peak bodies consulted expressed serious concerns about future impacts of these changes not only to their lands and livelihoods, but also to the ability of the area to remain a prime agricultural producer for the nation in the long term. As such, expansion of opportunities in extractive industries could be seen as a 'double edged sword' in terms of community wellbeing and resilience.

Table 1.3: Other factors of vulnerability and resilience relevant to Dalby-Wambo

Factor	Likely to be Resilient?	Comment
Nature of 'next best' land use with reduced water	X?	Generally irrigated cereal or dryland cropping. However, commodity price dependent, so no alternative to cotton may be grown in some years. Limited horticulture due to water

Factor	Likely to be Resilient?	Comment
Potential benefits of water trade	X	security issues. Some within area trade, but out of area trade reported to be very limited due to: • Reduced connectivity of Upper Condamine catchment due to many 'unregulated' parts of the system; • Uncertainty around whether 'opportunity based' licenses are worth trading due to inconsistent nature of supply; and • No participation in Federal buyback to date, reported to be related to the low security water and lack of environmental assets of interest to Government in the catchment.
Past responses to 'stressors' (e.g. drought)	√	Cushioned from drought until 'bad years' of 06/07, 07/08 and 08/09, possibly contributed to no population loss from 2001 to 2006. Ability to augment irrigation water in times of low flow through groundwater extraction - 'an insurance policy'. However, this reliance on groundwater has led to concerns about over-allocation, over-use and long term sustainability of the resource. Cotton growers reported they have become 'opportunistic irrigators', with a mixed crop portfolio to spread risk including fluctuations in water availability as part of robust business strategy, rather than solely 'cotton farmers'. Significant increase in on-farm efficiencies including improved metering and applying 'no till' practices. Agricultural benefits in the district from good soil profile with high water retention.
Ability to make further efficiency gains	X?	Gains that are cost-effective are reported to have been put in place during times of low water access, and to increase production through technological advances and research as part of good business practice. Lower water security than areas of the Southern Basin are reported to have been responsible for ongoing initiatives to increase efficiency. Further water efficiencies reported to be very limited without major capital investment. This is very unlikely in the current climate of uncertainty and risk. Major concerns about imminent cuts to groundwater under review of State policy and regulations.
Access to Other Economic Opportunities	√	Access to minerals and energy resources (coal, coal seam gas extraction, ethanol plant, etc) likely to have significant benefits in short to medium term employment growth and economic development, though also identified as potentially having significant longer term social and environmental costs. Manufacturing sector reported to be strong, including local companies with national markets and good growth

Factor	Likely to be Resilient?	Comment
		opportunities. Options for more intensive agriculture (feedlots), though also exposed to water and commodity price risks. Located on Warrego Highway linking large mining and agricultural hinterland to Toowoomba and Brisbane, so opportunities for expanded warehousing and distribution, as well as relocation of other manufacturing businesses.
Natural attributes	√?	Agriculture benefits from good soil profile with high water retention capacity. Wider community benefits from locational advantages and proximity as noted above. Reported to be some increase in lifestyle block take-up by 'tree changers' due to proximity to larger centres and good services. Presence of minerals and energy resources for exploitation, though there is concern about long-term impacts that may arise.
Leadership /Social Capital	?	Leadership evident around key water issues from consultations among agriculture and related industries and NRM bodies. Some participants also expressed uncertainty regarding how engaged Council and other economic development and civic co-ordination groups are in proactively addressing groundwater issues and responding to Federal water policy, as focus appear to be on growth related to energy and mining sectors.
Other factors in vulnerability /resilience identified in consultations	?	Reductions to groundwater entitlements are likely under revision of plans and regulations. Irrigators consulted estimated that a significant reduction (of perhaps 60%) may be phased in by 2014. This is regarded as a high risk given the importance of groundwater in supplying potable, industry and irrigated agricultural, and stock and domestic needs, with increased importance during periods of low surface water availability. Serious concerns raised by agricultural industry groups regarding short and longer-term viability of farming from pressure on groundwater, agricultural land, labour and services from the growing mining/energy sectors including open-cut coal and coal seam gas extraction. Associated environmental and community impacts were raised as serious concerns. Concerns were also raised about competition for and contamination of groundwater from neighbouring and possible increase in feedlots. Community benefits of mining/energy need to be considered in the context of community and sectoral costs. As such, a thorough EIS including cost benefit analysis appears to be warranted.

2 Introduction

In June 2009, Judith Stubbs and Associates (JSA) were engaged by the Cotton Catchment Communities Co-operative Research Centre to undertake a significant research project investigating wellbeing and resilience of communities, particularly those engaged in irrigated agriculture including cotton, within the MDB. The study seeks to understand the likely social and economic impacts on communities at different scales arising from changes in government water policy, in particular, *Water for the Future* and the forthcoming *Basin Plan*, and projected climate change. This project included three research strategies and has so far produced three reports.⁷

2.1 Rationale

Given findings from the literature and the first three reports of this study, it is likely that the social and economic impacts related to changes in water availability will be experienced differently at different geographic scales (eg. farm, local community, region, MDB, national), and by different groups within a community (e.g. farmers, Aboriginal people, businesses). Key factors will include the existing wellbeing and resilience of these communities, and other mitigating factors such as access to the water market and alternative economic opportunities.

In order to understand the differential impacts upon areas and groups, we have carried out a cost-benefit analysis to determine impacts at the MDB and national levels and prepared eight case studies to explore the likely impacts at the farm, regional and local community levels. These documents comprise the fourth and final report for this study.

The eight case study areas were selected in order to represent different states, different CSIRO Sustainable Yields Regions, cotton and non-cotton producing areas, a diversity of irrigated agricultural uses and diversity across three key attributes including population size, remoteness and Indigenous population. The eight case study areas include Dalby-Wambo, Queensland; Balonne, Queensland; Moree Plains, NSW; Bourke, NSW; Griffith, NSW; Campaspe, Victoria; Mildura, Victoria; and Murray Bridge, South Australia.

2.2 Case study methodology

This case study is informed by JSA's extensive analysis of agriculture and population data; a review of policy, relevant document and reports; and a series of telephone and face-to-face interviews with individuals from a range of perspectives and organisations.

⁷ JSA (2010) Report 1: Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Scoping Paper, JSA (2010) Report 2: Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Understanding Agricultural Employment, and JSA (2010) Report 3: Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Irrigated Agriculture and Socio-Economic Indicators.

Interviews, workshops and a field visit to the Dalby-Wambo area were conducted from February to May 2010 in order to understand how water availability, agricultural land use and agricultural employment has changed in recent years as a result of government policy and short term climatic change (eg, the recent drought); how these changes resulted in social and economic impacts at the farm and wider community levels; and therefore how more permanent reductions in water availability (eg, new SDLs through the MDBA Basin Plan) are likely to affect wellbeing and resilience at the farm and community level.⁸ There was a high level of participation from irrigators, dryland farmers, peak industry groups and the QMDC, as well as local community services. While we had brief discussions with council staff and attempted to engage civic leaders more broadly, a shortcoming of this case study is the minimal input from Western Downs Regional Council, and it is hoped that their input will be provided on this draft report.

2.3 Case study content overview

This case study provides:

- A description of the case study area including its location, land and water use, water policy, and relative social and economic wellbeing and resilience against key indicators;
- A prediction of impacts to community wellbeing and resilience based on hypothetical reductions in water availability of 10%, 25% and 50% from the most recent year for which comparative agricultural and population data is available (the 2005/06 growing year and 2006 Census);
- An exploration of the 'short term' social and economic impacts that have been experienced as a result of the recent drought, fluctuations in commodities prices, water market and other relevant factors affecting communities; and
- An analysis of how the attributes of the area and other factors have exacerbated and/or helped to mitigate the impacts already experienced as an indicator of the area's resilience, and how it may therefore respond to more permanent changes in water availability under the forthcoming Basin Plan or permanent trade out of area.

⁸ Participants included 4 irrigated cotton growers, agricultural consultants, group of small scale croppers and irrigated dairy farmers, Condamine Catchment Management Association, Queensland Department of Primary Industries, Queensland Farmers Federation, Queensland Murray Darling Commission and the Western Downs Skills Project.

3 Description of case study area

3.1 Location

The Dalby-Wambo case study area is located in the Upper Condamine catchment in the north-east of the Balonne-Condamine Sustainable Yield Region, which forms the headwaters of the Murray Darling Basin. The town of Dalby is the headquarters of the Western Downs Regional Council, which was formed through an amalgamation of Dalby Town Council and the Shires of Wambo, Chinchilla, Murilla, Tara and Taroom in 2008. The area prides itself on its diversification, productive capacity and its growth over the last few years, 'reversing the trend of rural decline'. The area describes itself as, 'a hive of activity and growth through continued agriculture, manufacturing and resource diversification'.⁹



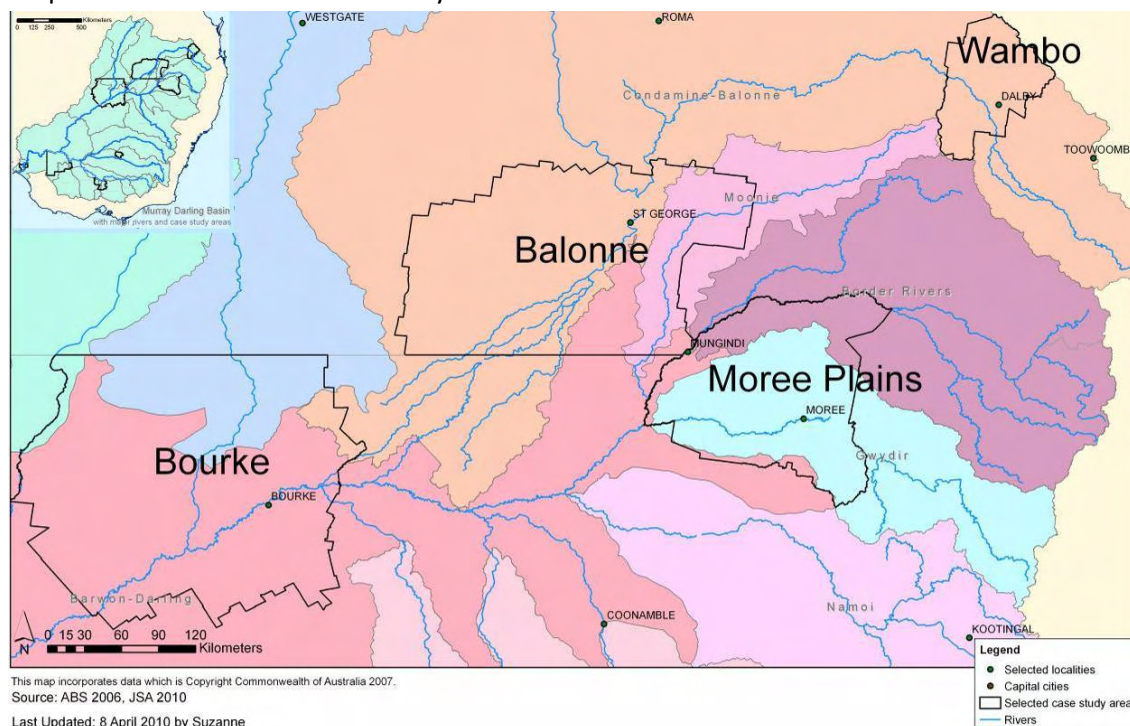
Figure 3.1: Condamine Street, Dalby

Source: JSA 2009

For the purposes of this study, the Dalby-Wambo case study area includes the Statistical Local Areas (SLAs) of Dalby Town and Wambo Shire based on 2006 census boundaries. The following map shows the location of the four Northern Basin case study areas, including Dalby-Wambo, in the context of the CSIRO Sustainable Yield Regions.

⁹ Western Downs Regional Council, Regional Profile, accessed online at www.wdrc.qld.gov.au/visitors/index.shtml, 31 March 2010

Map 3.1: Northern Basin Case Study Areas



3.2 Water and Land Use Context

3.2.1 Overview

The Upper Condamine catchment forms the headwaters of the Murray-Darling Basin and encompasses the Condamine River and its tributaries, upstream of the confluence with Myall Creek (southwest of Dalby). The Great Dividing Range bounds the area in the east, the Herries Ranges provide the southern boundary and the Bunya Mountains provide the northern boundary. Tributaries of the Condamine River flow away from the Great Dividing Range through relatively narrow valleys at the headwaters, with a gradual broadening to wide alluvial plains near the Condamine River. The Condamine River flows north and west across the Darling Downs before joining with Dogwood Creek, upstream from Surat, to become the Balonne River.

The main towns located throughout the catchment include Kilarney, Clifton, Pittsworth, Cecil Plains, Bell, Jandowae, Chinchilla, Barakula, Condamine, and the major population centres of Toowoomba, Warwick and Dalby.¹⁰ Land use in the Condamine-Balonne is dominated by cattle and sheep grazing, and there are significant areas of grain. Over 112,000 hectares of irrigated crops were reported to be grown in 2000, and 63% of this was cotton.¹¹ It is noted that this period preceded the prolonged drought that has affected irrigation in this region over the past decade.

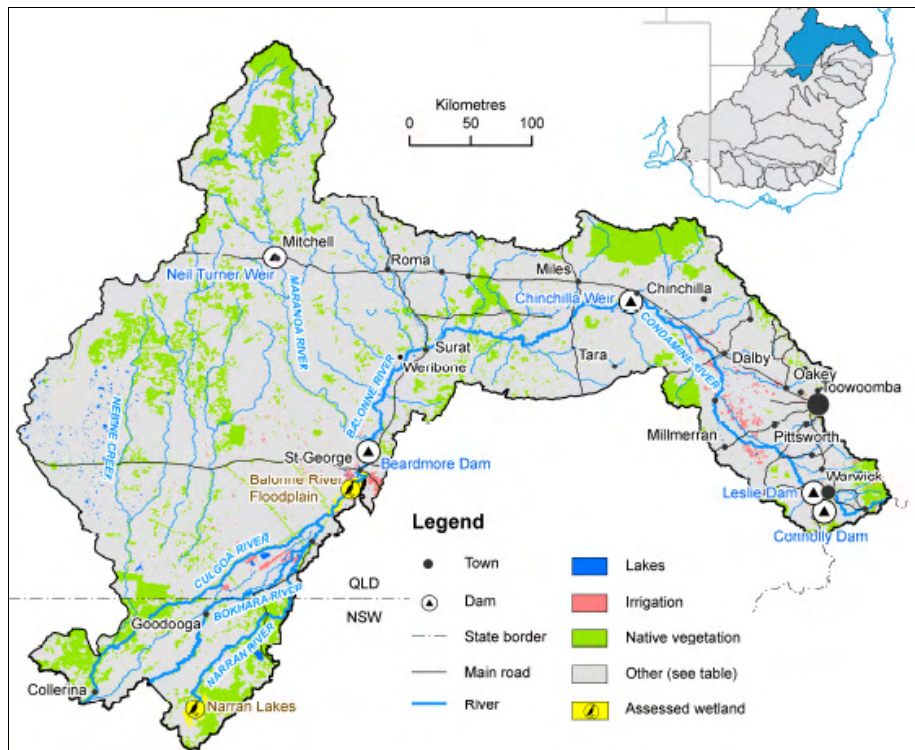
¹⁰ Queensland Department of Environment and Resource Management

¹¹ CSIRO (2008) *Water Availability in the Condamine-Balonne, Summary Sheet from the CSIRO MDB Sustainable Yields Project*, p.1.

3.2.2 CSIRO Condamine-Balonne Sustainable Yield Region & Projections

The Condamine-Balonne SYR is predominantly in southern Queensland but extends around 100 kms into northern NSW. It covers 13% of the land area of the MDB and uses 3% of surface water diverted for irrigation in the Basin and 10% of groundwater used for this purpose.¹² The region generates 8.5% of runoff in the MDB.

Map 3.2: Condamine-Balonne Sustainable Yield Region



Source: CSIRO (2008) Murray Darling Sustainable Yields Project

Surface Water

The Condamine is a largely unregulated ('unsupplemented'¹³) river system, apart from a small 'supplemented' section at Leslie Dam in the Upper Condamine Water Supply Scheme. The Upper Condamine Water Supply Scheme was initiated in 1965 with the completion of the Leslie Dam, and provides town water for Warwick and Cecil Plains as well as irrigation for a variety of crops including cotton. As a result of the largely 'unsupplemented' system, surface water security is a significant issue, and has been very unreliable during drought conditions in the past decade. The framework for surface water management in the area, including environmental flow

¹² CSIRO (2008) *Water Availability in the Condamine-Balonne, Summary Sheet from the CSIRO MDB Sustainable Yields Project*, p.1.

¹³ 'unsupplemented water' is water that is not supplied under an interim resource operations licence, resource operations licence or other authority to operate water infrastructure, as defined in the Water Resource (Condamine and Balonne) Plan 2004.

objectives and the regulation of supplemented and unsupplemented water, is detailed in the *Water Resource (Condamine and Balonne) Plan 2004* with its provisions implemented through the *Condamine and Balonne Resource Operations Plan 2008*.

It is noted that this part of the Condamine-Balonne catchment did not receive the substantial floods that have occurred elsewhere in southwest Queensland (such as the Lower Balonne) at the time of writing (April 2010). As at 1 April 2010, the Beardmore Dam at St George is sitting at 100%, while the Leslie Dam remains at 10% capacity.¹⁴



Figure 3.2: Condamine River (dry) outside Dalby

Source: JSA, February 2010

Based on the historical climate (1895-2006), the CSIRO reports that 53% of available surface water or 722 GL per annum is used for current development. This is assessed by the CSIRO as an 'extremely high' average use of surface water,¹⁵ which is reported to have significantly reduced end of system flows, including to the Ramsar-listed Narran Lakes Nature Reserve in NSW, part of the large terminal wetlands of the Narran River at the end of the Condamine System.¹⁶ The Culgoa Flood Plain National Park is the other major environmental asset in this region, and is located at the end of the Culgoa River that extends southward from the Balonne River Floodplain.

In terms of the CSIRO climate change projections for the Condamine-Balonne Sustainable Yield Region, the recent climate (1997 to 2006) is not statistically different to the historical climate averages. Under the CSIRO's best estimate of climate change, runoff in the Condamine-Balonne is projected to reduce by 9% by 2030. As a result, average surface water availability would reduce by 8%, total end-of-system flows would decrease by 12%, surface water diversions would reduce by 4%, whilst relative surface water use would be 55% (2% increase from current use).

¹⁴ SunWater Storage Levels, accessed www.sunwater.com.au/water_store.htm, 01 April 2010

¹⁵ CSIRO (2008) *Water Availability in the Condamine-Balonne, Summary Sheet from the CSIRO MDB Sustainable Yields Project*, p.1.

¹⁶ CSIRO (2008) *Water Availability in the Condamine-Balonne, Summary Sheet from the CSIRO MDB Sustainable Yields Project*, p.1.

Likely future development of farm dams and groundwater extractions are projected to have negligible impacts on stream flow and surface water use.¹⁷

Groundwater

The primary source of groundwater in the area is the alluvial aquifer associated with the Condamine River, otherwise known as the Condamine River alluvium. The Condamine groundwater management area starts downstream of the confluence of the Condamine River North Branch and the Condamine River near Tummaville, and ends about 10 kilometres south of Macalister. Water sharing rules apply to the use of groundwater in this system and are laid out in the *Condamine groundwater management area water sharing rules and seasonal water assignment rules 2006*.¹⁸

Monitored groundwater extraction in the Condamine-Balonne region was around 160 GL per annum for 2004-05, although actual use is thought to be around 25% higher,¹⁹ possibly due to unmetered usage in more remote areas and inadequate monitoring of water extraction reported during local consultations. Although only 18% of water used on average in the region is sourced from groundwater, groundwater is reported to be over 60% of total water used in times of low surface water flows.²⁰ The relatively heavy reliance upon groundwater in the Upper Condamine Catchment is particularly evident in the Dalby-Wambo area with 97% of the region's total groundwater extraction occurring in this part of the catchment.²¹ This is largely due to the ephemeral nature of Condamine River and its tributaries, which are particularly affected in times of drought. As such, the Dalby-Wambo area is highly groundwater dependent, and is reliant on this water source for irrigation, stock and domestic watering and potable town water to a far greater extent than any of the other selected case study areas.

Concerns regarding the future supply of groundwater from competing uses in the area are evident in consultations, including in relation to recharge capacity arising from the extended drought and usage patterns of surface and groundwater resources. These concerns would appear to be supported by data indicating that current rates of extraction at 15 of the 22 groundwater management units (GMUs) in the region are double the calculated recharge rate, and are 5 times the recharge rate at six of these GMUs.²² The CSIRO projects that groundwater extraction is likely to decrease overall due to management intervention through the downward revision of

¹⁷ CSIRO (2008) *Water Availability in the Campaspe*, Summary of a report to the Australian Government from the CSIRO MDB Sustainable Yields Project.

¹⁸ Queensland Department of Environment and Resource Management (2006) *Condamine groundwater management area water sharing rules and seasonal water assignment rules*, WMU/2005/2210 – Version 1, September 26.

¹⁹ CSIRO (2008) *Water Availability in the Condamine-Balonne*, Summary Sheet from the CSIRO MDB Sustainable Yields Project, p.1.

²⁰ CSIRO (2008) *Water Availability in the Condamine-Balonne*, Summary Sheet from the CSIRO MDB Sustainable Yields Project, p.1.

²¹ CSIRO (2008) *Water Availability in the Condamine-Balonne*, Summary Sheet from the CSIRO MDB Sustainable Yields Project, p.1.

²² CSIRO (2008) *Water Availability in the Condamine-Balonne*, Summary Sheet from the CSIRO MDB Sustainable Yields Project, p.1.

entitlements. If these steps were not taken, the CSIRO warns that the system would be ‘severely over-allocated’ and additional stream flow impacts would occur.²³

3.2.3 Water and land use in the case study area for a model year

We have used 2005/2006 as a model year for our analysis of social and economic indicators and agricultural land and water uses, and our predictive modelling of likely long-term impacts of reductions in water availability due to the availability of census data by small area.

Agricultural Land Use

Based on the ABS Agricultural Census of 2005-2006, there were approximately 402,466 hectares of land under cultivation in the Dalby-Wambo case study area. The majority of land was used for cattle and sheep grazing (57%), with the second largest area used for cereals, oilseeds and other broadacre crops at 38.6%, followed by 4.5% of cultivated land used for cotton.

Table 3.1: Agricultural Land Uses, Dalby-Wambo 2005/06

Agricultural Use	# Hectares	% of Agricultural Use Hectares
Grazing	228932	56.9%
Cereal, oilseeds, other broadacre crops	155433	38.6%
Cotton	17944	4.5%
Vegetables	75	0.02%
Grapes	70	0.02%
Fruit	12	0%

Source: ABS (2006) and JSA (2009)

Note: See *JSA (2010) Report 2 – Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Understanding Agricultural Employment, Appendix 2: Data sources and methods used*, for an explanation of how each agricultural use has been determined.

Agricultural Employment and Water Use

According to the ABS in 2005-2006, 57,259 megalitres of water were applied to irrigated crops and pastures in the Dalby-Wambo case study area.²⁴ The table below shows the proportion of total irrigation volume applied in the area by each type of crop or pasture. Cotton was the dominant use for irrigation at 73% of water applied, followed by cereal crops for grain or seed at nearly 21% of water applied. Other broadacre crops and pasture for hay and silage used around 2% of irrigation water applied each.

²³ CSIRO (2008) *Water Availability in the Condamine-Balonne, Summary Sheet from the CSIRO MDB Sustainable Yields Project*, p.1.

²⁴ Values refer solely to the Wambo Shire area, as values for Dalby Town were not provided.

Table 3.2: Irrigated Water Use and Employment in Dalby-Wambo 2005/06

Indicator	2005/06 (1)	% Ag Employment/ Water Use
Employment (Cereal)	473	37%
Irrigation water use (GI)	15.1	26%
Employment (Grazing)	468	36%
Irrigation water use (GI)	0.1	0.2%
Employment (Cotton)	167	13%
Irrigation water use (GI)	41.9	73%
Employment (Grapes)	8	0.6%
Irrigation water use (GI)	0.1	0.2%
Employment (Vegetables)	16	1.2%
Irrigation water use (GI)	0	0%
Employment (Balance Agriculture)	160	12%
Employment (Total Agriculture)	1291	100%
Irrigation water use (GI)	57.2	100%

Source: JSA (2009) derived from ABS (2008) Water Use on Australian Farms, 2005-2006: Estimates for Local Government Areas, 4618.0

(1) Allows for distribution of 'not stated', 'inadequately described' etc

Two major land uses represented the majority of agricultural employment in the 2005/06 growing season. Cereals, oilseeds and other broadacre crops employed 473 people, 37% of all agriculture employment, while grazing employed 468 people, 36% of all agriculture employment. Lesser but relatively high proportions of agricultural employment were in cotton 167 jobs (13%) and other agricultural services (12%). It is noted that this employment in 'cotton' includes on-farm and ginning activities only, while 'other agricultural services' includes flow-on employment such as aerial crop spraying and farm irrigation services. It is also likely that the importance of agriculture may be understated at the time of the last Census, as this represented the peak of the drought, and those facing more difficult economic situations were reported to be seek off-farm employment or leaving farming altogether for a time to work in the expanding energy and extractive industries.²⁵ It is also noted that employment in these sectors may be lower than an 'average' year due to drought effects.

On average, cotton makes up around 60% of irrigation crops grown in the region,²⁶ though irrigators interviewed noted that cotton will range from 30% to 70% of crop mix depending on water availability, growing and market conditions, where sorghum and wheat would generally be the next best use. Horticulture is reported to be relatively limited in this part of the catchment due to the greater profitability of other fibre and grain crops in a range of market conditions, as well

²⁵ Consultation interview, 18 February 2010.

²⁶ CSIRO (2008) *Water Availability in the Condamine-Balonne, Summary Sheet from the CSIRO MDB Sustainable Yields Project*, p.1.

difficulties in competing with established food growing areas of the Southern Basin and cost of establishing required irrigation, storage and packing infrastructure in a high risk environment.²⁷

3.3 Water Policy Context

3.3.1 Overview

This section of the case study provides a basic overview of the system of water policy that exists in the Dalby-Wambo case study area and how the availability of water has changed in recent years. The aim of this section is to provide a context within which to understand any future changes in water availability, for example through reduced SDLs as part of the Basin Plan.

The town of Dalby draws its water from ten underground bores from the Condamine Alluvium and surface storage on the Condamine River at Loudoun Weir and is reportedly 95% dependent on desalinated groundwater.²⁸ Likewise, the range of industries including farming, feedlots, manufacturing and the mining and energy sectors are largely reliant on groundwater for their operations. This is likely to expand considerably with proposed expansion of coal seam gas mining and the resultant extraction of groundwater as part of the mining process, and through related population and employment increases. The expansion of the coal seam gas industry has the potential to dramatically increase the extraction of groundwater²⁹, although it may also provide opportunities for reuse and recharge of highly treated coal seam gas water.

3.3.2 Management of Surface and Groundwater

The management of both surface and groundwater resources to ensure sustainability for all types of users is an increasingly complex task to be addressed by both the federal and state governments.

Under the *Queensland Water Act 2000*, water resource plans were developed to sustainably manage surface and groundwater resources for human and environmental uses. As mentioned, the *Water Resource (Condamine and Balonne) Plan 2004* with its provisions implemented through the *Condamine and Balonne Resource Operations Plan 2008* and the *Condamine groundwater management area water sharing rules and seasonal water assignment rules 2006* provide the framework for water management in the Dalby-Wambo case study area, including water sharing rules, environmental flow objectives and the regulation of supplemented and unsupplemented water. The plans place limitations on the amount of water that users can access from surface, groundwater and overland

²⁷ Consultation interview, 18 February 2010.

²⁸ Dalby Town Water Supply, accessed online at www.dalby.qld.gov.au/services/water_supply.asp 01 April 2010.

²⁹ CSG production across the Surat Basin is projected to bring 25 GL of 'associated water' to the surface each year for the next 25 years. Queensland Government (2009) Management of water produced from coal seam gas production: achieving environmentally sustainable outcomes and greater beneficial use of coal seam gas water, discussion paper, May.

flows. These water resource plans will expire in 2014, when new plans will be required under the forthcoming *Murray Darling Basin Plan*.

Throughout the recent dry period and subsequent declines in surface water flow and overland flows after large rainfall events, the reliance of irrigators on groundwater has increased, although irrigators report a mixed degree of reliance on groundwater. Those on properties adjacent to watercourses having direct pumping access to the river and creeks when in flow are predominantly reliant upon surface water, while those without direct access to watercourses are increasingly reliant on groundwater.

The recent gazettal of the *Condamine and Balonne Resource Operations Plan 2008* reassessed allocations based on current and historical water usage patterns, and will not significantly change access to surface water for irrigators. Irrigators consulted consider that the *Plan* represents ‘sustainable use’ as it provides for a maximum average extraction of 30% of river flows in this part of the catchment, compared with at least 46% elsewhere in the region. A water access regime has been negotiated that provides for priority environmental flows, and the activation of water licences of different volumes depending on river flows. As such, the major impact for irrigators reliant on surface water in recent years has been the drought. However, in their view the management of Coal Seam Gas (CSG) water has the potential to have a much greater impact on the long term sustainability of water availability in the region.

3.3.3 Management of Coal Seam Gas Water

CSG is a form of natural gas that is trapped in coal seams by water typically 300-600 metres below ground. This gas is considered to be a ‘clean gas’ requiring little treatment prior to use. The Queensland Government and other governments around the world are supportive of the transition from coal to gas to reduce greenhouse gas emissions. The process of extracting CSG also brings some of the underground water to the surface. This water is defined in Queensland legislation at ‘associated water’³⁰. CSG production has the potential to bring a tremendous amount of water to the surface. In 2007, 12.5 GL of water was extracted through the CSG production. CSG production across the Surat Basin is projected to bring 25 GL of ‘associated water’ to the surface each year for the next 25 years.³¹ In the context of groundwater sourced for agriculture, in 2005-2006 the entire Queensland portion of the MDB used 108 GL of groundwater and the Dalby-Wambo case study area used 16 GL.

Associated water is variable in quality and can contain high quantities of salt and other contaminants. As a result of its poor quality, it is unsuitable for direct release to the environment or for other uses without treatment. While disposal in evaporation ponds has been the primary management tool for CSG water, the Queensland government has stated that retention is not a

³⁰ “Associated water” means underground water taken or interfered with, if the taking or interference happens during the course of, or results from, the carrying out of another authorised activity under a petroleum authority, such as a petroleum well, and includes waters also known as produced formation water. The term includes all contaminants suspended or dissolved within the water.

³¹ Queensland Government (2009) Management of water produced from coal seam gas production: achieving environmentally sustainable outcomes and greater beneficial use of coal seam gas water, discussion paper, May.

long term sustainable management option due to the vast area of land (25-100 km²) that would be required to store and evaporate the ‘associated water’ as well as 1.8 – 7.5 million tonnes of salt likely to be produced.³²

The removal, use and on-supply of CSG water are governed by range of relevant Queensland state legislation including the *Petroleum and Gas (Production and Safety) Act 2004*, *Petroleum Act 1923*, *Environmental Protection Act 1994*, *Water Act 2000*, *Water Supply (Safety and Reliability) Act 2008* and the *Integrated Planning Act 1997*.³³ The *Petroleum and Gas Act 2004* provides a petroleum tenure holder the ‘right to take underground water during the course of, or resulting from, the carrying out of another authorised activity for tenure’. This water can be used for ‘stock and domestic’ purposes to land in the area of the tenure or adjoining land owned by the same person. The *PG Act* provide ‘authorisation from the Water Act’ for petroleum tenure holders to take or interfere with underground water and use ‘associated water’ for stock and domestic purposes as described above. To use CSG water for any other purpose, such as supplying treated CGS water for irrigation, the petroleum tenure holder must register as a water service provider and apply for appropriate licensing under the Water Act 2000.³⁴

Recently, the Senate Environment, Communications and the Arts Reference Committee conducted an inquiry into the impacts of mining in the Murray Darling Basin,³⁵ where it looked specifically at developments in the Namoi Valley and the Darling Downs.³⁶ The committee looked at the regulation of mining in relation to associated legislation to protect water resources at the Basin and state levels. The inquiry stated that there are three ways that mining can impact on water in the MDB - through consumption, dewatering of mines and subsequent disposal of wastewater and aquifer interference (e.g. where mining activities damage or destroy groundwater systems).³⁷ The inquiry noted that although mining will operate under the Basin Plan, the National Water Commission acknowledged in its submission that mining water is largely beyond the scope of the National Water Initiative (eg, as per the 2004 COAG Water Reform Agreement) and that the states had the primary responsibility for regulating the impact of mining on the environment, including water resources.³⁸ The Committee also stated that ‘it is not clear that the existing framework for managing impacts of new developments in the Basin is adequate’.³⁹ However, the Committee also found that there is not enough scientific evidence to understand the extent of damage mining activities could have on farms, regions or the MDB as a whole. Funding has been allocated for additional research, and the Committee has called for greater

³² Queensland Government (2009) Ibid.

³³ Queensland Government (2009) Ibid.

³⁴ Queensland Government (2009) Ibid.

³⁵ In this instance ‘mining’ refers to all minerals exploration and all minerals extraction including exploration for and extraction of gas.

³⁶ Commonwealth of Australia (2009) The Impacts of Mining in the Murray Darling Basin, Senate Environment, Communications and the Arts Reference Committee, December.

³⁷ Commonwealth of Australia (2009) Ibid, pg 25.

³⁸ Commonwealth of Australia (2009) Ibid, pg 25.

³⁹ Commonwealth of Australia (2009) Ibid, pg 33.

coordination between different levels of government to better understand the cumulative impacts of mining on regions and the MDB.⁴⁰ The committee's final recommendation is that, 'the Commonwealth Government works to ensure the prevention of new mines or extractive industries in the Murray Darling Basin if their impacts on water resources are inconsistent with the Basin Plan'.⁴¹

3.4 Social and Economic Context

This section of the case study explores population trends, employment and industry profiles and how the Dalby-Wambo case study compared with the other case study communities and the MDB average across a range of wellbeing and resilience indicators.

3.4.1 Population Profile

While the Darling Downs has long been known for its agricultural productivity, in recent years it has been growing and diversifying through further development in the mining and energy sectors.

Dalby Township

Dalby town is approximately 85 kilometres from the larger regional centre of Toowoomba, and 210 kilometres from the capital city of Brisbane. The town is well serviced and has access to a range of sporting and recreational activities.



Figure 3.3: Dalby town centre

Source: JSA, February 2010

⁴⁰ Commonwealth of Australia (2009) Ibid, pg 39.

⁴¹ Commonwealth of Australia (2009) Ibid, pg 40.

From 1976 to 1986, the Dalby township population declined by around 7%. Between 1986 and 1991, this trend reversed and the population rose by around 1,000 people (or 12% in a five-year period). The population has been relatively stable from 1991 to 2006 increasing by 4.7%, or by 26 people (around 0.28%) on average per annum. Growth since 1986 has likely been due to the growth in irrigated agriculture, more intensive agricultural uses (e.g. feedlots) and diversification and growth of other industries including mining, energy, manufacturing and service industries. The area's proximity to Toowoomba and Brisbane contributes positively to town growth and development.

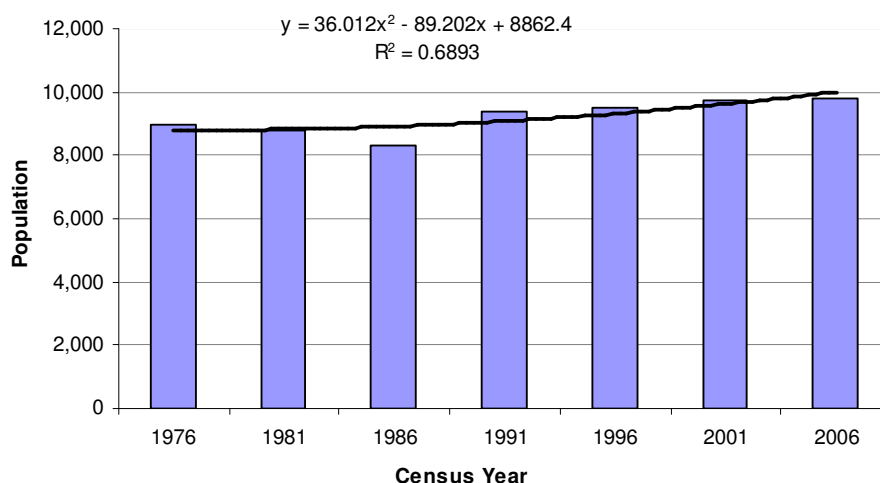


Figure 3.4: Population Change 1976-2006 for Dalby Township

Source: ABS Census of Population and Housing, by Place of Enumeration

Dalby-Wambo LGA

The combined Dalby-Wambo local government area has followed the same growth pattern as the Dalby township, although not as strongly. From 1976 to 1986, the combined area declined by 4% or approximately 60 people (0.4%) per annum. Between 1986 and 1991 the population increased by 734 people, or around 5% in the five-year period. Growth continued to steadily increase by an average of 30 people (around 0.2%) per annum to 2006. It is likely that most of the population growth occurred in the town of Dalby.

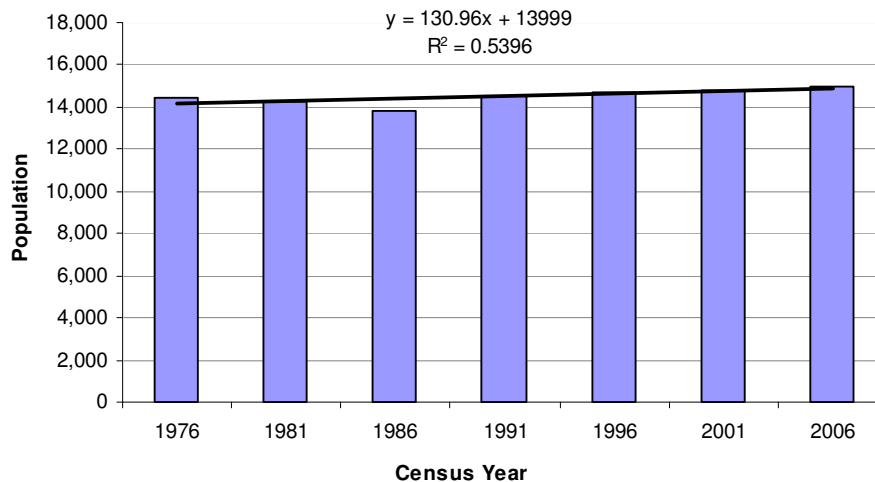


Figure 3.5: Population Change 1976-2006 for Dalby-Wambo Shires

Source: ABS Census of Population and Housing, by Place of Enumeration

The Dalby-Wambo case study area had just over 15,000 at the time of the 2006 Census, which was an increase of 1.4% on the 2001 population, and makes it the largest and most urbanised of the Northern Basin case study areas. It is far less remote than the other study areas and less remote than the MDB average of areas, being around one hour's drive from the regional city of Toowoomba and around 2.5 hours from Brisbane and the coast. The rate of growth for Dalby-Wambo was slightly higher than the MDB average of 1.1% for this period, and it was the only case study area in Northern Basin to experience positive population growth. In contrast, the populations of Moree Plains, Bourke and Balonne decreased by between 10% and 15% during this time. Dalby-Wambo's growth was considerably lower than that for Australia in the 5-year period (5.8%). Apart from Griffith, it also had a much lower growth rate than most of the Southern Basin case study areas, where Murray Bridge, Mildura and Campaspe grew by 2.4%, 4.3% and 5.4% respectively. However, the Queensland Government estimates that the Western Downs Regional Council area will experience considerable growth of between 11.7%-22% between 2008 and 2021 as a result of significant development in the Surat Basin.⁴²

3.4.2 Employment and Industry Profile

At 1.4%, employment growth in Dalby-Wambo was also slightly higher than the MDB average for 2001-2006 (1.2%), and far exceeded that of the other Northern Basin case studies, where employment declines ranged from 16% (Moree Plains and Bourke) to 19% (Balonne). However, local job growth but was well below that of most of the Southern Basin case study areas (between 4% and 7%), and a long way behind Australia (around 10% for the period).

⁴² Queensland Government (2010) Surat Basin Future Directions Statement, pg 12.

In 2006, 6,288 people were employed in Dalby-Wambo case study area, with the largest proportion employed in agriculture (1,163 people, 18.5%), though this was much lower than the MDB average (29%). Though generally more diverse than the MDB, the local economy was generally less diverse than Australia. Employment in retail and wholesale was higher than both benchmark areas, and made up 14% and 5% respectively of local jobs as would be expected in a larger regional centre. Education jobs were also somewhat above average (8.5%). Manufacturing was also a significant employer (10%) compared with the MDB (7%) though slightly lower than the national average. Employment in mining and utilities (2.5% and 1.5% respectively) was also somewhat higher than average, though a relatively small proportion of direct employment in the local economy in 2006. Employment in tourist-related activities was somewhat lower than average, as was that in health, public administration, professional and financial services and communication, though this may be due to Dalby-Wambo's proximity to larger regional centres with such services. The local employment mix is shown in more detail in the following figure.

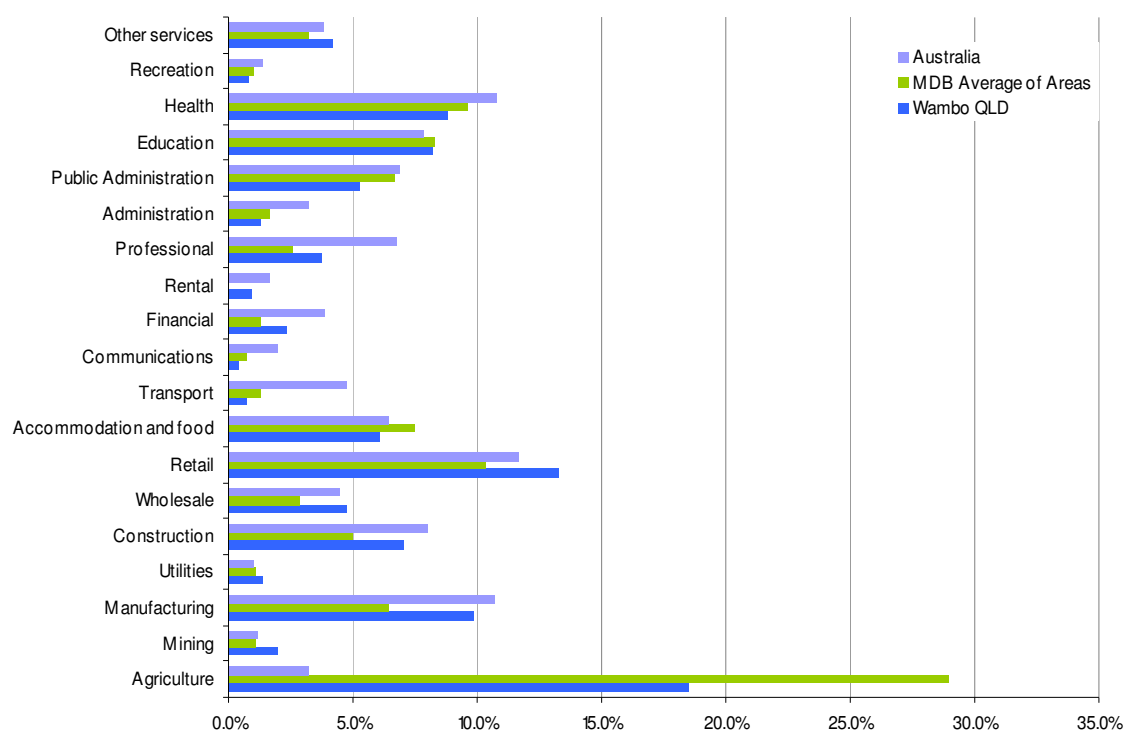


Figure 3.6: Employment Profile, Dalby-Wambo QLD

Source: ABS (2006) Census of Population and Housing, JSA (2009)

Significant expansion of the mining and energy sectors, particularly ethanol plant development and the mining and exploration of coal and coal seam gas, is reported to have occurred prior to and since 2006. The number of coal seam gas exploration wells drilled annually across

Queensland increased from 10 in the early 1990s to approximately 600 in 2007-2008.⁴³ Activities related to the expansion phase of these industries, such as construction, are also likely to expand in the short-term. For example, the Dalby Bio-Refinery is Queensland's first grain-to-ethanol production facility. Construction of the facility commenced in February 2007 with the plant operating since late 2008.⁴⁴ The facility employs, 'over 50 but less than 100 people'.⁴⁵ Nonetheless, the local economy remains relatively dependent on agriculture and the flow on employment related to this.

Dalby-Wambo has a far more diverse economy than other Northern Basin case study areas, with the considerable growth in extractive and energy-based industries including coal, coal seam gas, ethanol, manufacturing and service industries evident in the growth or employment and population over the past 15 to 20 years. At the same time, the mining and energy industries and related activities have been an important part of the regional economy for the past 15 years, and have had significant benefits to the economic and social life of the Dalby-Wambo over this time. As well as locational advantages related to its proximity to major urban, its size that provides for a critical mass of services, and natural advantages related to amenity and agricultural production; Dalby-Wambo is in the enviable position of having to actively source labour due to its very low unemployment rate and demand for a labour with a range of skills by mining, energy and service sectors. Competition for labour has led to a number of initiatives by the agricultural sector to attract and retain labour, including paying in some cases 25-30% higher wages and participating in a range of skills development and training initiatives.⁴⁶ This is contrasted with the NSW northern basin case study areas (Bourke and Moree) where a range of factors including location disadvantage and lack of replacement industries has led to a far more constrained labour market and higher levels of social disadvantage.

3.4.3 Indicators of Community Wellbeing and Resilience

The effects of a less remote location, larger size, greater degree of urbanisation and other natural attributes such as access to natural resources are evident in the degree of industry diversification and other selected indicators of community wellbeing and resilience for Dalby-Wambo compared with other smaller or more remote case study areas. A much lower proportion of Indigenous residents than other areas in the Northern Basin was also likely to be a factor in resilience, with such populations generally associated with a more disadvantaged profile.⁴⁷

⁴³ Commonwealth of Australia (2009) The Impacts of Mining in the Murray Darling Basin, Senate Environment, Communications and the Arts Reference Committee, December, citing CSIRO and Queensland Department of Employment, Economic Development and Innovation.

⁴⁴ Dalby Bio-Refinery, accessed online at www.dbri.com.au/about.htm, 01 April 2010

⁴⁵ Telephone correspondence with DBRL, 01 April 2010.

⁴⁶ Consultation interview, 18 February 2010.

⁴⁷ Indigenous people were around 5% of the total population, which reflected the Basin average, compared with much higher values in the other Northern Basin case study areas of Bourke, Moree and Balonne, at 30%, 19% and 15% of the population respectively.

A key issue in community resilience is the ability of an area to attract and retain population and expand its economic and employment base. As noted above, the Dalby-Wambo area experienced a small increase in both population and employment from 2001-06, which was slightly higher than the MDB average and much different to other Northern Basin case study areas, which experienced significant decline during this period. It has a diverse industry base that more closely resembles Australia than the MDB, with the exception of the much greater reliance upon agriculture (around 18% compared with the Australian average of 3.5%) and other differences noted above.

Dalby-Wambo also has more positive socio-economic indicators of wellbeing and resilience than the MDB average in relation to labour force participation rate and age, SEIFA Index of Socio-Economic Disadvantage, median age, skills base, household income, general and youth unemployment. The case study area has a much more mobile population than other areas selected for study and than the Basin and Australia as a whole, with almost one-third of residents reporting that they had moved into the area from an outside LGA in the 5 years to 2006. A younger and more mobile population associated with opportunities in the region's extractive and energy sectors, intensive agriculture and retail, manufacturing and construction, as well as Dalby's attractiveness to people from smaller surrounding areas and accessibility to major urban centres and the coast is likely to be contributing to such population turnover. However, this high rate of mobility may also be an indicator of a more transient and less stable population. Nonetheless, like the Basin as a whole, Dalby-Wambo shows far less positive indicators than the Australian average in relation to its skills base, median household income, rate of premature death, participation of those 65+ years in the workforce, and SEIFA Index of Disadvantage.

Health indicators were more mixed, with a lower rate of premature death and a higher rate of chronic ill health and profound and severe disability than the Basin average, and somewhat greater reliance upon disability support pension than average. This may reflect the need for people with such health issues to live close to the community, health and support services provided by a large regional service centre like Dalby.

Less positively, Dalby-Wambo had a lower level of SEIFA Index of Education and Occupation and of participation in school by those 16 years and older, though the latter may be due to the increased opportunities related to a more diverse industry base and skill shortage, and the active recruitment of young people and school students into traineeships, apprenticeship and less skilled work in the mining, energy and agricultural sectors reported during local consultations.⁴⁸ The lower SEIFA Index may also signal a higher level of unskilled employment in the area, reported to be required by intensive agriculture (feedlots) and some other industries.

⁴⁸ Consultation interview, 18 February 2010.

4 Potential Impacts of the Long-Term or Permanent Reductions in Water

4.1 Modelling and Quantification of Impacts

The impact on the Dalby-Wambo case study area from permanent reductions in the availability of irrigation water that may occur under the forthcoming *Basin Plan* and permanent trade of water out of area (whether open market or government ‘buyback’) has been modelled using data from Research Strategies 1 and 2 of this study.⁴⁹

The impact on Dalby-Wambo area from reductions in the availability of irrigation water has been modelled using data from Research Strategies 1 and 2. Such reductions may arise under the forthcoming Basin Plan, ‘water buyback’, permanent out of area trade and the like. The extent to which additional reductions in entitlements or allocations may occur under the Basin Plan is at the time of writing unknown. As such, we have modelled 10%, 25% and 50% cuts in irrigation water from that used in 2006. The results of that modelling in relation to the likely impact on employment, population and other key indicators of wellbeing and resilience are summarised here, and detailed in the table below.

4.1.1 Employment and Population Projections

The effects of cuts to irrigation water on Dalby-Wambo are small by comparison with other case study areas. This is because irrigated agriculture forms a small proportion of agricultural industries in the area and there are important non-agricultural industries in the area.

Employment and Population

The primary effect of reductions in the availability of irrigation water will be a loss of employment, with a 0.7% loss (49 jobs) predicted from a 50% reduction in irrigated water use based on 2005-2006 data. This is likely to be an under-estimate as we do not have reliable data to estimate job losses associated with loss of irrigation water to cereal production. Based on data for rice and cotton, job losses could be expected to be of the order of an additional 20 jobs. Subsequent population loss is estimated at 0.9% (137 people).

⁴⁹ JSA (2010) Report 1: Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Scoping Paper, JSA (2010) Report 2: Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Understanding Agricultural Employment, and JSA (2010) Report 3: Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Irrigated Agriculture and Socio-Economic Indicators.

Community Wellbeing and Resilience

Socio-economic indicators of wellbeing and resilience are expected to be generally unchanged as a result of changing water availability.

Table 4.1: Predicted 'long term' impacts of reduced water availability in Dalby-Wambo

Indicator	Base case	Predicted indicators for reduced irrigation water scenarios			
	2006	10% reduction	25% reduction	50% reduction	
irrigation water use (GJ)	57.2	51.5	42.9	28.6	
Employment (total) ⁽¹⁾	6980	6972	6957	6931	
% decrease in employment		0.1%	0.3%	0.7%	
Employment (Vegetables) ⁽²⁾	16	16	16	16	
irrigation water use (GJ)	0	0.0	0.0	0.0	
Employment (Fruit) ⁽²⁾	0	0	0	0	
irrigation water use (GJ)	0	0.0	0.0	0.0	
Employment (Grapes) ⁽²⁾	8	8	8	7	
irrigation water use (GJ)	0.1	0.1	0.1	0.1	
Employment (Grazing) ⁽²⁾	468	468	469	470	Assumed next best use
irrigation water use (GJ)	0.1	0.1	0.1	0.1	
Employment (Cereal) ⁽²⁾	473	473	473	473	likely to be a reduction but data is unreliable
irrigation water use (GJ)	15.1	13.6	11.3	7.6	
Employment (Rice) ⁽²⁾	0	0	0	0	
irrigation water use (GJ)	0	0.0	0.0	0.0	
Employment (Cotton) ⁽²⁾	167	161	153	139	
irrigation water use (GJ)	41.9	37.7	31.4	21.0	
Employment (Balance Agriculture)	160	160	160	160	
Employment (Total Agriculture)	1291	1287	1279	1265	
Population ⁽³⁾	15007	14984	14941	14870	remains above 10,000 threshold
estimated % decrease in population		0.2%	0.4%	0.9%	
Indigenous population ⁽⁴⁾	4.9%	4.9%	4.9%	4.9%	

Indicator	Base case	Predicted indicators for reduced irrigation water scenarios			
	2006	10% reduction	25% reduction	50% reduction	
Number of indigenous people	735	735	733	731	
Dependent variables:					
SEIFA Disadvantage	981	981	981	980	
SEIFA Economic Resources	928	928	928	927	
Premature death	319.9	319.9	320.0	320.0	
LFP 15+	63.1%	63.1%	63.0%	62.9%	
Median Household income	\$896	\$ 895	\$ 893	\$ 890	
Disability support pensioners	6.4%	6.4%	6.4%	6.5%	
Profound or severe disability	4.1%	4.1%	4.1%	4.1%	
Chronic ill health	220	219.9	219.8	219.6	
LFP 65+	16.3%	16.3%	16.2%	16.2%	
Median Age	36	36.0	36.1	36.2	
Skills Base	28.4%	28.4%	28.4%	28.3%	
Education participation	63.4%	63.4%	63.4%	63.5%	
SEIFA Education and Occupation	935	935	935	935	
Polarisation	0.84	0.84	0.84	0.84	
Youth unemployment	8.7%	8.7%	8.7%	8.7%	
Unemployment	4.6%	4.6%	4.6%	4.6%	
Change of SLA five years ago	30.0%	30.0%	29.9%	29.8%	
Voluntary work	27.7%	27.7%	27.8%	27.8%	
Assault (Non domestic violence)	645	645	645	644	2006 value estimated
Assault (Domestic violence)	432	432	432	433	2006 value estimated
Property Crime	4706	4700	4691	4675	2006 value estimated

Notes:

- (1) Includes factor of 1.11 to account for census under reporting, and allows loss of 0.9 jobs for each lost agricultural job
- (2) Estimates using data from Table 3.1 of report two and using regression analysis data to account for dryland production, factor of 1.11 included)
- (3) Assumed one job per household, 2.8 people per household, unemployed households leave the area
- (4) In 2006, the indigenous LFP rate was 57%, compared to 69% for the non indigenous population

We have assumed that job losses will therefore have a lesser effect on indigenous populations, leading to an increased proportion of indigenous people in the population, at the rate of the loss of one indigenous person for each 1.2 non-indigenous persons.

4.2 Field Work: understanding likely impacts through responses to recent drought and other stressors

4.2.1 Overview

Compared to a long-term reduction in water availability that may occur as a result of government policy and climate change the recent drought represents a short-term reduction in water availability. The reduction in water availability that has been experienced throughout the drought has prompted changes across agricultural industries and has resulted in significant impacts at the farm and community levels. This section of the case study documents the changes, responses and impacts that have been experienced from the drought in Dalby-Wambo. An understanding of how farms, agricultural industries and the local community have responded to the 'short term' impact of the drought is necessary to better predict and understand the likely impacts of 'long term' reductions in water availability.

JSA consulted with two types of agricultural water users as part of this case study: relatively large-scale irrigators of cotton and other broadacre crops, and those engaged in relatively small-scale 'stock and domestic' irrigated dairying and cropping. Interviewees were asked to reflect on how water availability has changed due to the recent dry period, how they have adapted their practices and land uses to respond to those changes and any resultant social impacts that they have experienced on-farm or at the community level as a result of changes in water availability. While both groups report quite different use patterns and mitigations they have taken, they shared a concern about the rate of development in the agricultural, mining and energy sectors in the region as a threat to future water availability. We acknowledge that this case study is limited in the range of views we were able to access and include, and do not consider that this is a full account of the complexity of these issues in the region. We welcome additional feedback and input from those views not represented here.

4.2.2 Broadacre irrigators

According to those irrigators consulted, around 50% of broadacre irrigators in the area (mainly those with limited access to a watercourse) are reported to be reliant upon groundwater, to a greater or lesser extent, and overland flows when available to fill on-farm storages. Currently, 64,000 ML per annum is reported to be allocated from the Condamine Alluvium for industry, feedlots, irrigation, stock and domestic and potable use with a moratorium on new applications for water licenses in place since 2008.

Irrigators note that they have responded to changes in water availability due to drought and market conditions by mixing the crops that are grown, including cotton, sorghum and wheat. They noted that cotton continues to be the most profitable crop per megalitre of water used. They also noted that due to the optimal soil conditions in the Darling Downs, a cotton crop requires between 3 and 4 irrigation events per growing season compared to 7 or 8 irrigation

events required in other cotton growing areas like the Lower Balonne. Overall, growers note that they have significant opportunities for flexibility in a range of irrigated agriculture and dryland cropping compared with other cotton growing areas due to the higher rainfall, increased water holding capacity of the soil, lower temperatures, lower evaporation rates, fewer problems with pests, and proximity to markets. Although there have been some horticulture ventures in the area, this is not generally viewed as a viable alternative due to market factors and the profitability of crops like cotton. The Darling Downs is viewed by growers as a prime agricultural area, as one study participant stated, *“We could grow anything here, water is our only limiting resource.”*

4.2.3 Small scale ‘stock and domestic’ dairying & cropping

Like the broadacre irrigators, small block dairy and crop growers in the northeast of the catchment near the Bunya Mountains have become increasingly reliant upon groundwater for stock and domestic purposes. Groundwater extraction for stock and domestic purposes does not currently require a licence. Prior to the drought, small -scale farmers utilised water from a mix of rain-fed farm dams, some unlicensed extraction from unregistered creeks (which is permissible) and some groundwater. However, in recent years rainfall has been so low and surface water so unreliable that nearly all of the water they use is supplied by groundwater.

Small scale farmers that participated in the study report that in recent years they have experienced significant drops in the level of the groundwater they access via shallow bores, some to the point of needing to drill significantly deeper bores to access water, which has proved to be an expensive exercise. Many of these farmers have also embraced more water efficient methods including ‘zero till’ practices.

As well as the impacts of the prolonged drought on groundwater recharge, they also expressed strong concerns regarding the growth and proliferation of more intensive agricultural uses (e.g. feedlots) over the past 20 years on resultant impacts of this development on the quantity and quality of groundwater and consequently their livelihoods. Those interviewed also expressed significant concerns about the over-allocation of groundwater extraction licences and the inadequacy of the Queensland Department of Environment and Resource Management to monitor and enforce current licence conditions.

A further impact identified for this group is the increasing cost of land, due to ‘tree change’ migrants who are prepared to commute to larger centres like Toowoomba (1 hr) or Dalby (35 minutes) or who may use the properties as weekends. In order to remain profitable, small agricultural enterprises looking to expand may be unable to do so due to the rising costs of land.

4.2.4 What can the ‘short term’ experience tell us about likely ‘long term’ impacts?

The potential social and economic impacts of permanent reductions in water availability under the forthcoming *Basin Plan* are occurring in the context of existing impacts of reduced water availability related to prolonged drought and preceding reductions to water availability through

water resources planning for surface and groundwater that has taken place recently over many years. The potential impacts are also occurring in the context of the existing socio-economic conditions regarding their existing wellbeing and resilience, and the potential for significant impacts arising from proposed expansion of the mining and extractive industries in the region.

Compared to other areas in the Basin, Dalby-Wambo appears to have been buffered somewhat from the most severe impacts of the drought as evidenced by its population and employment growth in the last censal period. This is likely to be related to positive locational attributes, such as its proximity to larger urban centres and position along major transport routes, relatively low Indigenous population and younger age profile as well as other factors such as the relatively diverse agricultural base, associate and emerging industries such as the mining and energy sector in the immediate and wider region. For these reasons, Dalby-Wambo is likely to be more resilient than some other communities within the Basin in the face of reduced water availability.

However, there are significant ‘unknowns’ regarding future and cumulative impacts from the expansion of the energy and mining industries upon water quality and quantity (both surface and groundwater) and agricultural production and livelihoods. Many irrigators in the Darling Downs have expressed considerable concern about these unknowns and mitigations that may be possible to reduce potential impact to their long-term viability, regardless of potential reductions to water entitlements under the forthcoming *Basin Plan*.

The relative sustainability of the extractive industries in the region, socially, economically and environmentally, was also raised by farmers. Expressing what appeared to be the sentiment of the group, one farmer commented,

“This is a prime agricultural area. We are efficient, we can grow anything. We could feed Australia. We’re here for a thousand years, longer. But what we have and what we can contribute could be jeopardised by an activity that will last for 15 to 20 years and provide the community with very short-term benefits. I’d hate to own a home in Dalby in 20 or 30 years time.”

The extent to which the concerns of irrigators and others are realised will depend upon the extent of mitigation possible. There may be opportunities to treat and utilise ‘associated water’ from coal seam gas mining for irrigation, stock and domestic, and recharge of groundwater reserves. However, there remain questions about the disposal of the waste stream associated with this water, and impacts to groundwater chemistry, flora and fauna.

While there will undoubtedly be social and economic benefits of the expansion of these industries, as has already been seen to some extent through the wellbeing and resilience indicators for Dalby-Wambo, agriculture remains by far the largest employer in the local economy despite the peak drought phase during which the 2006 Census was taken. The extent to which long-term employment in extractive industries will replace such employment, particularly if some adverse impacts to agricultural land and water supplies occur, as well as future impacts to community wellbeing and resilience are questions that will take some time to answer.

Appendix 5: Griffith, NSW Case Study



Report 4: Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Social and economic impacts of reduced irrigation water

July 2010

This report has been prepared for



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1. Key Findings

1.1. Background

The primary driver for long-term reductions in water availability for irrigation communities in the Murray Darling Basin will be government policy, including the purchase of water entitlements under *Water for the Future* and the setting of new Sustainable Diversion Limits under the forthcoming *Basin Plan*. Climate change is also projected to have an impact on reduced water availability by 2030. Whilst there are likely to be benefits from increased water for the environment, reduced water for irrigation will result in a range of social and economic impacts on agriculturally dependant communities across the Basin. It is important in this regard to distinguish between short-term stressors such as rainfall variation and fluctuating commodities prices, to which agricultural communities have been adapting over many years, and more permanent impacts from a long-term policy-driven and climatic reduction of water for consumptive uses.

In the face of possible permanent reductions in water availability and the associated impacts, this part of the study aims to answer the question, ‘how resilient are communities likely to be to change?’ A number of factors were found to predict changes in indicators of wellbeing and resilience in earlier stages of this study¹ including changes in employment and population. Our findings for the MDB were generally in line with other research on rural and regional communities, with key indicators that predict wellbeing and resilience including degree of remoteness, degree of urbanisation (population size), proportion of Indigenous people particularly remote populations, and age of the population.² Degree of economic diversity and opportunities to diversify were also relevant factors identified in the literature,³ though our findings indicate that these factors are largely a function of other more endogenous factors like remoteness, proximity to a large urban centre or to other economic resources like extractive industries. Though things like community leadership and collaborative initiatives are important, it can be difficult for communities to respond to major stressors where they have characteristics that work against their ability to adapt to change.

To explore the likely social and economic impacts and degree of resilience to more permanent changes in water at different geographic scales, JSA has researched eight case studies across the Murray Darling Basin in different types of irrigated agricultural communities. The eight case

¹ JSA (2010) Report 2: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Understanding Agricultural Employment*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri; and JSA (2010) Report 3: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Irrigated Agriculture and Socio-Economic Indicators*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri

² JSA (2010) Report 2: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Understanding Agricultural Employment*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri; and JSA (2010) Report 3: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Irrigated Agriculture and Socio-Economic Indicators*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri

³ JSA (2010) Report 1: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Scoping Paper*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri

study areas are Dalby-Wambo, Queensland; Balonne, Queensland; Moree Plains, NSW; Bourke, NSW; Griffith, NSW; Campaspe, Victoria; Mildura, Victoria; and Murray Bridge, South Australia. These are augmented by an overview of the regional context, or of smaller communities within these areas, to illustrate some of the impacts that are likely at different scales.

This report presents the findings of the Griffith, NSW case study. The key findings from the study, particularly the area's current status against a range of wellbeing and resilience indicators is presented first, and is followed by a detailed discussion of quantitative and qualitative findings from the research. It is important to note that, although we have only been able to focus on eight areas, it is hoped that the case studies will provide information for communities within the Basin facing similar challenges, and draw out the characteristics that are likely to mitigate or exacerbate the impacts of permanent reductions in irrigation water.

1.2. How Resilient is Griffith LGA Likely to be to Change?

1.2.1. Overview of Findings

More so than any of the other case studies, Griffith is truly an irrigation community. It was established, built and grew for the purpose of producing food and fibre and providing services to farmers and communities within the Murrumbidgee Irrigation Area. Its past and its future are inherently linked to irrigation and its associated industries. As one study participant said, *"Irrigation is inherent to our identity. There is no separation between our identity and our businesses."*

Griffith's population experienced no change between 2001 and 2006. Compared to some of the northern basin case study areas where populations declined by as much as 15% over the five-year period, this appears to be positive. However, the other southern basin case study areas and the nation all grew by 2% to 6%. Griffith was also the only southern basin case study area to lose jobs between 2001 and 2006. While again this loss was not nearly as significant as some of the northern basin areas, this clearly went against the trend of job growth in the other southern basin cases, the MDB average and the nation. What does this stagnation tell us about how the Griffith economy and community were going during the recent drought period and before the worst of the low allocation years were to come? This stagnation was possibly due to the impact of drought and low allocations for general security license holders, such as rice growers, that occurred during this period. Griffith, with its mix of high and general security licences, was more protected than other NSW LGAs in its hinterland like Coleambally, however, where a predominance of general security water left them more exposed to the early years of the drought. These population and employment findings, as well as Griffith's status against a range of other social and economic indicators, show not only a snapshot of the community as at 2006 but also provide an indication of how resilient a community is likely to be to future impacts of permanent reductions in water availability.

Whilst Griffith is a vibrant regional hub with a number of strengths such as a relatively young population, low unemployment levels and a high median household income level its is particularly vulnerable to further permanent reductions in water availability due to its remoteness, lack of a ‘critical mass’ in terms of population, and its continued reliance on irrigated agriculture for its economic base including significant value-adding manufacturing, warehousing and distribution industries related to agriculture locally and in the wider hinterland. Many irrigated agricultural enterprises in the area, both small and large, have made significant on-farm efficiency gains to use water more wisely and expand their businesses in order to remain profitable while using less water. For many, further permanent reductions in entitlements will have a tremendous impact on their business model with few options to further improve efficiencies to make up the loss. Due to the role irrigated agriculture plays in the local economy, these impacts will quickly flow from farms through to local and regional communities. Cumulative impacts are also expected as certain service thresholds are reached in response to population decline.

1.2.2. Griffith’s Resilience ‘Report Card’

The following provides an overview of key factors that have led to this assessment of how resilient the Griffith local government area (LGA) is likely to be in the face of permanent reductions in water availability. Key factors are reviewed as a ‘report card’ on resilience, and include:

- Projected changes in employment, population, and indicators of community wellbeing modelled for 10%, 25% and 50% cuts in irrigation water on the 2005/06 growing season;
- Degree of reliance upon agriculture and in particular irrigated agriculture and related industries;
- Factors that have a statistically significant relationship to wellbeing and resilience;
- The current status of the Griffith LGA in terms of existing socio-economic indicators; and
- Factors which are likely to mitigate or worsen projected impacts identified during field research.

Each of these is looked at in turn below. This is followed by detailed data and information from desktop analysis and fieldwork undertaken by JSA from January to May 2010.

Population and Employment Impacts Forecast

The ‘long term’ impacts of reduced water availability on Griffith LGA are likely to be significant, particularly with regard to employment and population change. This is because irrigated agriculture forms a large proportion of both agricultural industries and the total economy of Griffith.

The primary effect will be a loss of employment, ranging from at least a 3.9% loss (440 jobs) predicted from a 10% reduction in water availability to an 18.9% loss (2,139 jobs) predicted from a 50% reduction in water availability, including direct and indirect employment in agriculture and multipliers. Given the job loss experienced during the recent drought (prior to 2005/2006) and the fact that irrigated agriculture is anecdotally stated to have higher multipliers than the average for agriculture, and the likelihood that some agricultural jobs have not been identified in our analysis, this is almost certainly an underestimate. Subsequent population loss is estimated as at least a 5.2% loss (1,232 people) predicted from a 10% reduction in water availability to at least a 25.2% loss (5,988 people) predicted from a 50% reduction in water availability.

Predicted Changes in Indicators of Wellbeing and Resilience

Modelling of impacts on indicators of community wellbeing and resilience for Griffith from reduced water availability also indicates impacts on such indicators will accompany employment and population loss. Notable changes⁴ are projected to be an increase in labour force participation 65+, an increase in youth unemployment, and a more mobile population. On the positive side, a higher level of voluntary work is also predicted.

Factors Affecting Wellbeing and Resilience

The following table provides an overview of the key factors for the Griffith LGA case study area, which are discussed in more detail in the body of the case study report. Griffith's low level of Indigenous residents and relatively young median age indicate that it is likely to experience less adverse impacts on indicators of wellbeing than some areas with populations that are already more residualised. However, the relative remoteness of the area, lack of strategic advantage in terms of its distance from other major centres and lack of a transport hub make it very vulnerable to changes in the productivity of its economic base and related industries. At a population of 24,000 people, it has not reached the critical mass of a major service centre⁵ independent of its agricultural fortunes, which again makes it vulnerable to population or employment loss. Employment in Griffith LGA remains highly reliant on irrigated agriculture and associated industries. Reduced capability, output and employment in these industries will likely have significant impacts on total employment, population and resilience due to this heavy reliance. Cumulative impacts are also likely, as Griffith decreases in size and certain service thresholds are reached.

⁴ More than 5% change

⁵ JSA (2010) Report 3: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Irrigated Agriculture and Socio-Economic Indicators*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri.

Table 1.1: Key Factors in Community Resilience

Statistically Significant Factors	Resilient?	Comment
Remoteness	X	More remote than MDB average and equivalent to case study areas of Moree Plains and Mildura. Not located on a major highway or transport hub.
Degree of Urbanisation: • Population Size • Proximity to a large regional centre	X	Griffith LGA at 24,000 has not reached the 'critical mass' to be a stand alone centre. It did not grow in the inter-censal period (2001-2006) and would be adversely affected by loss of population at this stage of its development. Reasonably remote from larger regional centres, so unlikely to benefit from relocation of major enterprises.
Indigenous Population	√	Lower than MDB average
Age	√	With a median age of 35 years, it is younger than the national average and much younger than the MDB. It appears to be retaining more young people than other rural areas, probably due to entry level jobs in agriculture and processing, and cultural factors including family businesses. Farmers and smaller rural communities generally have much older age structures; as a result there may be fewer opportunities for succession planning and greater vulnerability to change. The youth of the labour force is a definite advantage, but one that may be threatened with a decline in entry level jobs in agriculture, related industries and any contraction of the economic base.
% of employment by industry compared with Australian benchmark	X	Lower than MDB and national averages for economic diversity. Remains highly reliant on irrigated agriculture and related industries. Decline in agriculture would need to be offset by new or expanded industries, which appears unlikely given locational disadvantages.

Current Status on Community Resilience Indicators

The current status of Griffith LGA regarding key socio-economic indicators is necessary to understand its resilience or vulnerability to changes in employment related to reduced water availability. The following provides a 'report card' on the extent to which the current status of Griffith LGA compares with the MDB and National benchmarks.

The 'report card' signifies a community that has prospered from irrigation, relatively high levels of water security, and a diverse irrigated agricultural and related industrial base in terms of lower levels of disadvantage, selected health indicators and income, though it is noted that some of this would be strongly related to its younger age structure.

Those indicators related to future resilience are not as positive, particularly in relation to lack of overall diversity of the economic base, lack of locational advantage and relative remoteness, and the lower than average underlying economic, educational and employment status of the

population which make it potentially less adaptive to change. Unemployment was much lower than average in 2006, however study participants indicated that unemployment has increased in subsequent years. Moreover, there is reasonable exposure to increased unemployment due to lower human capital indicators and locational disadvantages if water for irrigation were to substantially decrease.

Table 1.2: Current Status Report on Indicators of Community Resilience

Proxy Indicator of Resilience	Likely to be Resilient?	Comment
Community Wellbeing:		
SEIFA Disadvantage	✓	Much less disadvantaged than MDB average though somewhat more disadvantaged than Australia. Somewhat more disadvantaged in 2006 than 2001, which may relate to a 1.2% drop in employment.
SEIFA Economic Resources	X	Lower than Australia and the MDB average. Indicates that in comparison, Griffith has more households on low incomes or paying low rents and fewer with high incomes or owning homes.
Median Household Income	✓	Much higher than the MDB average and slightly lower than Australia.
Social Capital/Volunteering rate	X	Very low for a regional area, and around 70% lower than the MDB average.
Disability Support Pension	✓	Lower than MDB average but on par with Australia, likely due to a younger median age.
Premature Death	✓	Much lower than MDB but on par with Australia, signalling less accidents and suicide, but also likely to be due to a lower proportion of Indigenous people.
Profound or severe disability	✓	Lower than MDB average and equivalent to Australia, likely due to a younger median age.
Chronic Ill Health	✓	Slightly lower than MBD average and Australia, likely due to younger population and lower proportion of Indigenous people.
Economic growth:		
Change in Total Employment 2001-06	X	A slight contraction of the local economy (-0.5%), which was strongly against the national trend (+10% growth) and also the MDB average (+1.2%). Reported to be high job loss since 2006 arising from low general security water allocations and contraction in rice, related processing and flow-ons, some of which are likely to be delayed.

Proxy Indicator of Resilience	Likely to be Resilient?	Comment
Labour force participation 15+ years	√	Higher than both MDB and Australia. Low youth unemployment and entry level job opportunities likely to be a factor.
Labour force participation 65+ years	X	Much higher than MDB and especially national average. Farmers and those working in family processing businesses and in smaller communities likely to be older and working longer.
Post-school qualification (skills base)	X	Lower than MDB average with trade or better qualifications and much lower than Australia, likely related to predominance of agriculture and related industries in the local economy.
School participation at 16 years	X	Very low school participation rate compared with both MDB and Australia, possibly due to entry level job opportunities in the local economy.
SEIFA Index of Education and Occupation	X	Well below MDB average and much lower than Australia, and one of the lowest case study areas. Indicative of a population with many people with few qualifications, unemployed or in low skilled jobs and few people with high qualifications or in high skilled occupations. Likely reflects lower underlying human capital resources and nature of employment, and indicate less adequate capacity to industry sector change.
GINI co-efficient of household income distribution/polarisation	X	Like other areas of the MBD, Griffith LGA shows quite a high level of polarisation between the 'haves' and 'have nots' based on household income.
Youth unemployment rate	√	Much lower than average, which likely reflects employment opportunities. Exposure to increased unemployment, due to lower underlying level of human capital indicators, if current employment opportunities decline.
General unemployment rate	√	Lower than average, but perception that this may have worsened with reduced agricultural production since 2006, especially associated with rice and related industries, though some of this may have been taken up in other agricultural industries. Exposure to increased unemployment, due to lower underlying level of human capital indicators, again signifying potentially lower adaptive capacity.
Amenity:		
Population Growth/Retention 2001-2006	X	No inter-censal population growth, much lower than other Southern Basin areas and Australia. Perception of increased growth related to residential construction in Griffith, but likely to be coming from small towns and hinterland within the LGA as well as some natural increase. Some smaller towns and villages likely to be more vulnerable to reduced water availability.
In-migration	X	Very low levels of in-migration from outside the LGA evident, which support the above. It does not have the 'tree change' / 'life-styler' characteristics of some other Southern Basin case studies, and is not within commuting distance to a major regional centre or capital city.

1.2.3. Other factors that indicate vulnerability or resilience from consultation

Fieldwork and other consultations have provided valuable insights into other aspects of current and future vulnerability or resilience, as well as other factors that are likely to mitigate or worsen potential impacts. See **Section 5** for a detailed discussion of fieldwork findings.

Agriculture and communities have shown resilience and adaptability in the past. They have maintained population and employment during a period of drought including low allocations to general security water. A range of on-farm and system efficiency gains have been made over the past decade, and irrigated agriculture has continued to diversify and allowed value-adding industries to grow. The downturn in rice, as a result of low general security allocations since 2005, is reported to be offset to some extent by employment in other sectors with higher water security, which has been less exposed to drought. However, it is acknowledged that significant adverse impacts associated with the contraction of the rice industry and other crops more reliant on general security allocations have largely been experienced outside of the Griffith LGA case study area in other communities in the region such as Coleambally, Deniliquin and Hay.

The ability to make further efficiency gains and the nature of future water trade will to some extent determine how resilient the area is to more permanent loss of water through permanent out of area trade, reductions in SDLs and/or climate change. Other factors including lack of access to other economic opportunities, locational disadvantage and the relationship of Griffith to a highly agriculturally dependent hinterland and region mean that Griffith's future is likely to remain firmly tied to irrigated agriculture. Smaller and more agriculturally dependent communities are likely to be far more exposed, as are particular industries and related industries (e.g. rice in Leeton, Coleambally, Deniliquin and Hay), and will suffer disproportionate impacts.

Table 1.3: Other factors of vulnerability and resilience relevant to Griffith LGA

Factor	Resilient?	Comment
Nature of 'next best' land use with reduced water	?	Griffith 'exists because of irrigation'. It already has diverse irrigated products and value adding, and it is likely that existing uses would be most likely with reduced water but significantly reduced growth. Given its distance from the Murrumbidgee River system, it is noted that the irrigation system is relied upon not only for agriculture but also for all civic, potable, and industry uses. For other towns in the region, such as Hay, even a change of use to grazing is very limited due to low rainfall and conditions.
Potential benefits of water trade	?	Ability to trade temporary water has been of considerable benefit in retiring debt or keeping permanent plantings in low allocation times. Murrumbidgee has been a net seller of water in recent years. There are concerns about permanent sale of water out of the area, such that the government buyback is picking up the 'good operators' and more efficient irrigators who are selling through 'desperation not choice'.
Ability to 'recover' from drought	√?	Irrigators are reported to have been quite resilient in the face of drought conditions and previous fluctuations in commodities prices, e.g. since 2000. Activities have included varying agricultural

Factor	Resilient?	Comment
		products, increasing on-farm and system-based water efficiencies, and engaging in innovative and entrepreneurial market activities.
		For example, the rice industry has restructured itself for sustainability as a result of the short-term 'shock' of low general security water allocation in recent years.
Ability to make efficiency gains	?	Study participants report that many on-farm and system-wide efficiency gains have been made in recent years. Although some further gains are reported to be possible, these gains will be more difficult to achieve and will likely require significant capital investment and support, which will be difficult with reduced farm profitability with less water and an uncertain future. For example, many wine grape growers that converted to efficient drip technologies funded these adjustments through permanent water trade and would be vulnerable to any reduction in water availability.
Access to Other Economic Opportunities	X	The nature of the existing economic base and locational disadvantages mean that the Griffith LGA is likely to remain highly reliant upon irrigated agriculture and related industries. There are no reported replacement industries or large enterprise opportunities 'on the horizon'.
Natural attributes	X	There are significant locational disadvantages related to remoteness, distance from larger centres, as well as distance from the river system. There are not immediately identifiable natural attributes that would attract 'lifestyle' seekers to the area. These factors are likely to limit resilience if irrigated agriculture were reduced.
Leadership	√	There were clear indications of strong civic, community and industry leadership, networking and action from local consultations. There is evidence of innovation and adaptability in response to past short-term stressors (drought, commodities prices) among industry and community. Industry is reported to continue to seek adaptation, but there are concerns regarding how much "leadership" and "innovation" can assist in the face of permanent reductions in water given the above factors.
Other factors in future resilience from consultations	√	Large family businesses with a commitment to staying in the area and to the future wellbeing of the community were cited by study participants as a factor that may contribute to resilience. Cultural factors, such as the retention of young family members, was also a positive factor.
Other factors in future vulnerability from consultations	X	However, outside the case study area of the Griffith LGA, smaller towns in the region such as Coleambally and Hay are likely to be particularly vulnerable to reduced water availability and may have experienced more significant social and economic impacts as a result of the drought.

2. Introduction

2.1. Overview

In June 2009, Judith Stubbs and Associates (JSA) were engaged by the Cotton Catchment Communities Co-operative Research Centre to undertake a significant research project investigating wellbeing and resilience of communities, particularly those engaged in irrigated agriculture including cotton, within the Murray Darling Basin (MDB). The study seeks to understand the likely social and economic impacts on communities at different scales arising from changes in government water policy, in particular, Water for the Future and the forthcoming Basin Plan, and projected climate change. This project included three research strategies and has so far produced three reports.⁶

2.2. Rationale

Given findings from the literature and the first three reports of this study, it is likely that the social and economic impacts related to changes in water availability will be experienced differently at different geographic scales (eg. farm, local community, region, MDB, national), and by different groups within a community (e.g. farmers, Aboriginal people, businesses). Key factors will include the existing wellbeing and resilience of these communities, and other mitigating factors such as access to the water market and alternative economic opportunities.

In order to understand the differential impacts upon areas and groups, we have carried out a cost-benefit analysis to determine impacts at the MDB and national levels and prepared eight case studies to explore the likely impacts at the farm, regional and local community levels. These documents comprise the fourth and final report for this study.

The eight case study areas were selected in order to represent different states, different CSIRO Sustainable Yields Regions, cotton and non-cotton producing areas, a diversity of irrigated agricultural uses and diversity across three key attributes including population size, remoteness and Indigenous population. The eight case study areas include Dalby-Wambo, Queensland; Balonne, Queensland; Moree Plains, NSW; Bourke, NSW; Griffith, NSW; Campaspe, Victoria; Mildura, Victoria; and Murray Bridge, South Australia.

⁶ JSA (2010) Report 1: Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Scoping Paper, JSA (2010) Report 2: Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Understanding Agricultural Employment, and JSA (2010) Report 3: Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Irrigated Agriculture and Socio-Economic Indicators.

2.3. Case study methodology

This case study of Griffith NSW is informed by JSA's extensive analysis of agriculture and population data; a review of policy, relevant documents and reports; and a series of telephone and face-to-face interviews with individuals from a range of perspectives and organisations.⁷

Interviews, workshops and field visits to the Griffith area were conducted from February to April 2010 in order to understand how water availability, agricultural land use and agricultural employment has changed in recent years as a result of government policy and short term climatic change (eg, the recent drought); how these changes resulted in social and economic impacts at the farm and wider community levels; and therefore how more permanent reductions in water availability (eg, new SDLs through the MDBA Basin Plan) are likely to affect wellbeing and resilience at the farm and community level.

2.4. Case study overview

This case study provides:

- A description of the case study area including its location, land and water use, water policy, and relative social and economic wellbeing and resilience against key indicators;
- A prediction of impacts to community wellbeing and resilience based on hypothetical reductions in water availability of 10%, 25% and 50% from the most recent year for which comparative agricultural and population data is available (the 2005/06 growing year and 2006 Census);
- An exploration of the 'short term' social and economic impacts that have been experienced as a result of the recent drought, fluctuations in commodities prices, water market and other relevant factors affecting communities; and
- An analysis of how the attributes of the area and other factors have exacerbated and/or helped to mitigate the impacts already experienced as an indicator of the area's resilience, and how it may therefore respond to more permanent changes in water availability under the forthcoming Basin Plan or permanent trade out of area.

⁷ Including two rice growers in the Griffith area, Griffith City Council, Riverina and Murray Regional Organisation of Councils (RAMROC), Murrumbidgee Irrigation Limited, Coleambally Irrigation Co-operative Limited, Rice Growers Association of Australia, Riverina Wine Grape Growers Marketing Board, High Security Irrigators-Murrumbidgee, North East Riverina Rural Counselling Service, NSW Department of Primary Industries Drought Support and Centrelink.

3. Description of case study area

3.1. Location

The Griffith NSW case study area, in the southern MDB, is on the northern side of the Murrumbidgee River in the Murrumbidgee Irrigation Area (MIA). The town of Griffith is the primary population centre with around 16,000 residents, and services a wider regional area. The Griffith local government area had around 23,800 residents in 2006.

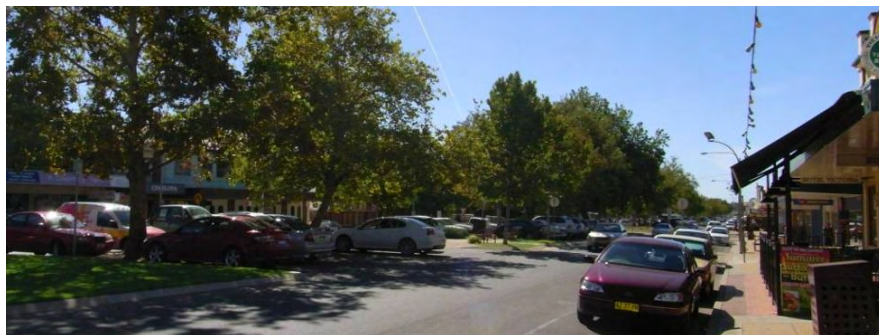
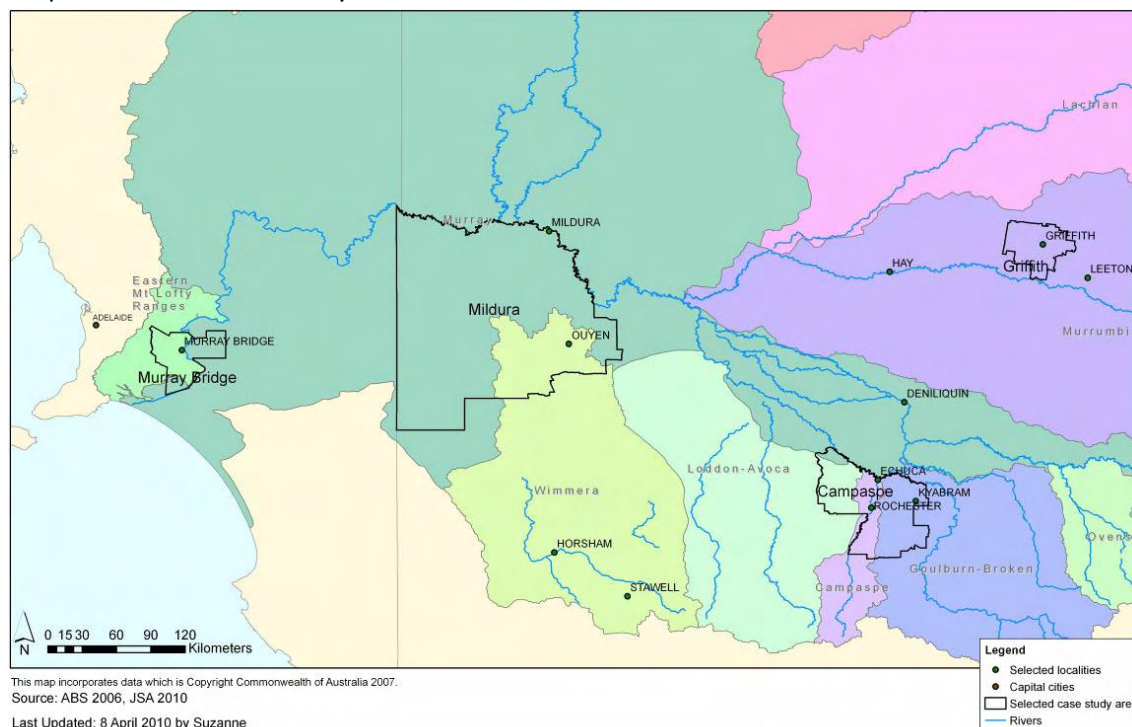


Figure 3.1: Griffith NSW town centre

Source: JSA, March 2010

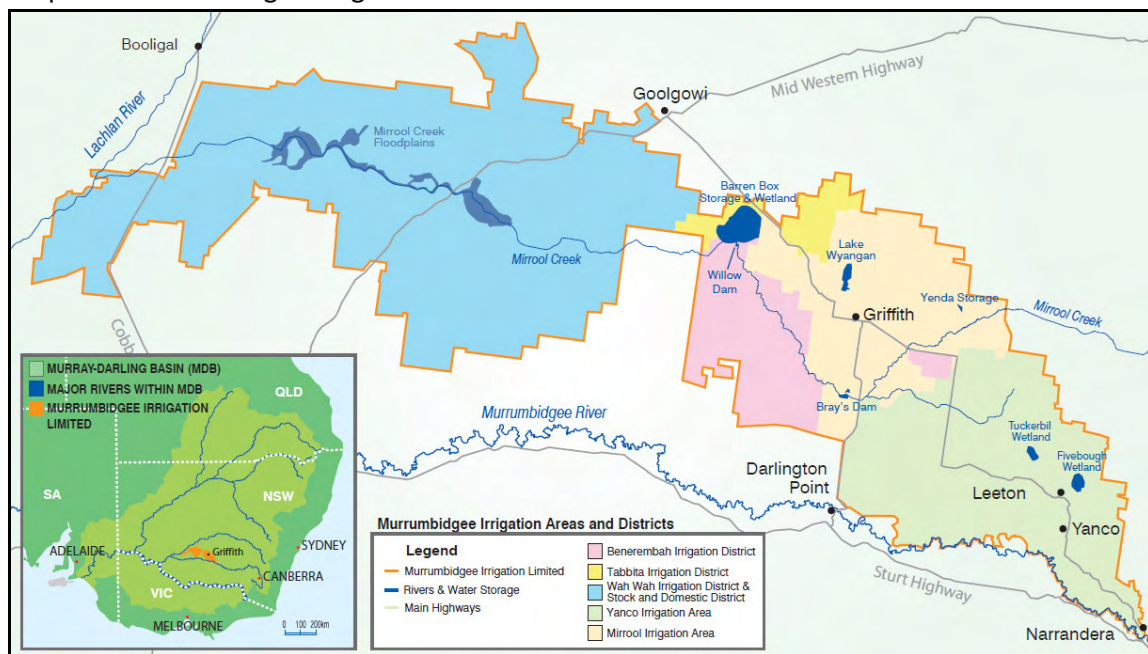
Map 3.1: Griffith Case Study Area



3.1.1. Murrumbidgee Irrigation Area

The NSW State Government developed the MIA from the early 1900s through the 1930s.⁸ The scheme was established in 1912 to deliver water from storage dams via an integrated system of gravity fed rivers and channels.⁹ Burrinjuck Dam is the main storage in the system and receives inflows from the upper catchment. The system also receives approximately 10% of its supply from an inter-basin transfer from the Snowy Mountains Hydro-electric Scheme, which is stored at Blowering Dam. Burrinjuck and Blowering dams store water during the winter and then supply irrigation farms downstream during summer. Murrumbidgee Irrigation Limited services approximately 2,800 rural water users.¹⁰ The figure below shows the MIA and its various districts.

Map 3.2: Murrumbidgee Irrigation Area



Source: Murrumbidgee Irrigation Limited (2010)

The town of Griffith and its surrounding villages have developed alongside the irrigated agricultural industries that the MIA supports. Primary commodities include wine grapes, citrus, rice and a variety of other horticultural products.

⁸ NSW Agriculture (2003) Murrumbidgee Catchment Irrigation Profile

⁹ Murrumbidgee Irrigation Limited, www.mirrigration.com.au/AboutUs/Water_for_Life.htm, accessed 16 March 2010.

¹⁰ Murrumbidgee Irrigation Limited



Figure 3.2: Wine Grapes in Griffith NSW

Source: JSA, March 2010

3.2. Water and Land Use Context

The Griffith case study area sits within the Murrumbidgee Sustainable Yield Region (SYR) as defined by the CSIRO.¹¹ This region includes extensive irrigation infrastructure, primarily in the MIA and the Coleambally Irrigation Area (CIA) on the north and south sides of the Murrumbidgee River respectively. The irrigation infrastructure, and its integration with the Snowy Hydro system, has provided reliable water availability to communities and growers in times of average rainfall.

3.2.1. Murrumbidgee Sustainable Yield Region

In 2008, the CSIRO completed a series of reports through the Sustainable Yields Project which assessed the current and future water availability in the MDB in terms of catchment development, changing groundwater extraction, climate variability and climate change.¹² The project is based on 18 regions or catchments that comprise the MDB. The Griffith case study area sits within the Murrumbidgee Sustainable Yield Region in southern NSW.¹³

The Murrumbidgee SYR covers 8.2% of the land area of the MDB, uses 22% of all surface water diverted for irrigation and urban uses and 24% of groundwater used in the MDB.¹⁴ The region generates approximately 16% of total runoff in the MDB. On average, 53% of available surface water (2257 GL/yr) is used under current development. Groundwater represents approximately

¹¹ For more information on the CSIRO Murray-Darling Basin Sustainable Yields Project, see <http://www.csiro.au/partnerships/MDBSY.html>

¹² For more information on the CSIRO Murray-Darling Basin Sustainable Yields Project, see <http://www.csiro.au/partnerships/MDBSY.html>

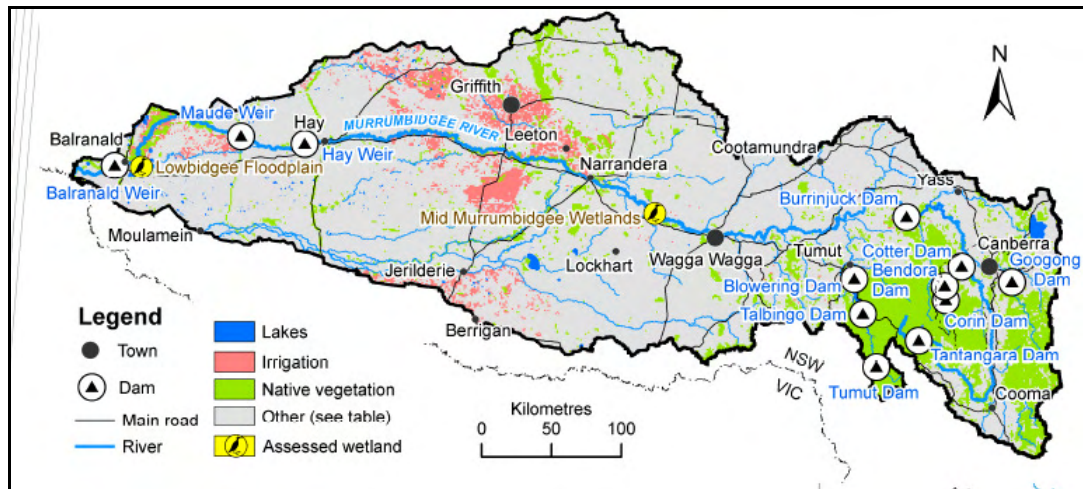
¹³ CSIRO (2008) Water Availability in the Murrumbidgee, Summary Sheet from the CSIRO MDB Sustainable Yields Project.

¹⁴ We understand that some of the CSIRO findings for the Murrumbidgee SYR, particularly for surface water diversions, are contested by Murrumbidgee Irrigation and other organisations. These organisations have sought clarification of the surface water diversion ratio to be used as the starting point for diversions prior to the release of SDLs under the Basin Plan.

17% of total water use (407 GL/yr).¹⁵ Major towns within the Murrumbidgee SYR include Canberra, Wagga Wagga, Griffith, Leeton and Hay.

The Murrumbidgee SYR is based around the Murrumbidgee River and divided into three parts: upper, middle and lower. The Murrumbidgee River is approximately 1,690 km in length and flows east to west across the 84,000km² catchment. The majority of river flow is derived from the Great Dividing Range and its major tributaries upstream of Wagga Wagga.¹⁶ There are 26 major dams and weirs that control flows along the Murrumbidgee and its tributaries, making it one of the most regulated systems in Australia.¹⁷ The following map shows the Murrumbidgee SYR.

Map 3.3: Murrumbidgee Sustainable Yield Region



Source: CSIRO (2008) Presentation of results from the Murrumbidgee region, Murray-Darling Basin sustainable yields project, available online at www.csiro.au/resources/MurrumbidgeePresentation.html.

The Griffith case study area falls within the Lower-Murrumbidgee area. In addition to the MIA and CIA, there are irrigation farms that pump river water directly from the Murrumbidgee River. Groundwater is also extracted for irrigation in many parts of the catchment.¹⁸ Today, there are two main irrigation companies in the Lower Murrumbidgee. Murrumbidgee Irrigation Limited (MIL) is the primary provider to irrigators on the north side of the Murrumbidgee River and the MIA, while the Coleambally Irrigation Co-operative Ltd (CICL) delivers to irrigators on the south side of the Murrumbidgee River.

Key environmental assets in the region include the Mid Murrumbidgee Wetlands and the Lowbidgee Floodplain. The Mid Murrumbidgee Wetlands are a nationally significant

¹⁵ CSIRO (2008) Water Availability in the Murrumbidgee, Summary Sheet from the CSIRO MDB Sustainable Yields Project.

¹⁶ Kingsford, R.T. (2003) Ecological impacts and institutional and economic drivers for water resource development – a case study of the Murrumbidgee River, Australia, *Aquatic Ecosystem Health & Management*, 6(1): 69-79, citing Crabb (1997) Murray-Darling Basin Resources. Murray-Darling Basin Commission, Canberra.

¹⁷ Kingsford, R.T. (2003) *Ibid*, pg 69.

¹⁸ NSW Agriculture (2003) Murrumbidgee Catchment Irrigation Profile

assemblage of lagoons and billabongs along the Murrumbidgee River from Narrandera to Carrathool where River Red Gum forests, Black Box woodland and a range of aquatic plant species provide habitat for many species of waterbirds.¹⁹ The Lowbidgee Floodplain is a 200,000 hectare wetland of international significance under the Ramsar Convention as it represents two significant wetland types, provision of breeding areas, and presence of particular bird species.²⁰

Murrumbidgee CSIRO SYR Climate Change Projections

Under the CSIRO's best estimate 2030 climate, runoff is more likely to decrease than increase with a reduction of around 9% projected. As a result, average surface water availability would reduce by 9%, diversions reduce by 2% and end-of-system flows would decrease by 17%.

Likely future development of commercial forestry plantations (12% increase), farm dam storage capacity (13% increase) and groundwater extraction (22% increase) by 2030 is projected to increase surface water use by 4% and in turn reduce diversions and end-of-system flows by an additional 2%.²¹

3.2.2. Overview of water and land use in Griffith NSW

We have used 2005/2006 as a model year for our analysis of social and economic indicators and agricultural land and water uses, and our predictive modelling of likely 'long term' impacts of reductions in water availability due to availability of census data by small area.

In 2005/2006, there were approximately 133,580 hectares under cultivation in the Griffith case study area. The dominate land use was cereals, oilseeds and other broadacre crops at nearly 40% of cultivated land. Grazing and rice were also significant land uses at 32.5% and 12.3% of cultivated land respectively. The typical rice farm in the area is between 200 and 400 hectares, with an average entitlement of 1500 ML. Horticulture crops make up the remainder of cultivated land, with grapes the largest at 9.5%. There are large and small block horticultural farms in the area. The traditional small blocks are between 30 to 50 acres.

Table 3.1: Agricultural Land Uses, Griffith

Agricultural Use	# Hectares	% of Agricultural Use Hectares
Vegetables	2,655	2.0%
Fruit	5,296	4.0%
Grapes	12,711	9.5%
Grazing	43,441	32.5%
Cereal, oilseeds, other broadacre	53,065	39.7%

¹⁹ CSIRO (2008) Water Availability in the Murrumbidgee: Summary of a report to the Australian Government from the CSIRO Murray-Darling Basin Sustainable Yields Project, June.

²⁰ Kingsford, R.T. (2003) pg 71.

²¹ CSIRO (2008) Water Availability in the Murrumbidgee, Summary Sheet from the CSIRO MDB Sustainable Yields Project.

Agricultural Use	# Hectares	% of Agricultural Use Hectares
Rice	16,412	12.3%
Cotton	0	0

Source: ABS (2006) and JSA (2009)

Note: See JSA (2010) Report 2: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Understanding Agricultural Employment*, Appendix 2: *Data sources and methods used*, for an explanation of how each agricultural use has been determined.

According to the ABS, in 2005/2006 424,184 megalitres of water were applied to irrigated crops and pastures in the Griffith case study area. The table below shows the proportion of total irrigation volume applied in the area by each type of crop or pasture. Rice received the largest amount of irrigation volume at 48%, followed by cereal crops for grain or seed at 16% and grapevines at 14.5%.

Table 3.2: Irrigation water applied to crops and pastures in Griffith SLA, 2005/2006

Pastures and Crops Irrigated	Irrigation volume applied (Megalitres)	% of irrigation volume applied
Pasture for grazing	21,916	5.2%
Pasture for seed production	796	0.2%
Pasture for hay and silage	6,034	1.4%
Cereal crops cut for hay	4,322	1.0%
Cereal crops for grain or seed	69,275	16.3%
Cereal crops not for grain or seed		
Rice	204,087	48.1%
Other broadacre crops	12,726	3.0%
Fruit trees, nut trees, plantation or berry fruits	27,858	6.6%
Vegetables for human consumption	13,188	3.1%
Vegetables for seed	438	0.1%
Nurseries, cutflowes or cultivated turf		
Grapevines	61,539	14.5%
Other crops	1,277	0.3%
Total	424,184	100.0%

Source: ABS (2008) Water Use on Australian Farms, 2005-06: Estimates for Local Government Areas, 4618.0.

3.3. Water Policy Context

The *Water Sharing Plan for the Murrumbidgee Regulated River Water Source 2003* sets out the environmental needs in the catchment and directs how water is to be shared between the environment and other users. The Plan sets rules that relate to water access licenses, water

allocation accounts, the trading or dealing of licenses and allocations, water extraction, operation of dams and the management of water flows.²²

3.3.1. Water Access Licenses

Basic landholder rights to water include ‘domestic and stock rights’ and ‘native title rights’. There are currently no extractions for native title rights in the Murrumbidgee catchment area. All other extraction of surface water must be authorised by an access license expressed by a share component. There has been an embargo on any new applications for commercial water access licenses for the Murrumbidgee Regulated River since 1985. The categories of access licenses and their respective share components in the Murrumbidgee River system are detailed in the table below.

Table 3.3: Murrumbidgee River System Access Licenses

Access license category	Total share component
General security	2,043,432 unit shares
High security	298,021 unit shares
Domestic and stock	35,572 ML per year
Local water utility	23,403 ML per year
Murrumbidgee Irrigation (conveyance) ²³	243,000 unit shares
Coleambally Irrigation (conveyance)	130,000 unit shares
Supplementary water	220,000 unit shares

Source: NSW DIPNR (2004)

The two primary types of water entitlements or access licenses for farmers in the Murrumbidgee case study area are ‘high security’ and ‘general security’. General security licenses account for a much larger proportion of unit shares than high security licenses, which has fostered the development of annual crops like rice in the catchment although within the Griffith case study area, high security licenses are more prevalent.

High security licenses provide allocation of water equal to at least 0.95 megalitres for each unit share in all years, and 1 megalitre per unit share in years when general security access licenses are also receiving 1 megalitre per share. High security licenses with their high reliability of supply are preferable for growers of permanent plantings, like wine grapes, citrus and nuts. Water available to general security licenses varies from year to year depending on the availability of water in the storages. The reliability of general security licenses in the Murrumbidgee system based on long-term averages is between 64-74%. Supplementary licenses are required to take water that was

²² NSW Department of Infrastructure, Planning and Natural Resources (2004) A Guide to the Water Sharing Plan for the Murrumbidgee Regulated River Water Source, September.

²³ Conveyance access licenses for irrigation service providers relate to delivery losses. The water available to Murrumbidgee Irrigation for conveyance can range from 100,000 to 243,000 megalitres.

previously termed ‘off allocation’ and are issued to general security license holders with a history of off-allocation quota.²⁴

3.4. Social and Economic Context

This section explores population trends, employment and industry profiles and how the Griffith case study area compared with the other case study areas and the MDB average across a range of wellbeing and resilience indicators.

3.4.1. Population Profile

Griffith has grown steadily over the last 30 years. This growth is driven by the strong irrigated agricultural sector and associated industries and perhaps, as some interviewees claim, the continued reinvestment of growers back into the town and wider community.

Griffith Township

The population of the Griffith township has increased over the last thirty years from 11,930 to 16,173 or 35%. The only exception to this was in the five years between 1986 and 1991, where the population decreased by 334 people or 2.5%.

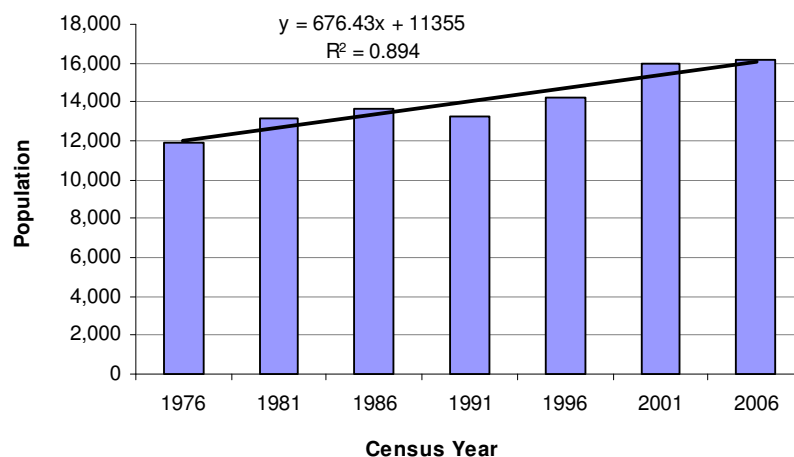


Figure 3.3: Population Change 1976-2006 for Griffith township

Source: ABS Census of Population and Housing, by Place of Enumeration

²⁴ NSW Department of Infrastructure, Planning and Natural Resources (2004) Ibid, pg 5.

Griffith LGA

Similar to the township, the Griffith LGA has also experienced population growth since 1976 from 19,534 to 23,637 or 21%. Like the township, Griffith LGA experienced a decline between 1986 and 1991 of 356 people or 1.7% and between 2001 and 2006 of 168 people or 0.7%, suggesting some impact of the drought.

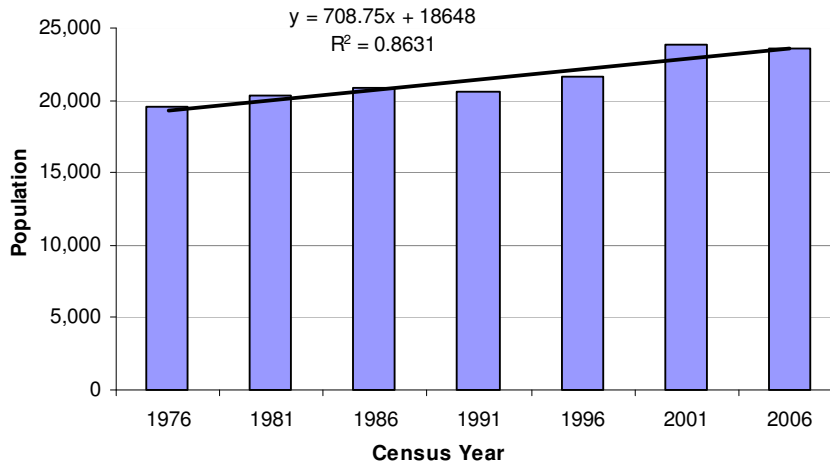


Figure 3.4: Population Change 1976-2006 for Griffith LGA

Source: ABS Census of Population and Housing, by Place of Enumeration

3.4.2. Employment and Industry Profile

In 2006, there were 11,316 people employed in the Griffith case study area. 2565 or 23% were employed in agriculture (13% grapes, 3% fruit and 2% rice of all employment). Among irrigation uses, horticulture and vegetables utilised 24% of irrigation water and provided 73% of employment in agriculture, rice utilised 48% of irrigation water applied and was estimated to provide 10% of agricultural employment²⁵ and other broad acre, pasture and cereal crops utilised 27% of irrigation water²⁶. It is likely that irrigation provides around 85% of agricultural employment in Griffith. Despite the area's high proportion of employment in agriculture, it is less dominated by agriculture than the MDB average. Other significant employment types included retail, manufacturing and health at 15%, 10% and 9% respectively. The proportion of employment in retail at nearly 15% is well above both the MDB and Australian averages. Manufacturing in the area is not far below the Australian average and is well above the MDB average.

²⁵ The ABS census 2006 reports very little or no employment in rice. This may be because of categorisation errors by ABS, or because rice is not the major crop of rice farmers. Employment values have been calculated as detailed in Appendix 3 of Volume two of this study.

²⁶ It is not possible to estimate the employment associated with this irrigation water. It is probably similar to employment levels in the other major broadacre crops of rice and cotton, that is around 1.3-1.4 jobs per GI of irrigation water applied and suggesting this irrigation water provides around 2% of agricultural employment.

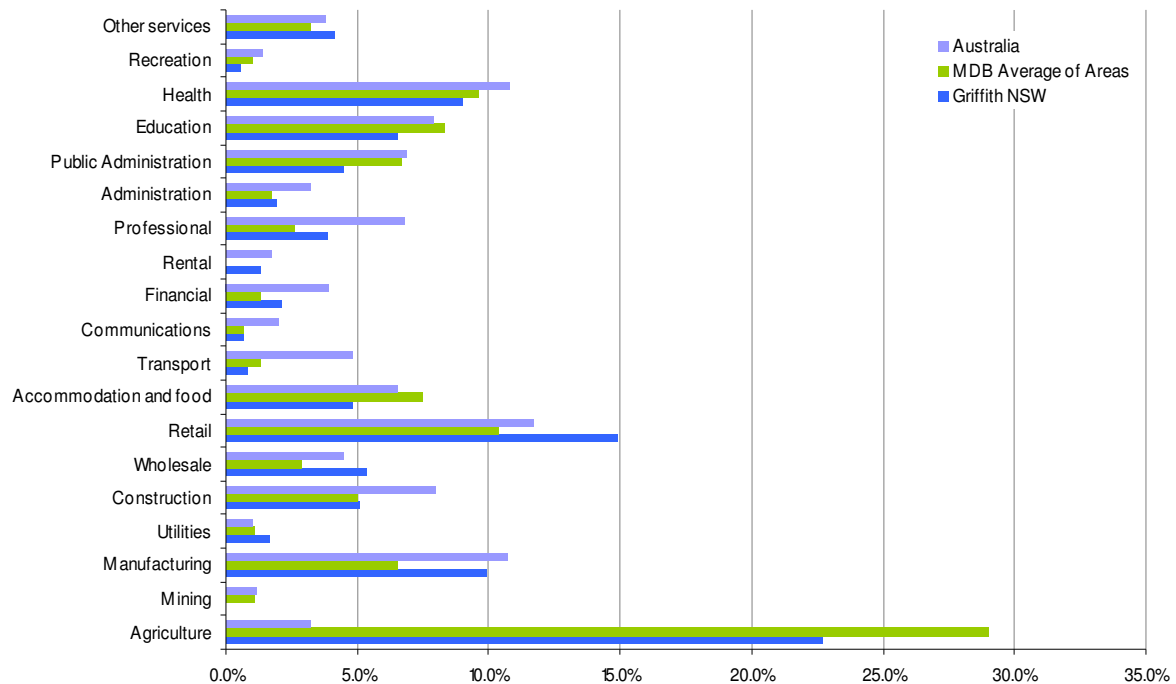


Figure 3.5: Employment Profile, Griffith NSW

Source: ABS (2006) Census of Population and Housing, JSA (2009)

Agricultural Employment

Large scale wineries such as Casella Wines and De Bortoli Wines contribute to ‘grapes’ being a large employer in the Griffith case study area with 55% of agricultural jobs and nearly 13% of all jobs. Casella Wines is Australia’s largest family owned winery and in 2007 was responsible for 9% of the country’s total grape crush.²⁷ Casella’s facility in Griffith is also reportedly the largest winery in the southern hemisphere.



Figure 3.6: Casella Wines facility in Griffith NSW

Source: JSA, March 2010

²⁷ Casella Wines website, www.casellawines.com/our-story, accessed 26 March 2010.

According to some interviewees, Casella's and other large scale processing facilities in the area have been a source of employment for some 'general security' farmers who have been unable to grow rice and other crops in recent years. There are also opportunities for young people, itinerant workers and backpackers. A basic cellarhand position at a winery can earn around \$1000 per week for an intense three month period of working 12 hour days, 7 days a week. These types of opportunities are likely to contribute to the relatively low youth unemployment and low secondary school participation rates for young people in Griffith compared to the other southern basin case study areas. In addition to jobs in the wine industry, there are other job opportunities associated with agriculture including packing and processing facilities for citrus, cherries, tomatoes, potatoes and chicken.

3.4.3. Indicators of Community Wellbeing and Resilience

In 2006, the Griffith case study area had a resident population of 23,801, making it the third largest of the case study areas. Despite steady growth since 1976, the population declined slightly by 0.5% from 2001 to 2006. This decline is in contrast to the other southern basin case study areas which grew over the period, but is much less than the declines experienced by most of the northern basin case studies. In the same period, there was a slight reduction in jobs of 0.5%, making Griffith the only southern basin case study to lose jobs.

Griffith's closest capital city is Melbourne at a distance of approximately 465km, with Sydney approximately 600km away. The area is more remote than the MDB average and at a similar level of 'remoteness' to Mildura and Moree Plains. Griffith has a relatively low Indigenous population at 3.8% compared with the MDB average of 4.9%, although it is slightly higher than the Australian average of 2.3%. It also has the lowest median age of the southern basin case study areas at 35 years, well below the MDB at 40 and Australia at 37.

Of the eight case study areas in 2006, Griffith was the least disadvantaged and had the highest median household income level at \$997 per week, 28% higher than the MDB average of \$779 per week and not far from the Australian median of \$1027 per week. Despite this, it had lower values for SEIFA Indexes of Education and Occupation and Economic Resources, perhaps indicative of a relatively polarised community. Griffith LGA also had the lowest rates of premature death and chronic ill health of the case study areas, and was the second lowest of the case study areas in terms of disability support pension recipients, and was the lowest of southern basin communities for proportion of the population with a profound or severe disability.

Griffith's labour force participation rate for those aged 15 and older, at 63.1%, was higher than the MDB and Australian averages, and was the highest of the southern basin areas. Griffith also had one of the lowest rates of unemployment of the case study areas at 3.9%, well below the MDB and Australia. However, study participants report that unemployment has increased in the years since 2006. Griffith had the highest labour force participation rate for those aged 65 and over of the southern basin case study areas, just under the MDB average and well above the Australian average, which is indicative of many older people, particularly farmers, working well into their 60s and 70s.

There is a relatively high proportion of the population with trade or better qualifications, at 30.7%, second highest of all the case studies and just below the MDB average. There is a relatively low rate of participation in secondary education at age 16 at 57.5%, which is the second lowest of the case study areas; much lower than the MDB at 71% and Australia at 74.8%. However, youth unemployment is among the lowest of the case study areas at 8.3% and below the MDB and Australian averages. This suggests that young people are opting for employment over education in the local area.

Griffith had the lowest rate of migration into the area with the lowest proportion of residents who lived in a different SLA 5 years ago at 13%, well below the MDB average of 22.7% and Australia at 24.2%. This suggests that while residents seem to stay in the area, there is little attraction of new residents to the area. The area also has the lowest rate of voluntary work for an organisation or group of the eight case study areas at 18.2%, which may be representative of the younger age profile combined with the high labour force participation rate amongst those over 65 years.

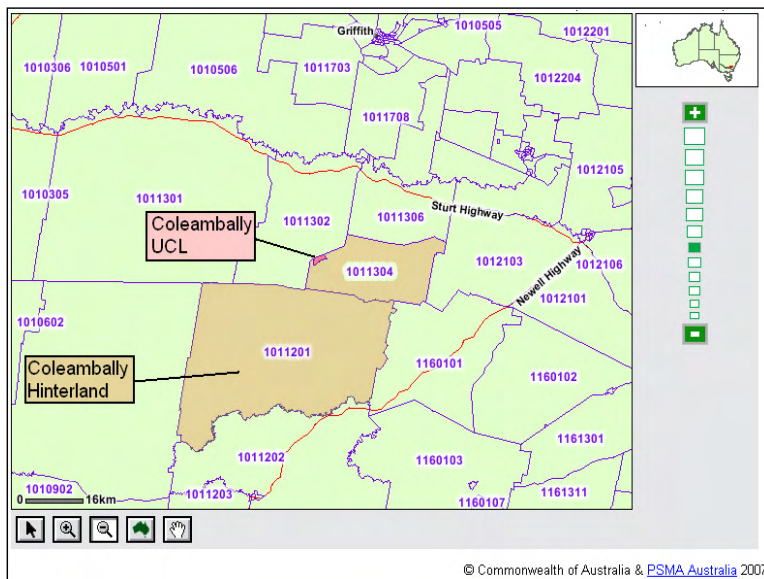
Profile on a small town in the region: Coleambally NSW

Coleambally is a small town approximately 65 kilometres drive south of Griffith. Much like Griffith, Coleambally is an irrigation community. It developed as a service centre for farmers of the Coleambally Irrigation Area. The irrigation area was developed in the late 1950s through the 1960s, with the town officially opened in 1968 – making it the youngest town in NSW. The area was especially suited to rice production and it is the principal crop grown along with wheat, maize and soybeans. The development of a rice mill closely followed the opening of the town.

Coleambally provides an example of a much smaller community in the region with a more ‘general security’ dependent irrigation profile that is likely to be impacted by changes in water availability in different ways to Griffith. Whilst it is beyond the scope of our current work to fully explore Coleambally as its own case study, we have used ABS Census data from 2001 and 2006 to explore how the area has changed during the beginning of the recent drought period.

The population of the Coleambally township (shown in the map below as the Coleambally Urban Centre/Locality or UCL) decreased by around 4.4% between 2001 and 2006, from 686 to 656. The population of the Coleambally hinterland decreased by around 3.9% between 2001 and 2006, from 719 to 691.

Map 3.4: Coleambally UCL and Hinterland



Source: ABS Website 2010

As we might expect, agriculture is the dominant employer in the area. Compared with the MDB average, nearly half of Coleambally (UCL & Hinterland) employment was in agriculture. There was a relatively low proportion of employment in accommodation and food, retail, public administration and health. The area was well below the MDB average across all employment sectors apart from transport, wholesale, utilities and financial.

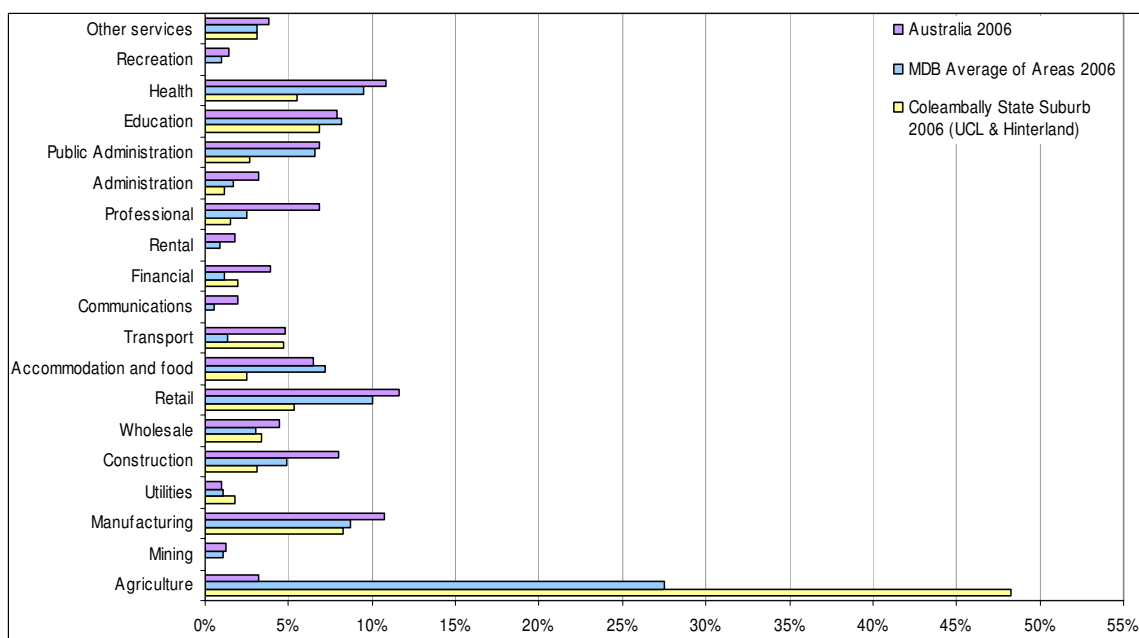


Figure 3.7: Employment Industry Breakdown – Coleambally UCL & Hinterland 2006

Source: ABS 2001 / 2006 Census

The number of persons working in agriculture in Coleambally dropped substantially from 373 in 2001 to 327 in 2006, a decline of 12%. There was also a significant 28% decline of those working in retail. Alternatively, employment in manufacturing almost doubled over the same period, and health increased substantially. Overall employment decreased by around 5% from 2001 to 2006, mirroring the decline in population.

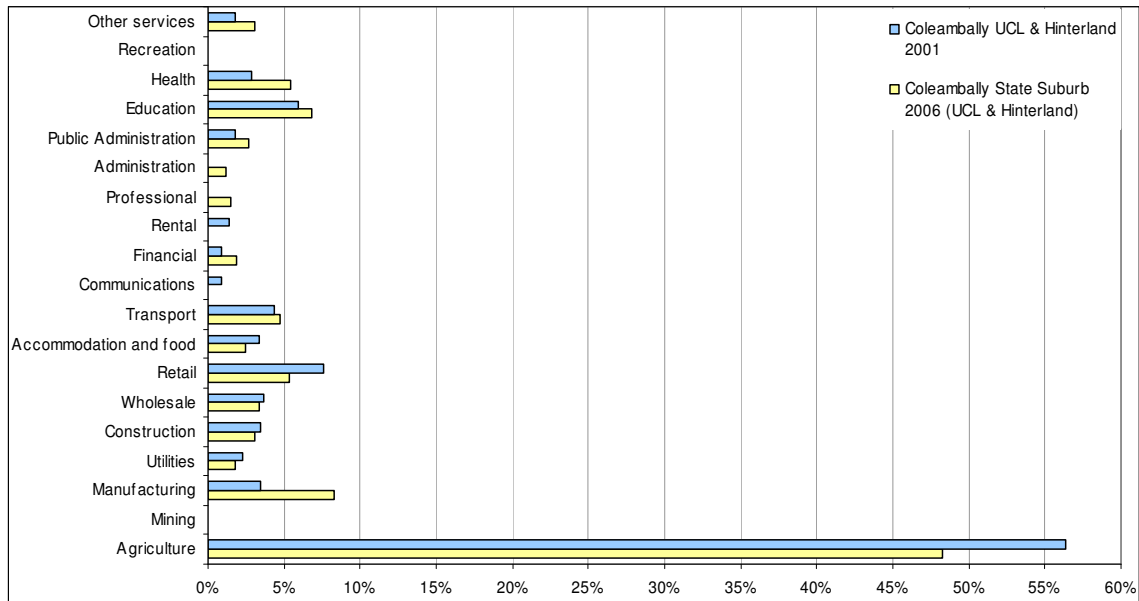


Figure 3.8: Employment Industry Comparison – Coleambally

Note: 2001 Census did not include the categories for 'Professional' and 'Administration'

Source: ABS 2001 / 2006 Census

The table below shows the status of Coleambally against a selection of wellbeing and resilience indicators for 2001 and 2006.

Table 3.4: Coleambally UCL & Hinterland Key Indicators

	2006				2001	
	Coleambally UCL	Coleambally UCL & Hinterland	MDB Average of Areas	Australia	Coleambally UCL	Coleambally UCL & Hinterland
Population	656	1,347	2,004,560	19,855,288	686 ²⁸	1,405 ²⁹
Persons Employed	316	688	921,300	9,104,185	334	721
Labour Force Participation of persons aged 65+ (%)	13.4%	30.8%	15.4%	9.4%	16.1%	35.8%

²⁸ Note that the 2001 population was based on place of enumeration on census night, whereas the 2006 population was based on place of usual residence. Small area data for 2001 is not available by Place of Usual Residence. The 2001 population of Coleambally UCL includes 41 visitors to the area.

²⁹ Includes 65 visitors.

	2006				2001	
	Coleambally UCL	Coleambally UCL & Hinterland	MDB Average of Areas	Australia	Coleambally UCL	Coleambally UCL & Hinterland
Youth Unemployment (%)	6.7%	3.8%	10.4%	10.2%	4.9%	3.4%
General Unemployment (%)	3.7%	2.5%	5.0%	5.2%	2.6%	1.2%
Tertiary Qualification, Certificate or Higher (% of persons aged 15+)	30.3%	28.6%	34.1%	39.4%	29.2%	27.5%
Median Age	39	39	38	37	37	34
Median Weekly Household Income (CPI Adjusted for 2001)	\$850	\$890	\$780	\$1,025	\$805	\$910
Voluntary Work Participation (%)	30.8%	35.9%	29.0%	19.8%	Information not available	Information not available
SEIFA: Disadvantage	953	1,007	953	1,000	979	Information not available
SEIFA: Education-Occupation	937	992	953	1,000	936	Information not available

Source: ABS (2006) Census of Population and Housing, by Place of Usual Residence; ABS (2001) Census of Population and Housing, by Place of Enumeration.

Results show that Coleambally had a very high labour force participation rate of persons aged 65 or older at nearly twice the MDB average, which is similar to other agricultural areas where farmers are working well into their 60s and 70s.

Coleambally had low unemployment, both youth and general, especially when the hinterland was included. However, these rates rose between 2001 and 2006. Tertiary qualification rates of persons aged 15 years and older lower than the MDB and Australian benchmarks.

The most interesting finding about Coleambally between 2001 and 2006 is the dramatic increase in the median age from 34 to 39. This suggests that the loss of population was largely an exodus of young residents, likely seeking employment for jobs lost in the area, and the remaining ageing population. These findings indicate a community whose fortunes are tightly linked to irrigated agriculture. Short-term reductions in water availability due to drought and low allocations will have (and undoubtedly have had) a significant impact on this small community. However, a permanent reduction in water availability will take away the opportunity for recovery from short-term shocks when water is available for general security uses.

4. Predicted ‘long term’ impacts of reduced water availability

JSA has modelled three scenarios to predict the likely short and long term impacts of reduced water availability on community wellbeing and resilience in the Griffith case study area. Changes in ‘water availability’ have been assessed relative to irrigation water applied within the case study area during the 2005/2006 season, as reported in the ABS Agricultural Census. Reductions in water availability may arise from:

- **government policy** (such as through the buyback of permanent entitlements and setting new Sustainable Diversion Limits under the Murray Darling Basin Plan),
- **short term climatic variations** (such as the recent drought), and/or
- **long term climate change** (such as per the CSIRO 2030 best estimate projections).

The extent to which these factors will reduce water availability is unknown. We have modelled three scenarios of 10%, 25% and 50% reductions in irrigation water applied in the local area on the variables of population, total employment, employment in key agricultural industries, and indicators of community wellbeing and resilience. These are indicative scenarios only. We recognise that the ‘irrigation water applied’ in the model year is a reflection of seasonal allocations, carryover water, on-farm water storage, groundwater extraction and any water purchased into the area.

We have selected 2005/2006 as the model year for this analysis, as it is the most recent data available by small area. We have assumed it represents a relatively ‘average’ season in terms of water availability and irrigation use, although employment and water usage in some instances may have been reduced because of the drought. The aim of this exercise is to predict the likely long term impacts of potential reductions that may arise from government policy and climate change in the context of an ‘average’ water availability and use scenario. We recognise that there have been considerable short term impacts experienced since 2005/2006 as a result of the drought. These impacts and responses by farmers and the local community are explored below. However we have taken the view that, all other things being equal, the agricultural sector will recover from the drought to achieve previous levels of production with the return of irrigation water. The challenge when considering these predicted long term impacts is to remember that they are based on a snapshot of an ‘average’ year, and to ignore the impacts that may have already been experienced since that time due to the drought.

4.1. Predicted ‘long term’ impacts on Griffith

The impact on the Griffith case study area from reductions in water availability has been modelled using data from JSA Research Strategies 1 and 2.

The ‘long term’ impacts of reduced water availability on Griffith are likely to be significant, particularly with regard to employment and population change. This is because irrigated agriculture forms a large proportion of both agricultural industries and the total economy of Griffith.

4.1.1. Employment and Population

The primary effect will be a loss of employment, ranging from a 3.9% loss (440 jobs) predicted from a 10% reduction in water availability to an 18.9% loss (2,139 jobs) predicted from a 50% reduction in water availability, including direct and indirect employment in agriculture and multipliers. Given the job loss experienced during the recent drought (prior to 2005/2006) and the fact that irrigated agriculture is anecdotally stated to have higher multipliers than the average for agriculture, and the likelihood that some agricultural jobs have not been identified in our analysis, this is almost certainly an underestimate. There may be threshold effects also, with rice production reported to reduce by 80% with a 50% reduction in availability in General Security water.³⁰ At the same time, the model probably overstates the quantum of lost employment in Griffith arising from a 50% reduction in water. Subsequent population loss is estimated at a 5.2% loss (1,232 people) predicted from a 10% reduction in water availability to a 25.2% loss (5,988 people) predicted from a 50% reduction in water availability.

Theoretically, if the enterprise level economics were such that trading resulted in water being moved from agricultural uses with lower employment per Gl like broad acre, pasture, cereal crops and rice to uses with higher employment per Gl such as horticulture, rather than water reductions being evenly distributed across all irrigated agricultural uses as assumed by our modelling, then employment losses are predicted to be about 4% or 450 jobs from a 50% reduction in water availability. Under this scenario, the ability to trade water could be a significant mitigation for job losses in this community arising from reduced water availability. However, job losses in rice³¹ would be significant under this scenario, with about 80% of jobs in this industry predicted to be lost, with commensurate severe social impacts upon relevant communities. This has already been seen during the recent drought in areas reliant upon general security water like Coleambally, and may be regarded as a real time simulation for permanent water reduction, as described below.

Practically, there are significant limitations to such trade. First, high security water is required for permanent plantings, and the general security water does not provide sufficient certainty for investment in grapes, horticulture and the like. As well, such uses are likely to require water in drier years, when general security water is less likely to be available. Trade will also be affected by relative commodities prices, as is the case now. A diversity of cropping options has been an important resilience strategy for regional irrigated agricultural communities to withstand such

³⁰ Correspondence, Murrumbidgee Irrigation, 28 June 2010.

³¹ See JSA (2010) Report 2: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Understanding Agricultural Employment*, Appendix 2: *Data sources and methods used*, for an explanation of how employment in each agricultural use has been determined.

fluctuations. There are also significant local area limitations to such trade. For example, the scenario described above may be possible in the immediate Griffith case study area, where there is a high diversity of irrigated agricultural uses and a mix of high and general security licences held. However, this scenario would not be possible in areas with a predominance of general security licences and reliance upon a narrower range of uses, for example, areas such as Hay, Deniliquin and Coleambally (see Section 5 below). It is also noted that impacts on these areas in the wider hinterland are also likely to flow on to Griffith as a major service centre in ways not taken into account in our modelling.

4.1.2. Community Wellbeing and Resilience

Socio-economic indicators of community wellbeing and resilience are expected to change to some degree as a result of reductions in water availability for irrigation, with mostly adverse impacts predicted on the range of indicators selected. Notable changes³² are an:

- Increase in **labour force participation 65+** ('average' of 14.7% predicted increase to 15.1% at a 10% reduction ranging to 16.1% at a 50% reduction);
- Increase in **youth unemployment** ('average' of 8.3% predicted increase to 8.4% at a 10% reduction ranging to 9.1% at a 50% reduction);
- More **mobile population** ('average' of 13% predicted increase to 13.2% at a 10% reduction ranging to 14% at a 50% reduction); and
- Higher levels of **voluntary work** ('average' of 18.2% predicted increase to 18.4% at a 10% reduction ranging to 19.5% at a 50% reduction).

The table below shows the predicted impacts for each of the three water availability reduction scenarios across all population, employment, and community wellbeing and resilience variables.

³² More than 5% change at 50% reduction in water availability

Table 4.1: Predicted 'long term' impacts of reduced water availability for Griffith NSW

Indicator	Base case	Predicted impacts for reduced irrigation water scenarios			Notes
	2006	10% reduction	25% reduction	50% reduction	
Irrigation water use (GL)	329.0	296.1	246.8	164.5	
Employment (total) ⁽¹⁾	11316	10876	10239	9177	
% decrease in employment		3.9%	9.5%	18.9%	
Employment (Vegetables) ⁽²⁾	75	52	18	-40	The negative number is because vegetable and fruit processing was allocated 50/50 between vegetables and fruit
irrigation water use (Gl)	13.6	12.2	10.2	6.8	
Employment (Fruit) ⁽²⁾	364	316	244	124	vegetable and fruit processing allocated 50/50
irrigation water use (Gl)	27.9	25.1	20.9	14.0	
Employment (Grapes) ⁽²⁾	1427	1312	1140	854	
irrigation water use (Gl)	61.5	55.4	46.1	30.8	most of these jobs are in processing
Employment (Grazing) ⁽²⁾	73	65	52	31	Assumed next best use
irrigation water use (Gl)	21.9	19.7	16.4	11.0	
Employment (Cereal) ⁽²⁾	58	58	58	58	Likely to reduce but estimates are unreliable
irrigation water use (Gl)	82.0	73.8	61.5	41.0	
Employment (Rice) ⁽²⁾	263	234	189	116	
irrigation water use (Gl)	204.1	183.7	153.1	102.1	
Employment (Cotton) ⁽²⁾	0	0	0	0	
irrigation water use (Gl)	0	0.0	0.0	0.0	
Employment (Balance Agriculture)	297	297	297	297	
Employment (Total Agriculture)	2565	2333	1998	1439	
Population ⁽³⁾	23801	22569	20786	17813	remains above 10,000 threshold

Indicator	Base case	Predicted impacts for reduced irrigation water scenarios			Notes
	2006	10% reduction	25% reduction	50% reduction	
estimated % decrease in population		5.2%	12.7%	25.2%	
Indigenous population ⁽⁴⁾	3.8%	3.9%	4.0%	4.3%	
Number of Indigenous people	904	877	838	773	
Dependent variables:					
SEIFA Disadvantage	983	983	982	981	
SEIFA Economic Resources	928	928	927	925	
Premature death	253.2	254.5	256.7	261.2	from changing indigenous structure
LFP 15+	63.1%	63.0%	62.8%	62.4%	from changing age and indigenous structure
Median Household income	\$997	\$995	\$ 991	\$ 986	from changing age and population
Disability support pensioners	5.3%	5.3%	5.3%	5.4%	
Profound or severe disability	4.2%	4.2%	4.3%	4.3%	
Chronic ill health	203	203.0	203.1	203.2	
LFP 65+	14.7%	15.1%	15.4%	16.1%	from changes in agriculture
Median Age	35	35.0	35.1	35.1	from change in agriculture
Skills Base	30.7%	30.8%	30.9%	31.1%	from changing agriculture
Education participation	57.5%	57.2%	56.8%	55.9%	
SEIFA Education and Occupation	932	931	930	929	
Polarisation	0.85	0.85	0.85	0.85	
Youth unemployment	8.3%	8.4%	8.7%	9.1%	from changing age structure
Unemployment	3.9%	3.9%	4.0%	4.0%	
Change of SLA five years ago	13.0%	13.2%	13.5%	14.0%	
Voluntary work	18.2%	18.4%	18.8%	19.5%	from change in agriculture and age

Indicator	Base case	Predicted impacts for reduced irrigation water scenarios			Notes
	2006	10% reduction	25% reduction	50% reduction	
Assault (Non domestic violence)	756	751	745	739	
Assault (Domestic violence)	583	587	595	610	
Property Crime	5666	5621	5540	5423	

- (1) Includes factor of 1.11 to account for census under reporting, and allows loss of 0.9 jobs for each lost agricultural job
- (2) Estimates using data from Table 3.1 of report two and using regression analysis data to account for dryland production, factor of 1.11 included)
- (3) Assumed one job per household, 2.8 people per household, unemployed households leave the area
- (4) In 2006, the Indigenous LFP rate was 52%, compared to 68% for the non Indigenous population. We have assumed that job losses will therefore have a lesser effect on Indigenous populations, leading to an increased proportion of Indigenous people in the population, at the rate of the loss of one Indigenous person for each 1.3 non-Indigenous persons.

5. Evidence of ‘short term’ impacts of reduced water availability

In contrast to a long-term or permanent reduction in water availability that may occur as a result of government policy and climate change, the recent drought represents a short term reduction in water availability. The reduction in water availability that has been experienced throughout the drought has prompted changes across agricultural industries and has resulted in significant impacts at the farm and community levels. This section of the case study documents the changes, responses and impacts that have been experienced from the drought in the Griffith LGA. An understanding of how farms, agricultural industries and the local community have responded to the ‘short term’ impact of the drought is necessary to better predict the likely impacts of ‘long term’ reductions in water availability.

5.1. Reduced water availability experienced

The recent drought has impacted farmers in the Murrumbidgee over the last ten years, with the most recent three years being particularly severe with rainfall levels not seen in any previous records.³³ The following figure shows general security allocations from 1892 to 2009, with the significantly low allocations of the drought period shown in red.

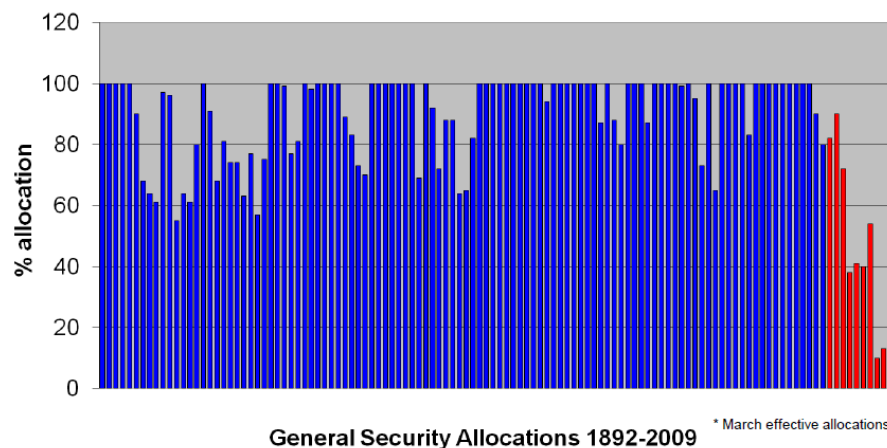


Figure 5.1: Murrumbidgee River Allocation Modelling

Source: Murrumbidgee Irrigation, 2010

³³ Murrumbidgee Irrigation presentation, 12 March 2010.

Since 2005/2006, general security license holders have experienced continued reductions in seasonal water allocations while high security license holders have had nearly full water availability.

Table 5.1: Allocations for Murrumbidgee Irrigation shareholders as at end of season

Season	High Security	General Security
2005/2006	95%	57%
2006/2007	90%	15%
2007/2008	90%	14%
2008/2009	95%	26%
2009/2010	95%	26% (as at 15/03/10)

Source: Murrumbidgee Irrigation

From its high of 1.7 million tonnes in 2001, the rice industry hit a low of 19,000 tonnes in 2008. For some rice farmers the very low allocations of the last 4 seasons have been particularly difficult. Early in the 2006/2007 season, due to exceptionally low in-flows into the Snowy system, the NSW Department of Water and Energy suspended the Water Sharing Plan required annual release level from the Snowy system to the Murrumbidgee. The Water Sharing Plan has since been suspended with the conditions of the 'dry in-flow sequence provisions' remaining in place.

5.2. Agricultural response to reduced water availability

5.2.1. Diversification

Diversification by high and general security irrigators in the Griffith area was occurring prior to the drought and has continued. Growers have diversified into olives, walnuts and almonds to achieve much higher value for water used. Others have investigated farm-stays; alpaca, ostrich and specialty export beef products; and other high-value specialty items like crocus and saffron. Cereal growers are investigating the potential for local ethanol production through crushing canola. While many growers have actively sought out diversification and value-adding, there are practical concerns about widespread diversification and market saturation as the oversupply in wine grapes has recently demonstrated. Despite the current downturn in grape prices, the wine grape industry appears to have a long term interest in the area as evidenced by the recent approval of a development application by Griffith City Council for Casella Wines to dramatically increase its crushing capacity by 250,000 tonnes. There has also been continued interest from overseas investors in both the large-scale purchase of land for possible future operations, as well as companies looking for growers to supply new initiatives (eg, industrial hemp for production of low-cost biodegradable coffins in China).

5.2.2. Utilisation of the Temporary Water Market

Development of the water market and ‘unbundling’ of land and water rights have provided irrigators with opportunities to access necessary water and sell water on the temporary market. In recent years irrigators in the Murrumbidgee have actively utilised the temporary and permanent water markets.

As a result of efficiency improvements many high security irrigators (though not all) have been able to sell some of their ‘excess’ water on the temporary water market, where prior to volumetric licensing and the existence of water markets any unused allocations remained in the ‘pool’ for use the next season. Original farm holdings in gazetted areas were 50 acres in size (roughly 20 hectares) with 260 ML of high security entitlement.³⁴ This arrangement is no longer typical as many of these farms have other properties to which they apply their water entitlement or other commodities besides wine grapes like prunes or citrus which require more water. With the improvements in on-farm water efficiency, these properties may only require 4-6 ML per hectare depending on soil and irrigation type.³⁵ The ability to sell some water on the temporary market, especially at a time when there was great demand for water in recent years, resulted in economic benefits for those irrigators able to sell as well as a source of water for general security holders in the area or growers elsewhere in the system with less reliable water supply for permanent plantings. Future reduced entitlements through the setting of new SDLs would likely limit irrigators ability to utilise the temporary market for mitigation.

5.2.3. Infrastructure Modernisation

All types of irrigators have taken steps to improve water use efficiency during the drought period, such as through investments in equipment like centre pivot sprinklers and drip irrigation technologies. There have also been significant system-wide upgrades that have been undertaken by Murrumbidgee Irrigation. The Rice Growers Association and its grower members have also worked with government over the last four years to deliver water (approximately 500 ML) in exchange for infrastructure funding.

The ability to trade ‘excess’ water has funded significant on-farm efficiency and infrastructure upgrades, with very few high security operations remaining that would not be utilising ‘high tech’ and efficient systems. However, many wine grape growers that converted to higher efficiency irrigation systems funded these initiatives through the sale of permanent water entitlements and have subsequently restructured their businesses to operate with less water. Impacts from any reduction in water availability for these growers are likely to be substantial. In addition, as many wine grape irrigators are efficient users of their entitlements further conversions may not realise any increases in on-farm production.³⁶ With increasing efficiency gains, not only in irrigation

³⁴ Correspondence with Riverina Wine Grapes Marketing Board, 19 July 2010.

³⁵ Correspondence with Riverina Wine Grapes Marketing Board, 19 July 2010.

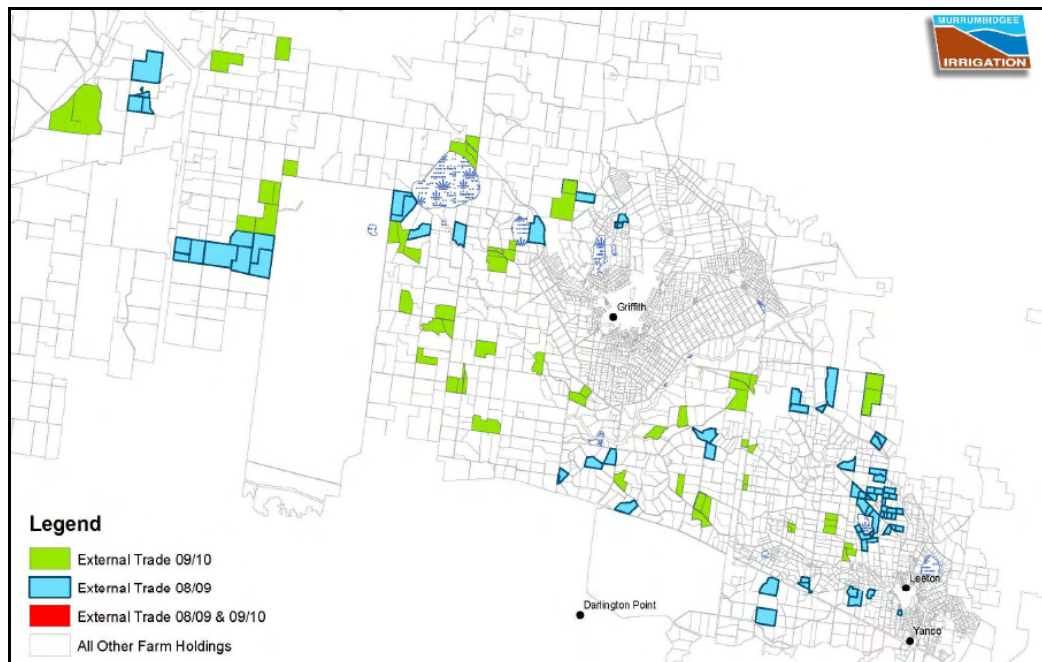
³⁶ Riverina Wine Grapes Marketing Board (2010) Water Sensitivity Analysis, April.

but also through mechanisation, on-farm labour requirements have also decreased. As a result, the movement away from small family owned blocks towards larger farms and corporate structures is likely to continue.

5.2.4. Sale of Permanent Entitlements to Government

Both the NSW and federal governments have actively purchased water for environmental flow purposes in the Murrumbidgee system through a variety of initiatives including the Living Murray, Water for Rivers and Restoring the Balance in the Murray Darling Basin. Whether state or federal, a government buyer has been the predominate purchaser of entitlements in the Murrumbidgee for the last few seasons. As at 28 February 2010, through its *Restoring the Balance* program the federal government has purchased 81,671 ML of general security entitlement and 20,821 ML of supplementary entitlement in the Murrumbidgee. According to Murrumbidgee Irrigation, for the 2009/2010 season at the time of writing, approximately 37,454 ML of entitlements (combination of high and general security) were traded permanently out of the system, with 6144 ML left before the area reaches the 4% cap limit. This is on top of any permanent sales from previous seasons, where we understand the 4% cap limit has been reached. Permanent trade of water out of the area has not been limited to one crop type or commodity group. There has been no coordination of these sales, which presents significant problems for the irrigation network and efficient delivery planning. The following figure shows the widespread distribution of permanent external trades from the Griffith area in recent years.

Map 5.1: External Trade in Griffith area



Source: Murrumbidgee Irrigation, 2010

5.2.5. Response to drought: wine grapes

Wine produced from the Griffith area accounts for over 15% of Australia's yield, and 70% of wine produced in New South Wales.³⁷ There are basically three categories of wine grape growers in the Griffith area, those with less than 20 hectares (small), 20-50 hectares (medium) and 50 or more hectares (large).

Wine grapes have expanded in the Griffith area from the mid-1990s. Small operations of 20 hectares or less have been managed by a single farmer with some additional contract labour, which enabled time for additional off-farm employment. Through the expansion period of the industry many small operations acquired an additional property, becoming medium sized operations. Large operations continued to purchase and expand or were already large property owners (often croppers) that decided to diversify into wine grapes during the expansion of the industry and high prices for grapes.

The drought hit during the expansion of the industry, and as a result some land uses changed to grow grapes in large scale plantings. Depending on the entitlement profile of a particular grower, those less reliant on general security entitlements were able to continue production and grow their businesses due to the high reliability of water. While reduced water availability has had some impact on wine grape growers in the area, the most significant impact has been the oversupply of wine grapes nationally, increased international competition and a resultant plummeting price.³⁸ In the 'short term' the impact of reduced water availability is not the primary issue facing wine grape growers in the Griffith area. However, as mentioned above, wine grape growers that converted to high efficiency drip irrigation systems by selling permanent water entitlements and restructuring to operate on less water would be vulnerable to any reduction in entitlements.³⁹

A number of interviewees commented that there is reluctance for some growers to accept what has happened recently in the wine grape market, as well as the changes that have occurred over many years with land and water including deregulation and water reforms. Anecdotally it appears that these types of growers have been less likely to make significant changes to their operations and in turn have become less resilient in the face of increasing change. Whilst there is greater awareness of depression and services available, some feel that the messages are still not getting through to some growers. There were also some concerns raised about generational conflict between older and younger growers, often in the same family, and the longer term impact of the over supply issue for the next generation of wine grape growers.

³⁷ Griffith City Council website, www.griffith.nsw.gov.au/lp.asp?cat=112, accessed 29 March 2010.

³⁸ The wine grape price fell 30% from the 2008/2009 to 2009/2010.

³⁹ Riverina Wine Grapes Marketing Board (2010) Water Sensitivity Analysis, April.

5.2.6. Response to drought: rice

Reduced water availability in recent years has profoundly affected rice growers and the industry in Australia. As a result, the rice industry in Australia has made significant changes and in its words has been “re-shaped” in recognition of its past performance and the likelihood of further reduced water availability. The industry is also now “completely vertically integrated”. Rice Growers Limited is 100% owned by Australian rice growers and markets its product domestically and internationally under the SunRice label. With the re-shaping of the industry it feels that it can confidently and competently manage an 800,000 tonnes level of production, even with a 20-30% reduction in entitlements that may occur through the Basin Plan.

Prior to the drought there were approximately 1700 irrigation farms producing rice across the industry, in the Murrumbidgee and other catchments. Many growers have not grown a rice crop in 4 years. In 2007/2008 only 37 growers were producing, 100 in 2008/2009 and 340 growers producing in 2009/2010. The industry estimates that around 1200 farms may still be viable if water were available. Widespread aggregation has reportedly not happened during the drought period, as growers have not been in a strong enough financial position to do so. It is expected that further aggregation will occur when higher allocations return.

Water availability for general security allocations have been at all time lows in recent years. In addition, some allocations were delivered ‘late’ or past the annual planting window. Depending on the price, many farmers chose to sell what water they were allocated on the temporary market or carry it over for the next season. Water market activity coupled with very low allocation resulted in summer crops becoming non-economical. As a result, land use within the area has primarily shifted from summer dominant cropping to winter dominant cropping with increases in wheat and barley. Summer crops like rice, maize and soybeans have all dramatically reduced in area. The loss of water through trading further reduced the productive capacity of these traditionally fertile areas.

Many rice growers in the Griffith area rely on a mix of general and high security water. Some have taken active steps to ‘drought proof’ their farms by investing in new infrastructure such as centre pivots, bores and associated licenses to pump groundwater, purchasing additional properties, and converting some general security licenses to high security where possible. In 2008, Murrumbidgee Irrigation offered a one-off opportunity to convert licenses to achieve savings based on surrendering one ML of general security water and obtaining 0.55 ML of high security entitlement and allocation. For example, a farm could forfeit 45% of their general security entitlement to end up with 55% high security entitlement and go from 2600 ML of general security (if 700ML of allocation is converted) to 1900 ML of general and 385 ML of high security.

While some growers have actively embraced water trading, others are more reticent about their role as a ‘farmer not a water trader’ and have always committed their water to a crop of some kind. There is also a sense that the low allocation period has seen the most inefficient farmers ‘weeded out’ through aggregation and the sale of water rights. As mentioned, continued aggregation is expected, particularly if and when allocations improve.

5.3. Community response to reduced water availability

Griffith is viewed as a vibrant regional hub that depends on the strength of its industries to keep a ‘critical mass’ of services. The industries in the area are highly dependent on water and irrigation. Interviewees noted that as a result of the drought some small businesses have closed, some agricultural contractors have left area, and that fundraising for community activities seems to be more difficult. The loss of contractors and associated businesses that help farmers to ‘re-invest’ in their properties is thought to be particularly important, as properties need to be maintained in order to produce once water becomes available.

While many rice growers have survived the drought by selling water on temporary and/or permanent market, there is concern that if the most viable use of water is to trade it then the production and consumptive capacity of local communities will diminish. As one interviewee said, *“Water trading does nothing but feed the banks. While it may be a good economic decision it can be horrible socially.”* While Griffith may not have been as visibly impacted at the community level, towns like Deniliquin and Coleambally have been significantly affected as their rice mills have closed.

The presence of large agricultural industries in the Griffith area like Casella Wines and others, often with greater water security, have provided a source of off-farm work for farmers and their family members. Whether or not a farm is actively cropping due to low allocations, family farms are still required to maintain the property so as to commence operations when water allocations return.

Mental health and counselling services report an increase in demand, with long term stress of ‘milling over decisions’, ‘second guessing’ and ‘ruminating past decisions’ developing into serious mental health issues for some farmers. While the awareness of services available to assist farmers and their families is high, there is a sense that the ‘message is not always getting through’ to some growers. Mental health and counselling services acknowledge that they are often working with growers who are at the bottom in terms of adapting to the changing circumstances, which is not to say that others who have remained relatively buoyant throughout the period are not also suffering from stress related issues but they appear to be less likely to seek advice and assistance. It is particularly difficult for older growers and others that must exit farming, whose skills and identity are strongly tied to their industry with few skills to apply to a new industry.

There is also a sense that the intense drought period has also come at a time when agricultural industries have undergone tremendous change and innovation. Regardless of the availability of water, farming now requires more business and technological skills than the profession may have required a generation ago. Those growers, whether young or old, that are able to astutely operate under these rapidly changing conditions seem to be more likely to survive and prosper. It is also acknowledged that peak industry groups, extension and education programs and research and others have long worked to assist growers to astutely operate. There is concern that government policy, such as its involvement in the water market, will not only ‘weed out’ the most inefficient growers but others who have been highly responsive and resilient to change. It is this loss that is

the most concern for farmers, and the long term implications on the productive and consumptive capacity for regional communities.

6. Predicted ‘long term’ impacts and possible mitigations

The primary driver for long term reductions in water availability in the short term will be government policy, such as through the setting of new Sustainable Diversion Limits under the Basin Plan. Reduced water availability for high and general security license holders will have an impact on agricultural production and the amount of water available to be traded.

As our modelling shows, with a permanent reduction in water availability (ranging from 10% to 50% of irrigation water applied in a model year) Griffith LGA could lose between 1,232 to 5,988 people and 440 to 2,139 jobs. Water trade could be a mitigation for some job losses. Impacts to other indicators of community wellbeing and resilience that are predicted include an increase in labour force participation for those aged 65 and older, an increase in youth unemployment, a more mobile population and higher levels of voluntary work.

Our research also shows that **population size**, **remoteness**, **Indigenous population size** and **median age** account for much of the variation in community wellbeing and resilience across the MDB. How these attributes are expressed in Griffith provides insight into the community’s resilience to future reductions in water availability.

Compared to a small town like Coleambally, Griffith has a relatively large population at around 24,000 residents. While this size is likely to contribute to its resilience compared to a small town of 650 like Coleambally, it has not reached a ‘critical mass’ such that it would be classified as a major regional centre. It is more remote than the MDB average, is not located on a major transport highway and is some distance to its nearest capital city, which will adversely impact its resilience. Griffith has a relatively low Indigenous population rate, especially compared to other northern basin communities. As areas with larger Indigenous populations were found to have lower levels of wellbeing and resilience as per the indicators, this does not appear to be a risk factor for Griffith. Older populations were found to have lower levels of wellbeing and resilience across some variables. Griffith has a relatively young age profile, plus a low level of youth unemployment, which suggests that young people are able to stay in the community. This is likely to contribute to the area’s resilience into the future.

6.1. What can the ‘short term’ experience tell us about likely ‘long term’ impacts?

In some ways Griffith LGA has come through the drought better than other areas, particularly compared to some of the northern basin case study areas. This is likely to be related to attributes described above as well as factors such as the:

- Relatively high reliability of the MIA system,

- Prevalence of high security irrigation in the immediate Griffith area that received near full allocations throughout the drought period,
- Ability of irrigators to actively trade on the water market, and
- Relatively diverse and robust employment profile of the area.

Despite these advantages, as mentioned Griffith did not experience any growth in population and slight decline in jobs between 2001 and 2006, against the trend of the other southern basin case study areas, the MDB average and the nation.

The wider Murrumbidgee Valley and other smaller communities outside the Griffith area such as Coleambally and Hay, which are much more reliant on general security licenses, have apparently experienced greater declines and more acute adverse impacts. These areas are likely to rely to some extent on the resilience of Griffith, and would in turn also be affected by its vulnerabilities. There has also been a considerable amount of water traded out of the area permanently, which is a concern for many due to the potential the implications of these sales on the irrigation system, other irrigators and the wider community which may not be fully realised in the short term.

Through the 'short term' shock of the drought, irrigators and industries responded through diversification, consolidation, infrastructure modernization, utilisation of the water markets and other adjustments. There have been adverse impacts experienced and the sale of some permanent entitlements from the area, and there are concerns that the long-term implications of these sales are yet to be experienced. However, there is some cautious optimism among those interviewed that with the 'unbundling' of rights, the reliability of the area's system and other positive attributes will enable Griffith to 'attract water' investment to the community.

While Griffith may experience less adverse impacts compared to another community in the MDB with less favourable indicators of wellbeing and resilience, there will undoubtedly be differential impacts experienced within the Griffith community and across the region particularly by irrigators and agricultural employers reliant on a lower security license portfolio, which has been demonstrated through the recent drought period. Moreover, as mentioned throughout this report, Griffith's strong reliability on irrigated agriculture and associated industries and its current status against a range of resilience indicators suggests that it is likely to be quite vulnerable to permanent reductions in water availability.

Appendix 6:

Mildura Rural City Case Study



Report 4: Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Social and economic impacts of reduced irrigation water

July 2010

This report has been prepared for



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1 Key Findings

1.1 Background

The primary driver for long-term reductions in water availability for irrigation communities in the Murray Darling Basin will be government policy, including the purchase of water entitlements under *Water for the Future* and the setting of new Sustainable Diversion Limits under the forthcoming *Basin Plan*. Climate change is also projected to have an impact on reduced water availability by 2030. Permanent out of area trade is also likely to affect communities quite differently, depending on whether they are a net importer or exporter of water, and conditions under which it is traded. Whilst there are likely to be benefits from increased water for the environment, reduced water for irrigation will result in a range of social and economic impacts on agriculturally dependant communities across the Basin. It is important in this regard to distinguish between **short-term stressors** such as rainfall variation and fluctuating commodities prices, to which agricultural communities have been adapting over many years, and more permanent impacts from **long-term stressors**, in this case policy and climate change-driven permanent reduction of water for irrigation.

In the face of possible permanent reductions in water availability and the associated impacts, this part of the study aims to answer the question, ‘how resilient are communities likely to be to permanent changes to irrigation water?’ A number of factors were found to predict changes in indicators of community wellbeing and resilience in earlier stages of this study¹ including changes in employment and population. Our findings for the MDB were generally in line with other research on rural and regional communities, with key indicators that predict wellbeing and resilience including degree of remoteness, degree of urbanisation (population size), proportion of Indigenous people particularly remote populations,² and age of the population.³ Degree of economic diversity and opportunities to diversify were also relevant factors identified in the literature,⁴ though our findings indicate that these factors are largely a function of other more endogenous factors like remoteness, proximity to a large urban centre or to other economic resources like extractive industries or scenic beauty. Though things like community leadership

¹ JSA (2010) Report 2: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Understanding Agricultural Employment*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri; and JSA (2010) Report 3: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Irrigated Agriculture and Socio-Economic Indicators*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri.

² It is noted that, although ‘Indigenous people’ is a proxy indicator, it is not being Aboriginal *per se* that signifies disadvantage but a range of attributes that are more likely to found among Aboriginal people, such as low income, educational and employment status, being a sole parent, lower likelihood of home ownership, etc

³ JSA (2010) Report 2: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Understanding Agricultural Employment*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri; and JSA (2010) Report 3: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Irrigated Agriculture and Socio-Economic Indicators*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri.

⁴ JSA (2010) Report 1: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Scoping Paper*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri.

and collaborative initiatives are important, it can be difficult for communities to respond to major stressors where they have characteristics that work against their ability to adapt to change. Other communities survive and even thrive against the odds, so that less tangible factors like leadership cannot be discounted.

To explore the likely social and economic impacts and degree of resilience to more permanent changes in water at different geographic scales, JSA has researched eight case studies across the Murray Darling Basin in different types of irrigated agricultural communities. The eight case study areas are Dalby-Wambo, Queensland; Balonne, Queensland; Moree Plains, NSW; Bourke, NSW; Griffith, NSW; Campaspe, Victoria; Mildura, Victoria; and Murray Bridge, South Australia. These are augmented by an overview of the regional context, or of smaller communities within these areas, to illustrate some of the impacts that are likely at different scales.

This report presents the findings of the **Mildura Rural City, Victoria case study**. The key findings from the study, particularly the area's current status against a range of wellbeing and resilience indicators is presented first, and is followed by a detailed discussion of research conducted on the Mildura area. Although we have only been able to focus on eight areas, it is hoped that the case studies will provide information for communities within the Basin facing similar challenges, and draw out the characteristics that are likely to mitigate or exacerbate the impacts of permanent reductions in irrigation water. A synthesis of findings related to the Basin as a whole, and to the eight case study communities is provided in the full report from Part 4 of this study (JSA 2010 forthcoming).

1.2 How Resilient is Mildura Rural City likely to be to permanent reductions in water?

1.2.1 Overview of Findings

Mildura Rural City

The impacts of a permanent reduction to irrigation water on **Mildura Rural City case study area** are likely to be significant, as irrigated agriculture forms a large proportion of both agricultural industries and the total economy of Mildura. Our modelling indicates that, with a permanent reduction in water ranging from 10% to 50% on the 2005-06 baseline year, Mildura LGA is predicted to lose at least 661 (3.2%) to 2,933 (14.2%) jobs in agriculture and related activities and from flow-on effects. Population loss ranging from at least 1,843 (3.7%) to 8,200 (16.5%) people is forecast from such water reductions. These are likely to be lower estimates due to Census undercounting and inability to identify all agricultural jobs in our analysis.

Existing indicators of community resilience and wellbeing for Mildura Rural City do not generally compare favourably with the MDB and national averages, and Mildura's relative disadvantage, relatively poor health indicators and measures of underlying human capital indicate that there would be constraints to flexible adaptation to structural change, particularly for more vulnerable groups. These socio-economic indicators are predicted to be somewhat worse

with reductions of irrigation water modelled, but with some reductions in crime and increase in voluntary work associated with reduced population.

It is also important to understand factors that may exacerbate or mitigate predicted population, employment and other socio-economic impacts. Mildura Rural City has some significant strengths including its size, its role as a regional service centre, high level of amenity from its location on the Murray River, attractive built and natural environment, multicultural heritage and diverse cultural and recreational institutions, and proximity to a range of natural assets including diverse national parks and environmental assets. Not surprisingly, it has been attracting a reasonable number of ‘tree changers’ from metropolitan areas seeking a better lifestyle, but also those who need more affordable housing, support services and lower skilled job opportunities from smaller and more remote areas in its wide hinterland. Community leadership is a definite strength, with civic and business leaders seeking to maximise any locational advantage from its location near the junction of three states and two major rivers and its high amenity, including opportunities from tourism, mineral sands extraction, warehousing and distribution, riverside development and alternative futures like solar energy.

Other advantages include its somewhat younger median age and relatively small Aboriginal population, the latter typically associated with significant disadvantage, are also predictors of a more robust level of community resilience and wellbeing. It is noted that areas like Wentworth LGA, near Mildura on the NSW side of the Murray, have larger Aboriginal populations and lower water security, and are of smaller size, and may be more adversely affected by less permanent water in the long-term.

That said, Mildura remains very vulnerable to a permanent reduction in irrigation water, particularly where these cuts are above 10%. There are reported to be very limited opportunities for on-farm and system efficiency gains remaining, and there would need to be significant capital investment to achieve further water savings. Significant industry restructuring and on-farm efficiencies are reported to have already been achieved through the latter years of the drought, which coincided with low allocations, falling commodities prices and an increased liberalisation of water trading. Further, the next best use without water is dryland grazing or cropping. The relatively small amount of irrigation land means that very few viable dryland enterprises would be created, even if total land under irrigation *could* be consolidated. A major loss of employment due to the extreme differentials between jobs in dryland uses compared with existing horticultural uses would be predicted from such a change of use in any case.

It is likely that there will continue to be benefits from trade in irrigation water, with Sunraysia likely to be a net importer, though this will depend on cost, relative value of produce, and supply of tradable water depending of the amount and location of reductions in SDLs under the forthcoming *Basin Plan*. There are likely to be quite different impacts from open trade in water on different growers, industry sectors and communities, as there have been in the past few years, with winners and losers from water trade between different users and at different scales.

Though there has been a dramatic loss of irrigation land, with 24% in Mildura currently out of production, most of this has become vacant since 2006. As well as low water allocations, low commodities prices were a significant factor, with ‘unbundling’ of land and water rights since

2007, and programs like the Small Block Exit Package providing the opportunity for many to exit the industry, temporarily or more permanently, or to restructure their business. It is reported that much of the vacant irrigation land could come back into production with the right growing and market conditions, though there are also constraints such as land prices and fragmentation.

A significant constraint in the short- to medium-term arises from Federal Government requirements related to the Small Block Exit Package to decommission infrastructure and not use the land for agriculture for 5 years. Though there have been benefits to individual growers, especially older producers on smaller blocks, serious concerns about the unintended consequences of this policy have been frequently raised in the Southern Basin. In particular, these concerns relate to exacerbation of social impacts on small communities, and impediments to sustainable economic restructuring including further farm consolidation and use of land for other horticultural uses for which there is market demand. Differences in the effectiveness of market-versus government-led interventions in achieving industry restructuring, and the unintended consequences of the latter, are key issues that emerges from this case study. It also raises issues related to top-down versus more participatory approaches to environmental management and economic restructuring.

Despite the advantage of size, amenity and natural advantages that have supported growth over previous decades, Mildura Rural City and the smaller communities that make up its hinterland, remain highly reliant upon irrigated agriculture and economic activities related to it. At least one-third of local employment is directly or indirectly related to irrigated agriculture, and Mildura acts as a service and processing centre for a much wider hinterland from Robinvale to the South Australian border, with many smaller, agriculturally dependent communities. Cumulative impacts related to processing, warehousing and distribution, and other local industry would also be expected. These factors also make it vulnerable to changes in its local agricultural base, and those in the wider region.

Moreover, a loss of irrigation water is likely to trigger job and population loss in smaller towns in Mildura Rural City, and smaller, more remote LGAs in the region, including those that had been 'holding their own' or even growing until 2006 (see Merbein case study in Section 4.2). Mildura urban centre may remain stable or continue to grow with less water, but this is likely to be increasingly at the expense of its smaller more remote towns and surrounding LGAs, depending on the size of reductions and their reliance upon irrigated agriculture. For these areas, job and population losses are likely to be more significant than those modelled for Mildura, with net regional job and population losses likely to be considerable.

There would have to be significant replacement industries to offset the loss of jobs above a 10% reduction in irrigation water in the region. Though continued growth in the service sector would be expected for Mildura urban centre, major diversification or expansion would be required in other sectors to offset predicted employment loss in agriculture, value adding, distribution and warehousing. Though community leaders are marketing its natural advantages and strategic location at the junction of three states, Mildura's relative remoteness, limited alternative economic alternatives, limits to urban expansion under State Government planning policy and degree of reliance upon irrigated agriculture and related industries, appear to make this problematic.

Supportive government regional development policy, assistance with economic restructuring, employment, training and small business development programs, and continued strong community leadership will be required if the region sustains significant reductions in irrigation water.

1.2.2 Mildura Rural City's 'Resilience' Report Card

Overview

This section provides an overview of key factors that have led to the above assessment of how resilient Mildura Rural City is likely to be in the face of permanent reductions in irrigation water. Key factors are reviewed as a 'report card' on resilience, and include:

- Projected changes in employment, population, and indicators of community wellbeing modelled for 10%, 25% and 50% cuts in irrigation water on the 2005/06 growing season;
- Degree of reliance upon agriculture and in particular irrigated agriculture and related industries;
- Factors that have a statistically significant relationship to wellbeing and resilience;
- The current status of Mildura Rural City in terms of existing socio-economic indicators; and
- Factors which are likely to mitigate or worsen projected impacts identified during field research.

Each of these is looked at in turn below. This is followed by detailed data and information from desktop analysis and fieldwork undertaken by JSA from January to May 2010.

Population and Employment Impact Forecast

The effects of a permanent reduction to irrigation water on **Mildura Rural City case study area** are likely to be significant, as irrigated agriculture forms a large proportion of both agricultural industries and the total economy of Mildura. Our modelling indicates that, with a permanent reduction in water ranging from 10% to 50% on the 2005/06 baseline year, Mildura LGA could lose **at least between 661 (3.2%) and 2,933 (14.2%) jobs** in agriculture and related employment and flow-on effects. They are also considered lower-bound estimates due to Census undercounting and the likelihood that not all agricultural jobs have been identified in our analysis due to problems with coding and self-identification.

Like downstream flow ons to other businesses in the area, related population loss is likely to also occur over time. Population loss has also been modelled for a reduction of permanent water from SDLs, permanent trade and climate change on the 2005/06 baseline year. Losses are projected to range from **at least 1,843 (3.7%) to 8,200 (16.5%) people** at the 10% and 50% water reduction levels (see Section 4.1.3 below).

It is noted that the upper values are similar to the employment and population losses experienced by Northern case study areas from 2001-06, arising largely from significant drought effects experienced during this time, and from which irrigated agriculture in the Southern Basin was largely cushioned until 2006-07.

The above employment impacts are probably understated, as Mildura contains a large number of value-adding processing jobs, and services a wider regional economy from which it sources a range of agricultural product for processing, warehousing and distribution. Such jobs in Mildura LGA are therefore expected to be adversely affected by loss of irrigated agriculture jobs in the wider region. Our analysis does not account for such cumulative impacts from areas outside Mildura, so that impacts are again likely to be understated.

Smaller towns and villages within Mildura LGA and outside the LGA in its wider hinterland are likely to be disproportionately affected, and the impacts on Mildura regional centre are in part reliant upon the extent to which people leave the area to move to larger centres outside the LGA when employment is lost, or resettle in Mildura urban centre. Mildura's gain may be another area's loss in this respect, though net population and job loss in the wider region is likely to be significant.

Predicted Changes in Indicators of Wellbeing and Resilience

Socio-economic indicators of wellbeing and resilience are expected to be generally adversely affected as a result of changing water availability, but with some reductions in crime associated with reduced population. Other notable exceptions⁵ are an increase in labour force participation 65+ and a more mobile population (see Section 4.1.3 below).

Factors Affecting Wellbeing and Resilience

A number of factors were found to predict changes in indicators of wellbeing and resilience in earlier stages of this study,⁶ including changes in employment and population. These included degree of remoteness,⁷ degree of urbanisation (population size), proportion of Indigenous people particularly remote populations,⁸ and age of the population.⁹ Degree of economic diversity and

⁵ More than 5% change at 50% level of reduction.

⁶ JSA (2010) Report 2: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Understanding Agricultural Employment*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri; and JSA (2010) Report 3: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Irrigated Agriculture and Socio-Economic Indicators*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri.

⁷ As set out in *Statistical Geography: Volume 1 Australian Standard Geographical Classification (ASGC), 2006 (cat. no. 1216.0)*.

⁸ It is noted that, although 'Indigenous people' is a proxy indicator, it is not being Aboriginal *per se* that signifies disadvantage but a range of attributes that are more likely to found among Aboriginal people, such as low income, educational and employment status, being sole parent, lower likelihood of home ownership, etc

⁹ JSA (2010) Report 2: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Understanding Agricultural Employment*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri; and JSA (2010) Report 3: *Exploring the relationship between community resilience & irrigated agriculture in the*

opportunities to diversify were also relevant factors identified in the literature,¹⁰ though our findings indicate that these factors are largely a function of other more endogenous factors like remoteness, proximity to a large urban centre or to other economic resources like extractive industries, and to a large extent not within the control of a local community, though strong community leadership from local government, regional development agencies and the like can assist in capturing investment opportunities.

The following table provides an overview of these key factors, which are discussed in more detail in the body of this case study report.

In summary, the main factor in Mildura's resilience in the face of permanent reduction in irrigation water is likely to be its size, with a population of at least 50,000 identified as a critical threshold for some degree of independence from the fortunes of its agricultural base.¹¹ Other positive factors are its somewhat younger age profile compared to the MDB average, and relatively low proportion of Aboriginal residents, though it is noted that areas like adjoining Wentworth LGA have significant Aboriginal populations.

Less positively, Mildura is relatively remote, and is not located near a capital city, though other locational advantages are evident. It lacks diversity in a number of productive industry sectors not related to agriculture or value-added processing, though again a strong retail and service sector in public administration, health and education is evident. At least one-third of local employment is directly or indirectly related to irrigated agriculture, and Mildura acts as a service, processing and distribution centre for a much wider hinterland, so that cumulative impacts from less water in the region would be significant. For example, most of the jobs associated with 'vegetables' were in 'processing' rather than growing and are likely to be affected by cuts in production in surrounding LGAs.

Mildura's reported popularity as a high amenity 'tree change' location may also work in its favour if faced with a significant reduction in irrigation water, though a contraction in its economic base may deter younger age groups and families from remaining in or relocating to the area. Moreover, there would need to be significant expansion in alternative employment opportunities to offset job losses arising from a major reduction in irrigation water, in Rural City of Mildura and the wider region.

Murray Darling Basin: Irrigated Agriculture and Socio-Economic Indicators, Cotton Catchment Communities Co-Operative Research Centre, Narrabri.

¹⁰ JSA (2010) Report 1: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Scoping Paper*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri.

¹¹ See JSA (2010) Report 2: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Understanding Agricultural Employment*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri; and JSA (2010) Report 3: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Irrigated Agriculture and Socio-Economic Indicators*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri.

Table 1.1: Key Factors in Community Resilience

Statistically Significant Factors	Likely to be Resilient?	Comment
Remoteness	X	Mildura LGA is more remote on the ABS Remoteness classification than the MDB average, and of similar remoteness to Griffith, also in the Southern MDB, and Moree in the Northern Basin. It would likely rate as even more remote if not for its size. It is classified as 'Outer Regional' while some areas within the LGA are classified as 'Remote'.
Degree of Urbanisation:		At around 50,000 'usually resident' people in 2006, Mildura may have reached the 'critical mass' to be a self-sustaining service centre, and population estimates indicate that it has grown since this time. It is reported to service a wide hinterland from Robinvale to the SA border.
• Population Size	√	
• Proximity to a large urban centre	X?	However, it is remote from larger urban centres and capital cities. Together with its high reliance on agriculture and value-added processing and warehousing including from its large hinterland, it remains vulnerable to direct and cumulative loss of jobs and population if substantial economic alternatives for job replacement are not found.
Indigenous Population	√	Mildura's Indigenous population is much lower than the MDB average, and slightly higher than Australia, though there was a 25% increase on 2001.
Age	√	Younger than the MDB average and equivalent to Australia. Likely to relate to employment and educational opportunities (e.g. Uni campus), and cultural factors related to the multicultural nature of its population base.
% of employment by industry compared with Australian benchmark	?	Much higher reliance on agriculture, value-adding and alternative productive industry sectors not related to agriculture. Services including health and education, and retail are the exceptions, which indicate Mildura's importance as a regional centre. Around 20% of direct employment is in agriculture, and at least 40% is related to agriculture when flow ons and likely under counting are considered. Importantly, 75% of local agriculture is irrigated agriculture, which is reported anecdotally to have much higher multipliers than dryland farming. This indicates that at around one-third of local jobs are related to irrigated agriculture. Significant impacts from a contraction in production in surrounding LGAs is again noted. For example, most jobs identified in 'vegetables for the Mildura LGA were in processing. A decline in irrigated agriculture would therefore need to be offset by significant new or expanded industries, which appears problematic given locational issues outlined below. Nonetheless, strong civic and industry leadership is evident in efforts to maintain and expand the area's economic base, though this may prove difficult if large reductions in permanent irrigation water are sustained.

Current Status on Community Resilience Indicators

It is also necessary to understand the current status of Mildura Rural City with regard to key socio-economic indicators in order to examine its resilience or vulnerability to changes in employment and population. The following provides a 'report card' on the extent to which the current status of Mildura Rural City compares with MDB and national benchmarks.

Overall, Mildura Rural City's existing indicators of community resilience and wellbeing do not compare favourably with the MDB average of areas, and are generally much less favourable than the national statistics. It is relatively disadvantaged on key ABS Indexes of social and economic wellbeing, and has become more so over the inter-censal period, though median income is slightly higher than the MDB average and has increased from 2001-06. Health indicators related to premature death and profound or severe disability are slightly worse than the MDB average and much worse than the national situation, despite the relative youth of its population and low proportion of Aboriginal residents. Indicators related to the educational and employment status of the population including those related to underlying human capital are also quite low for a regional area, and again much lower than the national averages, which indicate that the labour force or segments within it are likely to be quite vulnerable to changes in the structural economic base in terms of ability to flexibly adapt. Like other areas of the MDB, the income profile is quite polarised. Whilst there are clearly very well off residents, there are also a range of more vulnerable groups within the community, and the overall profile is not affluent.

It is positive that the area experienced population and employment growth from 2001-06, and its attractions as a high amenity and well-serviced 'tree change' location are clear in this regard. This is supported by observations from field visits. Mildura is reported to be attracting both older people and younger families leaving larger metropolitan areas. It is also likely to be attracting people from smaller towns and more remote communities, including older people and those with a disability requiring improved services. The absorption of people from its hinterland is likely as drought effects become more apparent post-2006, and if there are significant reductions in irrigation water in the future. That said, the overall socio-economic profile and the deterioration of SEIFA Indexes related to disadvantage, economic resources, and education and employment in the inter-censal period indicate that the area is attracting its share of people who are less well off, seeking more affordable housing and employment opportunities in lower skilled jobs, as well as better off 'lifestylers'.

Moreover, Mildura's socio-economic profile indicates that it is quite vulnerable to changes in its economic base, notwithstanding its size and reasonable growth from 2001-06. The impacts of the most recent drought years and further reductions in water will be important to monitor, and would be expected to arrest growth and may reverse such positive trends in the longer-term unless there are significant growth in alternative employment opportunities. Mildura urban centre could be expected to maintain its population or grow at the expense of smaller more remote towns and LGAs in its hinterland.

Table 1.2: Current Status Report on Indicators of Community Resilience

Proxy Indicator of Resilience / Wellbeing	Likely to be Resilient?	Comment
Community Wellbeing:		
SEIFA Disadvantage (includes indicators related to people's access to material and social resources, and their ability to participate in society)	?	Slightly less disadvantaged than MDB average but much lower than Australia (958 compared with 1000). The area became somewhat more disadvantaged on the Index since 2001 (then at 980 on the Index), which may reflect the increase in Indigenous people, and/or increasing lower skilled people coming in take up entry level jobs.
SEIFA Economic Resources (including income, housing expenditure and assets of households)	X	Low at 928 compared with 1000 for Australia, most likely related to low skilled jobs, lower asset value, etc
Median Household Income	√?	Slightly above the MDB average (\$785 compared with \$779) but much lower than Australia (\$1,027). Increased in real terms since 2001 (from \$750).
Disability Support Pensions	X?	Equivalent to the MDB average (around 6.8-6.9%), but much higher than Australia (5.4%), which is interesting given other health indicators below that are normally related to an older age profile with a high proportion of disadvantaged including Indigenous people. This could be accounted for by Mildura's services, with these attracting people with special service needs from a wide hinterland.
Premature Death	X	Slightly higher than the MDB average, and much higher than Australia. May be related to elevated levels of accidents and injuries, suicide, or pockets of disadvantage given the Indigenous population is low.
Profound or severe disability	X	Slightly higher than the MDB average, and much higher than Australia. Again, this is somewhat surprising given the age of the population and relatively low proportion of Aboriginal people in the local area. Like the above less favourable health indicators, this warrants further investigation, and again may be related to the attraction of those with health and disability issues from the hinterland.
Economic growth:		
Change in Total Employment 2001-06	√	A 4% increase in employment was well above the MDB average of 1.2% but much lower than national growth of 10%. The area doing quite well and clearly holding its own but not necessarily 'booming' (for example, compared with areas with extractive industries). There was reported to be employment loss post-2006/07 due to more recent reductions in allocations with the prolonged drought, with the area relatively cushioned prior to this time due to high levels of water security.
Labour force participation 15+ years	X	Slightly below the MDB and national averages, which is interesting given the somewhat lower school participation rate and the higher youth unemployment

Proxy Indicator of Resilience / Wellbeing	Likely to be Resilient?	Comment
		rate.
Labour force participation 65+ years	√	Very low for a regional area, though equivalent to Australia, and likely related to better retention of younger people and in-migration of families, so that 'succession planning' is feasible for local businesses.
Post-school qualification (skills base)	X	Lower than MDB and much lower than the Australian average. May be related to the nature of employment opportunities including entry-level employment in agriculture and value-adding industries.
School participation at 16 years	X	Slightly lower than MDB and much lower than the Australian average. Again, may be related to opportunities for entry-level employment in agriculture and value-adding industries, which is again interesting given the higher youth unemployment rate and the lower labour force participation rate.
SEIFA Index of Education and Occupation (includes relevant Census variables on the general level of education and occupation-related skills and status of a community)	X	Much lower than the MDB average and particularly compared with Australia. Likely reflects lower underlying human capital resources and nature of employment. There was a slight deterioration in this measure from 2001-06. Together with the above education and employment indicators, this indicates that the adaptive capacity of the work force as a whole or for some segments may be problematic in the face of structural change.
GINI co-efficient of household income distribution/polarisation	X	Like other areas of the MBD, the Murray Bridge shows quite a high level of polarisation between the 'haves' and 'have nots' based on household income.
Youth unemployment rate	X	Higher than average (12% compared with 10% for MDB and Australia).
General unemployment rate	√	Lower than the than MDB at 5.7%, though lower than the national average.
Amenity: Population Growth	√	4.3% increase in the 'usually resident population' (around 2,000 people) was well above the MDB average, but lower than national growth of around 6%.
In-migration	?	There was a relatively low level in-migration from outside the LGA compared with the MDB average and Australia from 2001-06 (16% compared with 23% and 24% respectively), which indicates that there was a relatively stable population underlying the 4% growth noted above. Perception of increased growth post-2006 are related to development approvals and residential dwelling construction in Mildura, but are likely to be coming from small towns and hinterland as well as some natural increase. Reported to be a mixture of older 'tree

Proxy Indicator of Resilience / Wellbeing	Likely to be Resilient?	Comment
		changers' and younger families seeking lifestyle options and more affordable housing and job opportunities. Some smaller towns and villages likely to be more vulnerable to population loss to larger centres, so that some absorption of the hinterland population into Mildura is likely. The actual growth of Mildura may be somewhat different to recent estimates in light of more recent and projected constraints to irrigation water, and will be clearer from the 2011 Census.
Volunteering rate	X	Relatively low volunteering rate for a regional area (22% compared with 29% for the MDB), but somewhat higher than the national rate (18%).

Other Factors that indicate vulnerability or resilience from consultation

Fieldwork and consultations have provided valuable insights into other aspects of current and future vulnerability or resilience, as well as other factors that are likely to mitigate or worsen projected impacts. (See **Section 4.2** for a more detailed discussion of fieldwork).

In summary, Mildura has some significant strengths from its size, role as a regional service centre, high level of amenity from its location on the Murray River, attractive built and natural environment, multicultural heritage and diverse cultural and recreational institutions, and proximity to a range of natural assets including diverse national parks and environmental assets. Not surprisingly, it has been attracting a reasonable number of 'tree changers' from metropolitan areas seeking a better lifestyle, but also those who need more affordable housing, support services and lower skilled job opportunities from urban and more remote areas. Community leadership is a definite strength, with civic and business leaders seeking to maximise any locational advantage from its location near the junction of three states and two major rivers, including opportunities from tourism, mineral sands extraction, warehousing and distribution, and alternative futures like solar energy.

That said, Mildura remains very vulnerable to reductions in irrigation water, particularly where these are above 10%. This is likely to impact on future employment retention and net growth, and constrain post-drought recovery. The next best use without water is dryland grazing or cropping, with very few dryland enterprises created even if total land under irrigation *could* be consolidated due to the small amount of land, and major loss of employment due to the extreme differentials between jobs in dryland uses compared with existing horticultural uses (less than 1 job/1,000 ha compared with 70-100/1,000 ha for horticulture).

There are reported to be very limited opportunities for on-farm and system efficiency gains remaining (in the order of 6% through all measures), with significant restructuring and on-farm efficiencies already achieved through the latter years of the drought, which coincided with low allocations, falling commodities prices and an increased liberalisation of water trading. Though there has been a dramatic loss of irrigation land (with 24% currently out of production), most of

this has been since 2006, and it is reported that much could come back into production with the right market and growing conditions, but this would clearly be more constrained with a loss of permanent water. There will continue to be benefits from trade in irrigation water, with Mildura likely to be a net importer, though this will depend on cost, relative value of produce compared with other areas, and ability to continue trade in water if there are significant reductions in supply through the Basin Plan. There are likely to be quite different impacts from open trade in water on different individuals, industry groups and communities, as there have been in the past few years, with winners and losers from such trade at different scales.

Moreover, despite the advantage of size, amenity and natural advantages that have supported growth over previous decades, Mildura remains highly reliant upon irrigated agriculture and economic activities related to it. It services a wide hinterland that will also be affected by reductions in irrigation water, and cumulative impacts related to processing, warehousing and distribution, and other local industries are likely. There would have to be significant replacement industries to offset the loss of jobs above a 10% reduction in irrigation water. Though continued growth in the service sector would be expected, major diversification or expansion in other sectors to offset predicted employment loss seems problematic.

Table 1.3: Other Factors in Resilience from Consultations

Factor	Likely to be Resilient?	Comment
Nature of 'next best' land use	X	Existing use for intensive irrigated horticulture likely to be best use going forward. Ongoing changes in crop mix likely in response to changing market and growing conditions, as has been the case over many years. Reduced water for irrigation is likely to be problematic as the 'next best use' without water would generally be dryland grazing or cropping, and consolidation of existing irrigation land would lead to very few dryland farms. Change to dryland uses predicted to lead to major job losses due to much lower employment per 1,000 ha (less than 1 job/1,000 ha for grazing compared with between 70 and 100 jobs/1,000 ha for fruit, grapes and vegetables).
Ability to 'recover' from drought and past responses	√?	Irrigated agriculture in the Mildura area was cushioned from the worst of the drought until the 2007/08 growing season, unlike the Northern case study areas, which have been experiencing drought effects since 2000/01. Growers in the Mallee CMA have responded to low allocations since 2007/08 by trading water (typically into private diversion and MIS areas, and out of pumped irrigation districts); reducing area under cultivation or rationalising plantings (e.g. in the case of vegetables or less popular varieties of grapes); and changing product mix. Of those trading water, a majority appear to be trading allocations (temporary water), whilst others have sold permanent entitlements, with some keeping delivery systems and leasing in water allocations. Participation in the Small Block Exit Program has been high in pumped

Factor	Likely to be Resilient?	Comment
		districts. Moreover, there are a diversity of strategies, with some exiting the industry, temporarily or permanently, others playing a 'waiting game', and still others buying up neighbouring properties to increase future viability through such consolidation. There have also been significant increases in on-farm water efficiencies by growers during this time, in response to changes in market and climatic conditions. It is reported that much of the irrigation land that is currently out of production (around 24%) could come back, depending on water availability, commodity and water market conditions, degree of consolidation that ultimately occurs, and future urban planning policy (e.g. regarding current restrictions on increased fragmentation of agricultural land). It is significant that most of the vacant irrigation land in Mildura LGA has gone out of production since 2006-07, and many interviewed noted the long-term resilience of agriculture over 100 years. It seems likely that much land could come back into production with the right conditions, though it was noted that permanent reductions in irrigation water would significantly constrain long-term recovery of agriculture in the LGA and its wider hinterland, depending on the size of reductions.
Ability to trade water	√?	The Victorian Murray had a strong net trade-in of allocation water from 2007-2009, the largest of any trading zone in Victoria, reflecting the value of horticulture in the Lower Murray (Vic and SA) and strong demand from this sector during times of water scarcity. Progressive liberalisation of the water trade has led to significant expansion of irrigated agriculture including by Managed Investment Schemes (MIS) since 1994, with irrigation areas almost doubling in the Mallee CMA Region from this time, much of it outside Mildura (e.g. in Swan Hill LGA). Land under irrigated cultivation in the pumped districts and to a lesser extent the private diversion districts of Mildura LGA decreased dramatically since 2006, due to a combination of low allocations, falling commodities prices and increased opportunity to trade water. The latter was reported to be a 'saviour' for many during this period, providing for flexible responses to market and climatic conditions. Participation in the Federal Small Block Exit Grant has been quite strong in the pumped districts. Moreover, there has generally been a net trade out of the pumped districts, hastening structural adjustment in these areas, and providing both positive and negative impacts in these areas, as illustrated by the Merbein case study below. Net importation of water appears likely to a high-value horticultural district like Mildura in the future, though the extent and impact of this will depend upon the nature of future commodities and water markets, climatic conditions,

Factor	Likely to be Resilient?	Comment
Ability to make efficiency gains	X?	the extent and distribution of reductions of irrigation water under the forthcoming <i>Basin Plan</i>, and ability to source water from other areas facing a reduction in water. While water trading will continue to be an important part of adjustment and resilience, it is likely that benefits and disbenefits of water trade will be differently distributed across communities, depending on whether they are net importers or exporters of water, and the conditions under which it is traded. There are reported to be two main opportunities for future efficiency gains - from lining channels, and from irrigators converting from furrow irrigation to spray or trickle irrigation. Based on advice from Lower Murray Water, 6% efficiency gain may be possible if all system and on-farm efficiencies were achieved on land currently under irrigated cultivation. To achieve this efficiency, it is likely that major capital investments would be required, which is not certain at this stage. 'Marked changes' in the irrigation methods used by local growers in recent years was also noted during consultations, with drip irrigation increasing from 17% of irrigated crops in 2005-06 to 33% of irrigated crops in 2009-10. Furrow irrigation declined from 22% of irrigated crops in 2005-06 to 9% in 2009-10. Overall, 70% of crops were irrigated by more water efficient methods (drippers or low level sprinklers) in 2009-10. The relatively low levels of efficiency that could be made in the future would leave irrigation in Mildura very exposed to moderate to larger reductions in permanent irrigation water through Federal Policy and long-term climate change. Reductions of water modelled at even the 10% level would have some impact, and certainly the impact of reductions above 15-20% would be considerable.
Access to Other Economic Opportunities	?	Limited opportunities for relocation of major enterprises due to remoteness, distance from larger capital cities, and quite limited opportunities from other natural resource development, though there is some potential to expand mining development in mineral sands. However, local employment in mining was much lower than the MDB and national average in 2006. Possible locational advantage from being close to juncture of three states, and established relationship with the Melbourne market, but again distance from other major centres may limit its attractiveness as a transport and distribution hub (for example, a centre like Shepparton appears to have more locational advantage, and there would appear to be a more logical link with an area like Murray Bridge for the Adelaide market). Council and other co-ordinating agencies are very proactive in seeking other economic opportunities wherever possible including major public investment in alternative futures like solar energy production, and are active in promoting any

Factor	Likely to be Resilient?	Comment
		strategic advantage Mildura may for industry relocation, transport and distribution functions. Nonetheless, the loss of larger players like Qantas and CSIRO more recently was noted as a significant blow during field visits. Reported to have good tourism prospects related to its restaurants, wineries and recreational attractions, and increased investment in riverside tourism infrastructure, though the area has lower than average levels of employment in tourism-related sectors (Food and Accommodation, and Recreation), indicating that this is not translating into jobs to the extent necessary to offset a significant decline in agriculture and related sectors. Significant alternative replacement of jobs will be needed to offset forecasts of a reduction in irrigation water.
Natural attributes	√?	Mildura's position on the banks of the Murray River and location near Lock 11 gives it a particularly high amenity and beautiful river aspect, including many ha of parkland with river frontage/aspect. There are also beautiful natural assets within or close to the area, including the Hattah-Kulkyne, Murray Sunset, Mungo National Parks and Chowilla Regional Reserve. Popular tree change location due to its mild, sunny climate, excellent services, and high amenity including high quality recreation, cafes and restaurants. There are also a wide range of cultural festivals, sporting events and the like. A downside to this is reported to be a reasonable proportion of older and unemployed/underemployed people coming to Mildura seeking cheaper accommodation, lifestyle and services. This can place a strain on social services and mean a less resilient labour force when faced with change.
Leadership	√	Very strong and positive local leadership and co-ordination evident from consultations with civic, business and economic development leaders, and review of regional and local economic development plans. This could help to offset general locational disadvantage where there is success in strongly advocating for the progress of the region, but significant reductions in jobs with less water for irrigated agriculture may be difficult to overcome, depending on size and distribution of reductions.

2 Introduction

In June 2009, Judith Stubbs and Associates (JSA) were engaged by the Cotton Catchment Communities Co-operative Research Centre to undertake a significant research project investigating wellbeing and resilience of communities, particularly those engaged in irrigated agriculture including cotton, within the Murray Darling Basin (MDB). The study seeks to understand the likely social and economic impacts on communities at different scales arising from changes in government water policy, in particular *Water for the Future*, and the forthcoming *Basin Plan*, and projected climate change. This project included three research strategies and has so far produced three reports.¹²

2.1 Rationale

Given findings from the literature and the first three reports of this study, it is likely that the social and economic impacts related to changes in water availability will be experienced differently at different geographic scales (eg. farm, local community, region, MDB, national), and by different groups within a community (e.g. farmers, Aboriginal people, businesses). Key factors will include the existing wellbeing and resilience of these communities, and other mitigating factors such as access to the water market and alternative economic opportunities.

In order to understand the differential impacts upon areas and groups, we have carried out a cost-benefit analysis to determine impacts at the MDB and national levels and prepared eight case studies to explore the likely impacts at the farm, regional and local community levels. These documents comprise the fourth and final report for this study.

The eight case study areas were selected in order to represent different states, different CSIRO Sustainable Yields Regions, cotton and non-cotton producing areas, a diversity of irrigated agricultural uses and diversity across three key attributes including population size, remoteness and Indigenous population. The eight case study areas include Dalby-Wambo, Queensland; Balonne, Queensland; Moree Plains, NSW; Bourke, NSW; Griffith, NSW; Campaspe, Victoria; Mildura, Victoria; and Murray Bridge, South Australia.

2.2 Case study methodology

This case study is informed by JSA's extensive analysis of agriculture and population data; a review of policy, relevant document and reports; and a series of telephone and face-to-face

¹² JSA (2010) Report 1: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Scoping Paper*, JSA (2010) Report 2: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Understanding Agricultural Employment*, and JSA (2010) Report 3: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Irrigated Agriculture and Socio-Economic Indicators*.

interviews with individuals from a range of perspectives and organisations. These included a wide range of staff and elected or appointed representatives of the following agencies/ groups:

- Mildura Rural City Council
- Mildura Development Corp
- Northern Mallee Local Learning and Employment Network
- Southern Cross Advisers
- Mallee CMA
- Murray Valley Citrus Board
- Department of Sustainability & Environment
- North West Rural Skills Connect
- Murray Mallee Local Action Planning Association
- Lower Murray Water
- Pinnacle Packers
- Western Murray Irrigation
- Victoria Department of Primary Industries
- Australian Dried Fruit Association
- Sunraysia Irrigators Council
- RDV
- A range of individual irrigators and dryland farmers
- Businesses, irrigators and community representatives in Merbein
- Interested community members who attended workshops and report back sessions

Interviews and a field visit to the Mildura Rural City were conducted between January and May 2010 in order to understand how water availability, agricultural land use and agricultural employment has changed in recent years as a result of government policy and short term climatic change (eg, the recent drought), how these changes resulted in social and economic impacts at the farm and wider community levels, and therefore how more permanent reductions in irrigation water are likely to affect wellbeing and resilience at the farm and community level.

2.3 Case study overview

This case study provides:

- A description of the case study area including its location, land and water use, water policy, and relative social and economic wellbeing and resilience against key indicators;

- A prediction of impacts to community wellbeing and resilience based on hypothetical reductions in water availability of 10%, 25% and 50% from the most recent year for which comparative agricultural and population data is available (the 2005/06 growing year and 2006 Census);
- An exploration of the 'short term' social and economic impacts that have been experienced as a result of the recent drought, fluctuations in commodities prices, water market and other relevant factors affecting communities; and
- An analysis of how the attributes of the area and other factors have exacerbated and/or helped to mitigate the impacts already experienced as an indicator of the area's resilience, and how it may therefore respond to more permanent changes in water availability under the forthcoming Basin Plan or permanent trade out of area.

3 Description of the Case Study Area

3.1 Location



Mildura Rural City Council covers an area just over 22,000 square kilometres and is located in northwestern Victoria. The council area is bordered by the Murray River and the South Australian border.

Covering around 10 percent of the state's area, its landscape ranges from Mallee vegetation to grain farms, intensive horticulture, and a range of urban centres, towns and villages including Mildura City, Red Cliffs, Merbein and

Irymple near the Murray River, and Ouyen and Murrayville further inland.¹³

Mildura's position on the banks of the Murray River and location on Lock 11 gives it a particularly high amenity and beautiful river aspect. There are also beautiful natural assets within or close to the area, including the Hattah-Kulkyne, Murray Sunset, and Mungo National Parks and Chowilla Regional Reserve.

The LGA is culturally diverse, and has a strong cosmopolitan atmosphere, as is evident from its many high quality restaurants and cafes and working riverboats which capitalise on the area's history and diverse seasonal produce. Its multicultural history, as well as a strong arts community and recreational opportunities are also evident in its community institutions, facilities and streetscapes.¹⁴ It hosts a wide range of festivals and event all year round,¹⁵ which is reported to act as a major tourism attractor and enhance the quality of life of local residents.

The municipality includes significant education and health services including university and TAFE institutions, a number of hospitals and medical specialties. Its mild, sunny climate is also reported to be an attraction for those leaving metropolitan centres to the southeast.

European settlement of the municipality began with grazing operations in the 1800s, before Mildura became Australia's first irrigation settlement in the middle of the century at the instigation of the Chaffey Brothers. Since then, Mildura has become a key service and economic hub of inland Australia. The district produces hundreds of millions of dollars in export revenue through horticulture.¹⁶ Mildura's irrigated agricultural land is reported to produce around 95 per

¹³ <http://www.mildura.vic.gov.au/index.asp?h=-1>

¹⁴ <http://www.mildura.vic.gov.au/index.asp?h=-1>

¹⁵ See for example <http://www.mildura.vic.gov.au/Files/july2010.pdf>

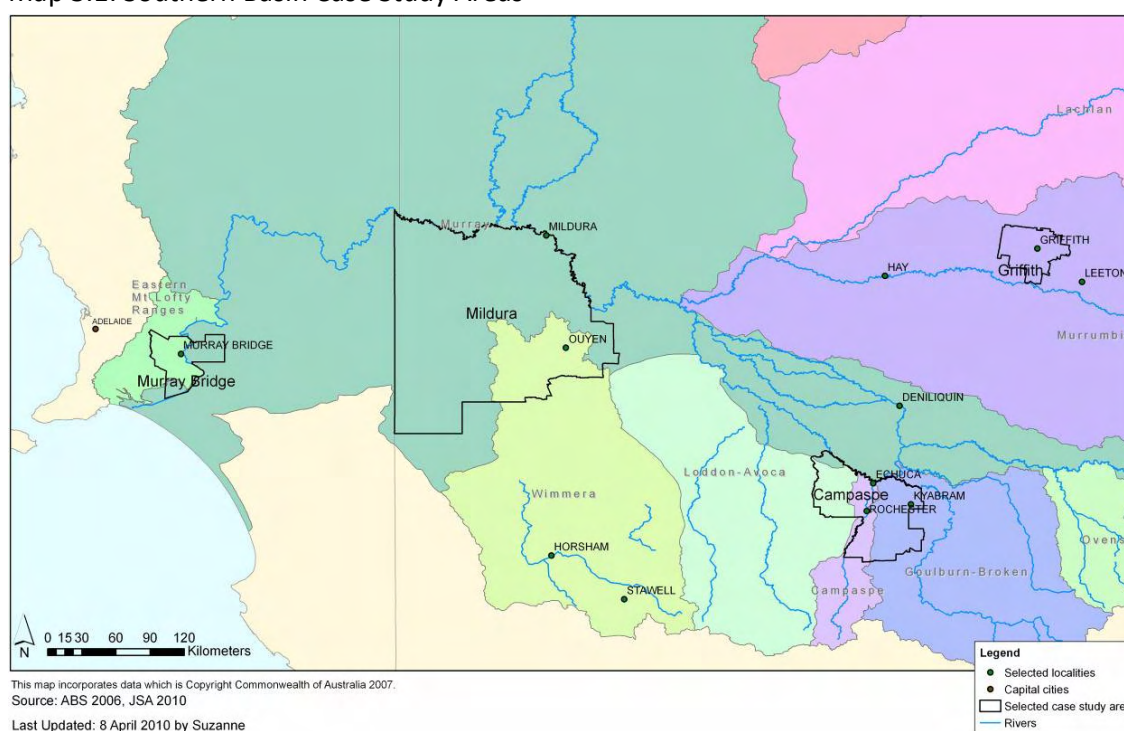
¹⁶ Interviews with Council officers, April 2010.

cent of Australia's dried grapes, 69 per cent of table grapes and 21 per cent of the country's citrus. The area also grows most of Australia's almonds, pistachios, olives, carrots, asparagus, and 21 per cent of wine grape crush.¹⁷

Council notes its strategic advantages, being 'positioned near the borders of three states, on the crossroads of transport links between three capital cities and near the meeting point of Australia's two great rivers', which it notes aids development and provides a distinctive regional flavour.¹⁸

The Mildura case study area is located in the **Murray Sustainable Yield Region (SYR)**,¹⁹ which straddles the NSW, Victorian and South Australian borders. The SYR is based around the Murray and the Lower Darling Rivers below Menindee, and runs the full length of the Southern Basin from east to west.²⁰ The map below shows the location of the four Southern Basin case study areas in the context of the CSIRO Sustainable Yield Regions.

Map 3.1: Southern Basin Case Study Areas



¹⁷ <http://www.visitmildura.com.au/produce.html>; http://www.growmilduraregion.com.au/table_grape.php

¹⁸ <http://www.mildura.vic.gov.au/index.asp?h=-1>

¹⁹ In 2008, the CSIRO completed a series of reports through the Sustainable Yields Project which assessed the current and future water availability in the Murray-Darling Basin in terms of catchment development, changing groundwater extraction, climate variability and climate change. For more information on the CSIRO Murray-Darling Basin Sustainable Yields Project, see

<http://www.csiro.au/partnerships/MDBSY.html>.

²⁰ CSIRO (2008) *Water Availability in the Murray, Summary Sheet from the CSIRO MDB Sustainable Yields Project*, p.1.

3.2 Water Policy Context

The Victorian *Water Act 1989* gives the State Government the overall right to the use, flow and control of all surface water and groundwater; and provides a framework for how water for consumptive purposes can be ‘taken’ and ‘used’ through a set of entitlements.²¹ Under the Act, a water entitlement is defined as the amount of water authorised to be stored, taken and used by a person under specific conditions, with associated entitlements that set conditions for delivery or use.²²

There are four types of entitlements to ‘take’ water including bulk entitlements, environmental entitlements,²³ water shares and water licences.²⁴ Bulk entitlements are held by water corporations and provide them with the right to water for system operations, seasonal allocations and other rights and obligations.²⁵ Lower Murray Water is the bulk service provider for urban water and irrigation water to customers from Kerang to the South Australian border, including the Mildura case study area.

‘Water rights’ in northern Victoria were unbundled in July 2007 into a water share, delivery share and water use license.²⁶ A water share is a legally recognised, secure share of the water available to be taken from a water system and may be ‘high-reliability’ or ‘low-reliability’.²⁷ Around three-quarters of water shares in the Northern Victoria region are high-reliability water shares.^{28 29} A water allocation is the amount of water that can be used under an entitlement to water each year, and depends on the conditions during the year.³⁰ The forecast reliability of ‘high’ and ‘low’ reliability shares can differ significantly between catchments, particularly for ‘low reliability’ shares.³¹

²¹ Victorian State Government Our Water Our Future website, www.ourwater.vic.gov.au/allocation/water_allocation_framework accessed 23 March 2010.

²² State of Victoria DSE (2009), Pg 10.

²³ The ‘environmental water reserve’ is a legally recognised amount of water set aside to meet environmental needs and objectives to preserve values and ecosystem health. In practice reserves are met by rules on passing flows that water corporations and licensed diverters are required to provide out of a storage or past a diversion, and through ‘above cap’ water that is water that is extra or left over after limits on diversions have been reached and unregulated flows cannot be kept in storage (State of Victoria DSE, 2009, Pg 10).

²⁴ There are also provisions in the Act for the ‘take’ of water for ‘domestic and stock’ purposes from surface and groundwater sources without an issued entitlement.

²⁵ State of Victoria DSE (2009), Pg 10.

²⁶ State of Victoria Department of Environment and Sustainability (2009) Northern Region Sustainable Water Strategy, Pg 202.

²⁷ State of Victoria DSE (2009), Pg 25.

²⁸ 2,288 GL of high-reliability shares compared with low-reliability water shares of 772 GL (State of Victoria DSE (2009), Pg 25-26, citing State Government of Victoria (2009) Victorian Water Register).

²⁹ Which includes Victoria’s share of the River Murray and its major Victorian tributaries including the Kiewa, Ovens, Broken, Goulburn, Campaspe and Loddon Rivers

³⁰ For example, in a dry year an allocation will be reduced.

³¹ Based on the long-term average climate for the Murray catchment, a ‘high reliability’ water share would expect 100% allocation for 98 out of every 100 years, while a ‘low reliability’ water share would expect 100% allocation for less than

Similar to other areas in the Southern Basin, irrigators in this part of the Victorian Murray had close to 100% allocations throughout much of early years of the drought (from 2000-01), unlike those in the less regulated river systems of the Northern Basin, where full allocations have not been experienced by many for a decade. However, seriously low levels in upstream storages³² combined with the lowest flows on record led to the first major cuts in water allocations experienced in this part of the system. Allocations for the Victorian Murray for high reliability licences (the vast majority of licences in the Mildura case study area) fell to a 43% allocation in 2007/08, 35% allocation in 2008/09, and rose to 78% for the most recent year (2009/10).³³ As discussed below, this contributed to significant restructuring of irrigated agriculture in recent years.

3.3 Water and Land Use Context

3.3.1 Overview of Current and Projected Water Use

The **Murray Sustainable Yield Region (SYR)**,³⁴ covers 19.5% of the total land area of the MDB, and is reported by the CSIRO to use over 36% of water diverted for irrigation in the MDB. It is reported to use around 14% of groundwater extracted in the Basin under current levels of development.³⁵ The SYR has a ‘high’ assessed level of usage of available surface water,³⁶ while groundwater makes up only 5% of total water used.³⁷

10 out of every 100 years. Under a 2055 medium climate change scenario, a ‘high reliability’ share would expect 100% allocation for every 89 out of 100 years, and a ‘low reliability’ share would expect 100% allocation for less than 10 out of every 100 years.

³² In April 2009, Hume was at around 4% of capacity, and Dartmouth and Lake Victoria at around 20% (see Figure 4.3.2 in NWC *op cit*, p.112).

³³ Goulburn-Murray Water (2010)

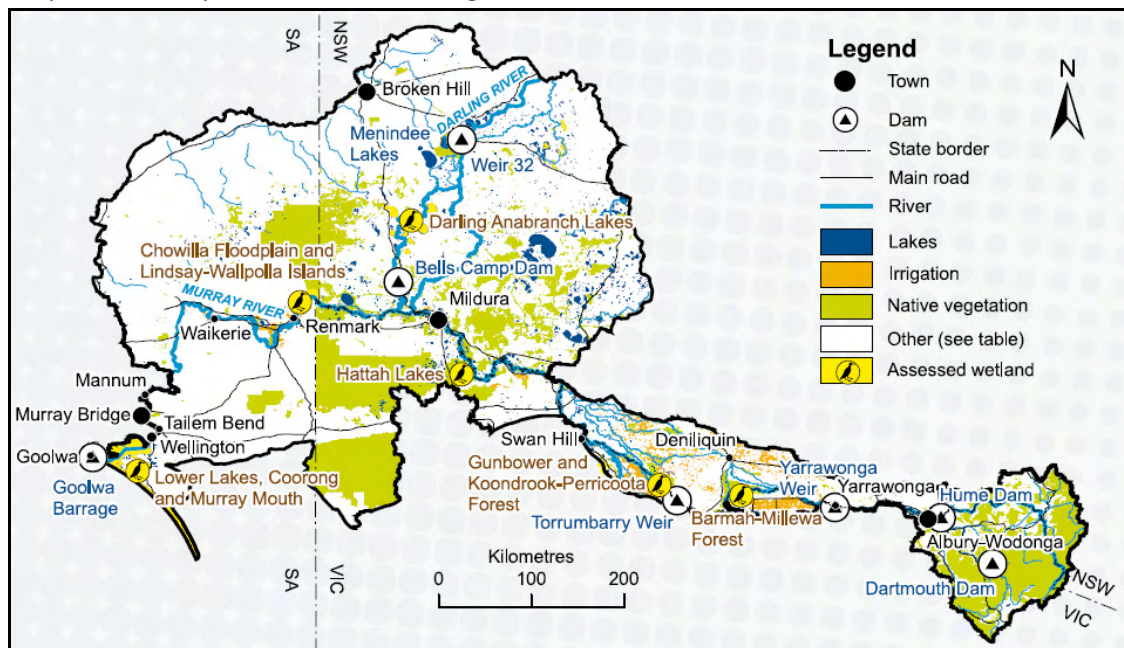
³⁴ In 2008, the CSIRO completed a series of reports through the Sustainable Yields Project, which assessed the current and future water availability in the Murray-Darling Basin in terms of catchment development, changing groundwater extraction, climate variability and climate change. For more information on the CSIRO Murray-Darling Basin Sustainable Yields Project, see <http://www.csiro.au/partnerships/MDBSY.html>.

³⁵ CSIRO (2008) *Water Availability in the Murray, Summary Sheet from the CSIRO MDB Sustainable Yields Project*, p.1.

³⁶ Average surface water availability for the Murray region is 11,162 Gl per year under the **historical climate** (1895 to 2006), of which 36% is reported to be used under current levels of development aggregated to Wentworth. This is assessed as a ‘high’ level of available surface water usage in the region (CSIRO (2008) *Water Availability in the Murray, Summary Sheet from the CSIRO MDB Sustainable Yields Project*, p.1).

³⁷ CSIRO (2008) *Water Availability in the Murray, Summary Sheet from the CSIRO MDB Sustainable Yields Project*, p.1.

Map 3.2: Murray Sustainable Yield Region



Source: CSIRO (2008) Murray Darling Basin Sustainable Yields Project

Of note, the Southern Basin has been in severe drought since 1997 and the catchment runoff in the southernmost parts of the MDB to 2006 was the lowest on record.³⁸ This event is reported to occur only once in more than 300 years, although such conditions are reported to be more likely with climate change by 2030.³⁹ Drought conditions in the south of the MDB worsened from 2007,⁴⁰ and rainfall that brought relief to parts of the Northern Basin in early 2009, and particularly early 2010, had generally not been experienced in the Southern Basin at the time of writing.⁴¹

The CSIRO's most likely estimate of **climate change** assumes that impacts on surface water availability will be less severe than the recent past,⁴² with availability predicted to fall 14% by 2030, average diversions by 4%, and end of system flows by 24%.⁴³ Likely **future development** of farm dams and plantations for the Murray SYR is expected to be 'negligible', although groundwater use is expected to treble by 2030.⁴⁴

³⁸ CSIRO (2008) *Water Availability in the MDB: A Report from the CSIRO to the Australian Government*, p. 5.

³⁹ CSIRO (2008) *Water Availability in the MDB: A Report from the CSIRO to the Australian Government*, p. 5.

⁴⁰ CSIRO (2008) *Water Availability in the MDB: A Report from the CSIRO to the Australian Government*, p. 5.

⁴¹ Field visit, May 2010.

⁴² The duration and severity of the recent drought is reflected in projections based on the **recent climate** (1997 to 2006), with regional surface water availability forecast to fall by 30%, diversions by 13%, and end of surface flow by 50% (CSIRO (2008) *Water Availability in the Murray, Summary Sheet from the CSIRO MDB Sustainable Yields Project*, p.1).

⁴³ CSIRO (2008) *Water Availability in the Murray, Summary Sheet from the CSIRO MDB Sustainable Yields Project*, p.1.

⁴⁴ CSIRO (2008) *Water Availability in the Murray, Summary Sheet from the CSIRO MDB Sustainable Yields Project*, p.1.

Overview of River Systems and Regulation

The Murray SYR receives inflows from the Barwon-Darling system, which joins the Murray at Wentworth in NSW (30 kms downstream from Mildura), having collected water from most river systems in the Northern Basin. The Murray River is also strongly affected by upstream flows from the Murrumbidgee, Ovens, Goulburn-Broken, Campaspe and Loddon-Avoca river systems in the Southern Basin.⁴⁵

Compared with the Northern Basin, the river systems of the Southern Basin are highly regulated, with an extensive system of dams and weirs the length of the Murray River, and major upstream storages east of Albury (Hume Weir completed in 1931) and in the Victorian Alps (Dartmouth Dam completed in 1979).⁴⁶ Together with a system of locks from Mildura to Blanchetown in SA, these have provided for a relatively constant water level since the 1930s and (until recently) a high level of water security to facilitate intensive irrigation for horticulture, dairying, viticulture and other crops in the surrounding otherwise semi-arid areas, where dryland wheat and pasture are the predominant land uses. A smaller storage is located upstream at Lake Victoria, just east of the NSW-SA border.⁴⁷

In addition to weirs, there are also 11 locks from Mildura (Lock 11) to Blanchetown (Lock 1), around 150 km upstream.

3.3.2 Key Environmental Issues



The Mildura case study area is downstream from the internationally significant and Ramsar listed Hattah-Kulkyne Lakes, which is a series of intermittent and perennial freshwater lakes covering over 1000 ha filled from Murray River flows via Chalka Creek.⁴⁸

The Mildura case study area is upstream from the Chowilla Floodplain and Lindsay-Wallpolla Islands, which cross the South Australian and Victorian borders. The Chowilla floodplain and its associated system is part of the 30,600 ha internationally and nationally significant (Ramsar-listed) Riverland wetland.⁴⁹

Figure 3.1: Hattah Lakes (JSA, Site Visit, March 2010).

Both of these areas have been identified as Icon Sites through the Living Murray program, as shown in the figure below.

⁴⁵ CSIRO (2008) *Water Availability in the Murray, Summary Sheet from the CSIRO MDB Sustainable Yields Project*, p.1.

⁴⁶ These have respectively 3038 G1 and 3906 G1 of storage capacity (MDBA April 2010).

⁴⁷ Storage capacity of 547 G1 (MDBA April 2010)

⁴⁸ CSIRO (2008) *Water Availability in the Murray: Summary of a report to the Australian Government from the CSIRO Murray-Darling Basin Sustainable Yields Project*, July.

⁴⁹ CSIRO (2008) *Ibid.*

Map 3.3: Living Murray Icon Sites near Mildura, Victoria



Source: Murray Darling Basin Commission, 2008

3.3.3 Water and land use in the case study area for a model year

We have used 2005/2006 as a model year for our analysis of social and economic indicators and agricultural land and water uses, and our predictive modelling of likely long-term impacts of reductions in water availability due to the availability of census data by small area.

Land Use

The dominant land use in the Murray sustainable yields region is dryland cropping, with dryland pasture for livestock grazing also a major land use. Around 22% of the region is native vegetation. In 2002, there were reported to be around 540,000 ha of irrigated cropping in the region, including rice in Southern NSW, pastures, hay production and horticulture in Northern Victoria, and horticulture in the Riverland Region and the Sunraysia Region (where Mildura is located) of the Lower Murray. There are also around 53,000 ha of commercial forestry plantations in the Upper Murray.⁵⁰

In 2006, there were 756,811 ha under cultivation in the Mildura case study area. This land was used primarily for grazing and cereals, oilseeds and other broadacre crops. Grapes were also a small but significant land use, as well as dried and fresh fruit and vegetables.

⁵⁰ CSIRO (2008) *Water Availability in the Murray Summary Sheet from the CSIRO MDB Sustainable Yields Project*, p.1.

Table 3.1: Agricultural Land Uses, Mildura LGA

Agricultural Use	# Hectares	% of Agricultural Use Hectares
Vegetables	1,088	0.1%
Fruit	4,582	0.6%
Grapes	17,919	2.4%
Grazing	335,153	44.3%
Cereal, oilseeds, other broadacre	398,069	52.6%
Total	756,811	100%

Source: ABS (2006) and JSA (2009)

Use of Irrigation Water and Employment

According to the ABS, in 2005/2006 168 GJ of water were applied to irrigated crops and pastures in the Mildura case study area. Horticulture was the primary use of irrigation water in the area, with grapevines using around 70% of irrigation water, and fruit, nut and berry trees using around 25% of water applied. This was a reasonably typical growing season, where those holding high reliability licences had almost 100% allocations until the 2007/08 growing season, as noted above.

In terms of employment, grape growing accounted for over half of all agricultural employment that was able to be identified; whilst employment in 'cereals', fruit, and in vegetable growing each accounted for over 11% of agricultural employment in 2005/06. Though grazing was also an important land use, as noted above, it accounted for only 4% of agricultural employment, as would be expected from the MDB average for this land use.⁵¹

As discussed elsewhere, it is likely that these employment figures are a significant under-estimate due to problems with self-identification, Census undercounting and the like. It is also likely that there will be significant flows on from loss of irrigation water and thus jobs from outside the LGA. For example, most of the jobs associated with 'vegetables' were in processing and would be affected by cuts in production in surrounding LGAs.

The table below shows the proportion of total irrigation volume applied in the area by each type of crop or pasture, as well as the employment associated with each use in the 2005/06 growing season.

⁵¹ See JSA (2010) Report 2: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Understanding Agricultural Employment*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri.

Table 3.2: Irrigated Water Use and Employment in Mildura Rural City LGA 2005/06

Employment & Water Use	2005/06 Growing Year	% Ag Employment/Water Use
Employment in Grapes	2050	52.2%
Irrigation water use	117.8 Gl	70%
Employment in Cereals (incl. feed, oilseeds, Other broadacre crops, etc)	468	11.9%
Irrigation water use	1.2 Gl	0.6%
Employment in Fruit	458	11.7%
Irrigation water use	41.9 Gl	24.9%
Employment in Vegetables (FTE Jobs)	441	11.2%
Irrigation water use	6 Gl	3.6%
Employment in Grazing	161	4.1%
Irrigation water use	1.3 Gl	0.7%
Employment in Cotton	14	0.3%
Irrigation water use	0	0%
Employment (Balance Agriculture)	284	7.2%
Total Agricultural Employment	3928	100%
Total Irrigation Water Use	168.2 Gl	100%
Total Employment	20660	N/A

Source: JSA (2009) derived from ABS (2008) Water Use on Australian Farms, 2005-06: Estimates for Local Government Areas, 4618.0.

The implications for significant reductions in irrigation water are important to note. Whilst around 97% of land under production is used for dryland cropping and grazing, this only represents around 15% of agricultural employment. Flow-ons from irrigated agriculture into non-related sectors are also reported to be higher than for dryland uses. Consolidation of all irrigated land (even if this were possible) would represent only a fraction of land currently in dryland production, and would lead to very small employment replacement. This is discussed in more detail below in relation to projected employment loss under different water reduction scenarios.

3.3.4 Mildura Irrigation Districts, Efficiency Gains and Water Trade

Overview

There are six irrigation districts in Mildura LGA. These are the pumped districts of Red Cliffs, First Mildura Irrigation Trust and Merbein; and the river reaches of Colignan, Mildura and Lock 10 to the South Australian border, where private diverters are generally active.

Table 3.3: Summary data, Mildura LGA irrigation districts

District	Total Identified Irrigation Area (2009)	% Not in Production (2003)	% Not in Production (2006)	% Not in Production (2009)	% Furrow irrigation (2009)
Red Cliffs	4,530 ha	4%	7%	24%	3%
Mildura (pumped district)	6,080 ha	3%	10%	30%	8%
Merbein	3,080 ha	4%	10%	35%	14%
Total pumped districts	13,690 ha	4%	9%	29%	8%
Colignan reach	10,660 ha	3%	6%	16%	0%
Mildura reach	1,730 ha	6%	12%	33%	10%
Lock 10 to SA border reach	2,765 ha	17%	18%	23%	0%
Total private diverters	15,155 ha	6%	9%	19%	1%
Total all irrigators	28,845	5%	9%	24%	4%

Source: Mallee CMA Website, accessed 8 July 2010⁵³

Of note, most of this land went out of production between 2006 and 2009, with 10% of irrigation land in private diversion areas and 25% in pumped districts going out of production during this period.⁵⁴ Low allocations since 2007/08, combined with the high price for temporary water in 2007-08 and fluctuating commodities prices are likely to have contributed to this steep acceleration in vacant irrigation land since 2006.

We note that at the time of writing the 2009-2010 status report for the pumped irrigation districts was issued. The report showed that the area of irrigable land in the pumped districts that has gone out of production has continued to increase. 32% of irrigable land across the four pumped districts of the Sunraysia was out of production, including 34% of irrigable land in Mildura and 43% of irrigable land in Merbein.⁵⁵

Increased water trade and Federal Government policy (in particular, the Small Block Irrigators Exit Grant) enabled those with unacceptable debt ratios, less viable enterprises or those with

⁵³ Mallee Catchment Management Authority "Mallee irrigated horticulture 1997-2009" at http://issuu.com/malleecma/docs/mallee_irrigated_horticulture_1997-2009_final?viewMode=magazine&mode=embed accessed 8 July 2010.

⁵⁴ Mallee Catchment Management Authority "Mallee irrigated horticulture 1997-2009" at http://issuu.com/malleecma/docs/mallee_irrigated_horticulture_1997-2009_final?viewMode=magazine&mode=embed accessed 8 July 2010.

⁵⁵ SunRISE 21 (2010) 2009-2010 Irrigation Status Report – Pumped Irrigation Districts, Report to the Mallee Catchment Management Authority, June. Accessed online at www.malleecma.vic.gov.au/resources/reports, 28 July 2010.

more personal reasons to exit irrigation, temporarily or permanently.⁵⁶ A total of 80 properties were reported to be subject to this grant by the end of 2009 - 27 properties in Merbein, 22 in Mildura, 27 properties in Red Cliffs pumped districts in Mildura LGA; and 4 in Robinvale pumped district within Swan Hill LGA.⁵⁷ It is understood from consultations that this figure is now higher,⁵⁸ though the Grant has now been discontinued.

In contrast to irrigation areas in Mildura noted above, increases in irrigated land were recorded in the Wemen and Boundary Bend reaches, in Swan Hill LGA. The irrigated area was reported to increase by 4,265 hectares in the Wemen reach and 6,090 hectares in the Boundary Bend reach between 2005-06 and 2009-10,⁵⁹ a total of over 10,000 ha compared with around 7,000 ha that was out of production in Mildura LGA in 2009.⁶⁰ Most of the Swan Hill land is reported to have gone to almond and olive tree plantations, often related to Managed Investment Schemes (MIS).⁶¹ Relevantly, a net trade out of water in pumped districts and a net trade into MIS and private diversion schemes in recent years was reported during consultations,⁶² which is discussed further below.

There were various views put during consultations regarding the extent to which land that has left irrigation in the past few years may have done so permanently. There was a general view that ‘irrigated agriculture has been resilient and flexible’ over the past 100 years in Mildura, and that much of the irrigation land that is currently out of production (around 24%) could come back, depending on water availability, commodity and water market conditions, degree of consolidation that ultimately occurs, and future urban planning policy (e.g. regarding current restrictions on increased fragmentation of agricultural land), particularly given the more recent rapidity of restructuring, and the inevitable consolidation that would occur based on historical trends if water is not permanently removed. This seems a reasonable position, though doubtless some would not be viable, and it is difficult to quantify this precisely. It was frequently noted that it was noted that significant permanent reductions in irrigation water would significantly constrain long-term recovery of agriculture in the LGA and its wider hinterland in this regard.

Likely Potential Efficiency Gains in Mildura LGA

It is also important to understand the extent to which there are remaining system-based and on-farm efficiencies to be gained, and how likely it is that these will offset potential permanent

⁵⁶ Field visits, March to May 2010

⁵⁷ Mallee CMA, *2009-2010 Irrigation Status Report: Private Diverters and Nyah District*; and Mallee CMA, *2009-2010 Irrigation Status Report: Pumped Districts*

⁵⁸ Field visits, March to May 2010

⁵⁹ Mallee CMA, *2009-2010 Irrigation Status Report: Private Diverters and Nyah District*; and Mallee CMA, *2009-2010 Irrigation Status Report: Pumped Districts*

⁶⁰ In contrast to other areas, only 7% of irrigable land in the Boundary Bend river reach did not receive water (other than rainfall); and 5% of the Wemen river reach was not watered in 2009-10 (Mallee CMA 2010).

⁶¹ Mallee CMA, *2009-2010 Irrigation Status Report: Private Diverters and Nyah District*; and Mallee CMA, *2009-2010 Irrigation Status Report: Pumped Districts*

⁶² Field visits, March to May 2010

reductions in irrigation water under Federal Government policy, water trade or long-term changes to climate.

There are reported to be two main opportunities for future efficiency gains - from lining of channels and from irrigators converting from furrow irrigation to spray or trickle irrigation. Lower Murray Water broadly estimates that there may be around 5% savings⁶³ from channel lining in pumped districts.⁶⁴ Lower Murray Water finds that furrow irrigators use around 9-10 Ml per ha, compared to 6-8 Ml per ha for sprays or trickle, a saving of about 27%, so expected overall savings would thus be in the order of 1%.⁶⁵ Hence a total saving of around 6% is likely if **all** system and on-farm efficiencies were achieved on land currently under irrigated cultivation.

It is noted that to achieve this efficiency, it is likely that major capital investments would be required, which is not certain at this stage.⁶⁶ Further efficiencies may be gained in the event that land currently out of production were re-irrigated, to the extent that the currently vacant land is furrow irrigated.⁶⁷

Lower Murray Water also noted that there have been 'marked changes' in the irrigation methods used by local growers, with drip irrigation increasing from 17 percent of irrigated crops in 2005-06 to 33 percent of irrigated crops in 2009-10, while furrow irrigation declined from 22 percent of irrigated crops in 2005-06 to nine percent of irrigated crops in 2009-10. Overall, 70 percent of crops were irrigated by the more water efficient methods of drippers or low level sprinklers in 2009-10.⁶⁸

As such, it is reasonable to assume that reductions of water modelled at even the 10% level would have some impact, and certainly the effect of reductions above 20% would be significant.

Ability to Benefit from Water Trade

Water trade has also been a significant boon to individual growers and to some communities, though the benefits and disbenefits of such trade can be quite differently distributed, depending on whether there is a net trade in or out of water, whether the trade is permanent or temporary, the cost of such water, and other factors like levels of indebtedness that may result or be ameliorated.

⁶³ Channel lining: $10\% \times \text{proportion of land in pumped districts} = 10\% \times 14/29 = 5\%$

⁶⁴ Interview Darren Raeck, Lower Murray Water, 8 July 2010; various field interviews from March to May 2010.

⁶⁵ Furrow irrigators: $27\% \times \text{proportion of furrow irrigators} = 27\% \times 4\% = 1\%$.

⁶⁶ Stage 1 of the Sunraysia Modernisation Project was reported to cost around \$120 million across the Mildura, Merbein and Red Cliffs pumped districts; whilst Stage 2 (pending) is estimated to cost around \$230.0 million across the region (Low Murray Water, 2009).

⁶⁷ If it is assumed that all vacant land is furrow irrigation, then possible savings are:

$27\% \times \text{proportion of furrow irrigators} = 27\% \times (4\% + 24\%) = 8\%$.

Hence a possible maximum overall saving is around 13%.

⁶⁸ Mallee CMA, *2009-2010 Irrigation Status Report: Private Diverters and Nyah District*; and Mallee CMA, *2009-2010 Irrigation Status Report: Pumped Districts*

The Victorian Murray had a strong net trade-in of allocation water from 2007-2009 (107 G1 in 2007/08 and 27 G1 in 2008/09), the largest of any trading zone in Victoria, where often net trade out of area was reported.⁶⁹ Most water was sourced from the Murrumbidgee in NSW, with substantial trade-in also reported upstream from the Victorian Murray. This reflects the value of horticulture in the Lower Murray (Vic and SA) and strong demand from this sector during times of water scarcity.⁷⁰

Progressive liberalisation of the water trade is reported to have led to significant expansion of irrigated agriculture by private diverters including Managed Investment Schemes (MIS) since 1994, including into grapes and later into almonds and olives, when water was permitted to be traded from above the Barmah Choke.⁷¹ Irrigation areas almost doubled in the Mallee CMA Region from 1994, much of this in areas like Boundary Bend and Wemen Reach in Swan Hill LGA, where MIS's and other private diverters are active, whereas land under irrigated cultivation decreased in the pumped districts like Merbein, Red Cliffs and FMID in Mildura LGA, and in private diversion areas like Mildura Reach.⁷²

The most dramatic decreases in land under irrigation in Mildura LGA occurred from 2006, as noted above, when a combination of low allocations, commodities prices, water prices and availability, and farm viability and personal circumstances led a number of irrigators to exit the industry, temporarily or permanently. Increasing opportunities to trade water (selling or buying) was reported to be a 'saviour' for many during this period, including through unbundling in 2007, providing for flexible responses to market and climatic conditions. As well as trade in entitlements and, more often, seasonal allocations, participation in government programs (particularly take up of the now defunct Federal Small Block Exit Grant in the pumped districts) has been quite strong.

Moreover, there has generally been a net trade out of water from the pumped districts, hastening structural adjustment in these areas, and providing a benefit to individual growers, though a range of impacts related to this scheme for growers and communities are discussed below, and it has been argued that the requirement to decommission infrastructure and not use the land for irrigated agriculture for 5 years has in fact severely limited flexible adjustment of agriculture (e.g. consolidation of blocks through neighbour buy-out) and exacerbated job loss experienced in the latter years of the drought. This also illustrates wider community impacts from water trade, and the likelihood that the benefits and disbenefits of such water trade will be differently distributed across communities, depending on whether they are net importers or exporters of such water, whether water trade is permanent or temporary, and the conditions under which it is traded.

⁶⁹ See National Water Commission, *Australian water Markets Report 2007-08*; and *Australian water Markets Report 2008-09* for detail.

⁷⁰ See National Water Commission, *Australian water Markets Report 2007-08*; and *Australian water Markets Report 2008-09* for detail.

⁷¹ See National Water Commission, *Australian water Markets Report 2007-08*; and *Australian water Markets Report 2008-09* for detail; and consultations during field work in March and May 2010.

⁷² Mallee Catchment Management Authority "Mallee irrigated horticulture 1997-2009" at http://issuu.com/malleecma/docs/mallee_irrigated_horticulture_1997-2009_final?viewMode=magazine&mode=embed accessed 8 July 2010.

Net importation of water to a high-value horticultural district like Mildura appears likely in the future, though the extent and impact of this will depend upon the extent of permanent water reductions under the forthcoming Basin Plan to Mildura, and the areas to and from which it may trade water, and the price and availability of water where there is a reduced overall quantum of supply. Again, it is likely that there will be winners and losers among different growers, sectors and communities at different geographic scales.

3.4 Social and Economic Context

3.4.1 Overview of Mildura Case Study Area

The **Mildura Rural City Local Government Area** had a total population of just under 50,000 people in 2006,⁷³ and is reported to have grown since this time. The major regional service centre is Mildura, located on the southern bank of the Murray River, had a population of around 30,000. When considered with Wentworth LGA, on the northern side of the River in NSW, the primary catchment area for Mildura's services and facilities is considered to be around 60,000 people.

Mildura LGA is more remote on the ABS remoteness index than the MDB area average (2.1 compared with 1.8), and of similar remoteness to Griffith, also in the Southern MDB, and Moree in the Northern Basin. Nonetheless, its population was much greater than these centres, and it was by far the largest of the eight case study areas selected for detailed study.

Mildura LGA experienced strong population growth (4.3%) from 2001-06, and slightly lower employment growth for the period (4%). Though much lower than national growth rates, population growth in the LGA was around 4 times that of the MDB average of areas, and the strongest growth of any case study with the exception of Murray Bridge, which is relatively close to Adelaide. Mildura was also very different to most of the Northern case study areas in this regard, where Moree, Bourke and Balonne Shire experienced large population decline and employment decline during the last inter-censal period. The impacts of the protracted drought and low levels of water security on Northern Basin case study areas is evident in these figures, with much of the Southern Basin largely cushioned from the worst impacts of the drought until 2006-07, as discussed above. Historical data for Mildura show long-term trends to be quite similar to 2001-06 growth rates.

Mildura township has been steadily growing over the past thirty years, more than doubling its population between 1976 and 2006 (an additional 16,050 people). The strength and ongoing expansion of its irrigated agricultural base are evident in these figures, as is its importance as a regional service centre, and its attractiveness as a 'tree change' location. All of the population growth that has occurred in net terms in the past 30 years has been in Mildura township.

⁷³ ABS (2006) Census of Population and Housing

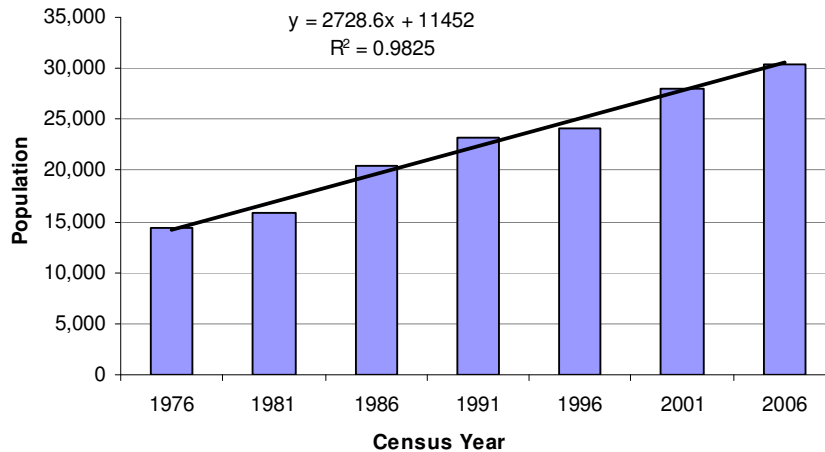


Figure 3.2: Population Change 1976-2006 for Mildura township

Source: ABS Census 1976, 1981, 1986, 1991, 1996, 2001, 2006, by Place of Enumeration

Mildura LGA has also been steadily increasing over the last thirty years, growing by 14,183 people (40%) between 1976 and 2006. However, growth of the main service centre (Mildura) outstripped LGA growth by almost 2,000 people from 1976 to 2006, and by around 769 people from 2001-06, suggesting that up to one-third of the Mildura urban centre's growth came from its hinterland. Nonetheless, a fairly stable hinterland population is also evident in these trends.

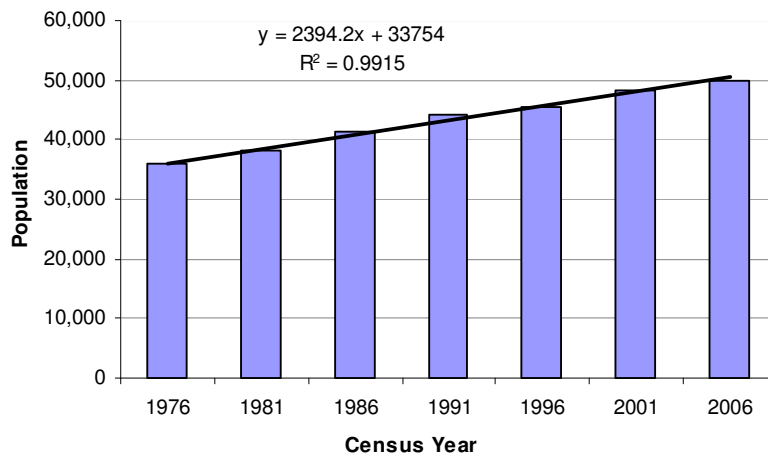


Figure 3.3: Population Change 1976-2006 for Mildura LGA

Source: ABS Census 1976, 1981, 1986, 1991, 1996, 2001, 2006, by Place of Enumeration

There were somewhat conflicting reports during consultations regarding population change since 2006. On the one hand, a number of stakeholders reported that there had been job losses associated with reduced allocations and vacant agricultural land, though it was likely that there would be a lag time in terms of flow ons to other local businesses. This appeared to be the experience in the Northern case study areas and so would be expected. On the other hand, there

were also reports of likely population growth since 2006, based on residential building commencements, though based on previous long-term trends, this could be through ‘cannibalisation’ of the hinterland, household formation of younger people from LGA, or could be through natural increase. The impression of net growth in the LGA may therefore be somewhat of an over-estimate, and this will be interesting to monitor when the next census is taken in 2011.

3.4.2 Employment and Industry Profile

Employment Profile

In 2006, there were 18,613 people employed in Mildura case study area, 19.5% of whom were employed in agriculture. Though well above the national average (3.5%), this is much lower than the MBD average (around 29%), as would be expected of a regional centre the size of Mildura. Nonetheless, this is likely to understate the importance of agriculture at a regional level, where Mildura services a much larger area than that bounded by its SLA, including in value-added processing, warehousing and distribution, as well as higher multipliers anecdotally reported to be associated with irrigated agriculture.⁷⁴

The following graph clearly indicates that Mildura is a major regional centre with a strong agricultural base, with higher than the MDB average employment in retail, wholesale, health, education, financial and professional services. The employment profile does not indicate a high level of economic diversity in alternative sectors such as mining and energy, construction, manufacturing and communications. Nor does it reveal a particularly high reliance upon tourism, where relevant employment in recreation and food and accommodation services is lower than the MDB average of areas. This is interesting given Mildura’s profile as a tourism destination (e.g. high quality restaurants, festivals and the like). Moreover, the continued importance of the agricultural sector and its regional service centre functions associated with its location and ‘critical mass’ are evident in the employment profile.

⁷⁴ Interview with staff of Mildura Development Corporation, March 2010.

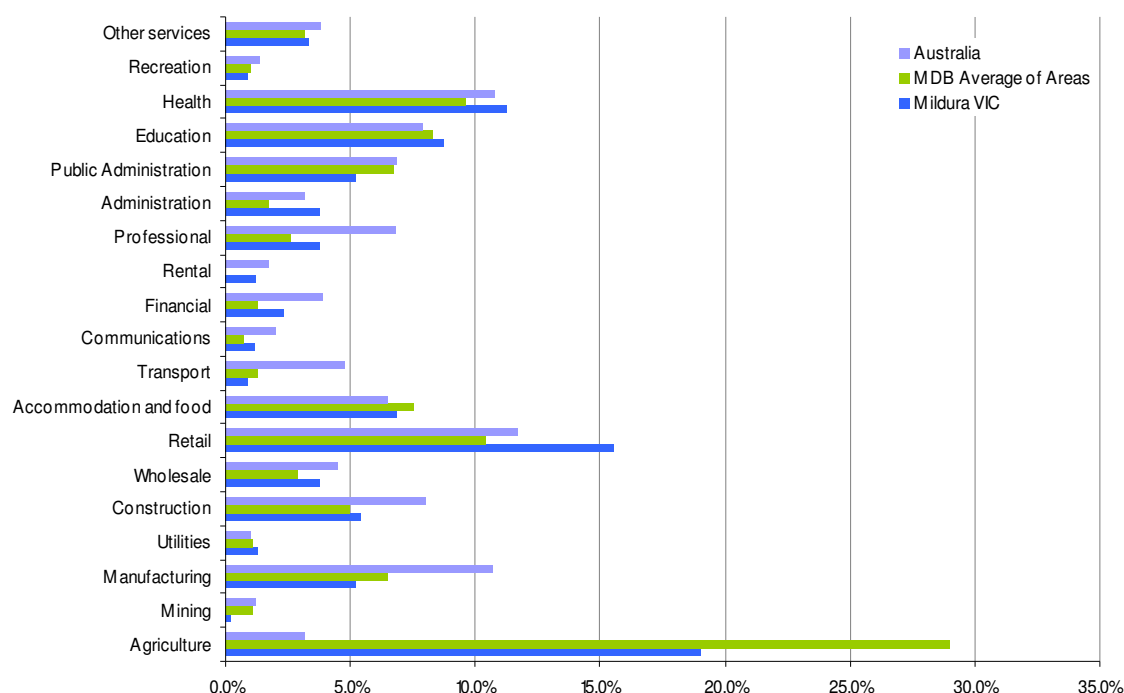


Figure 3.4: Employment Profile, Mildura VIC

Source: ABS (2006) Census of Population and Housing, JSA (2009)

3.4.3 Indicators of Community Wellbeing and Resilience

The effects of a more urbanised environment, status as a regional service centre, and other locational and natural attributes are evident in the degree to which Mildura has been able to retain its existing population and attract new people over the past decades. The growth and diversification of irrigated agriculture and related activities during this time has been an important part of population and economic growth. A key issue in community resilience is the ability of an area to attract and retain population and expand its economic and employment base. As noted above, the Mildura case study area showed very different trends to most of the case study areas in the Northern Basin, to Griffith and to the MDB average in this regard. By this measure it is showing quite a high degree of resilience at a time of significant environmental stress.

That said, it is quite different to the Dalby-Wambo case study area in the Northern Basin. Though the Dalby-Wambo area has only one-third the population of Mildura LGA, the area is closer to the major urban centres of Toowoomba, Brisbane and the Gold Coast, and has a diverse economic base that more closely resembles that of Australia. It has a strong manufacturing sector and natural advantages related to the mining and energies sector. These factors may make areas like Dalby-Wambo more resilient to permanent reductions in irrigation water in the long-term than areas like Mildura, with a strong regional economy which is still heavily reliant on agriculture but with few other productive economic alternatives to offset any loss in agriculture arising from further changes to water availability. Reliance upon ongoing lifestyle- and related

service-sector driven growth is unlikely to prove to be a substitute for a strong alternative primary or secondary productive sector in the long-term.

Report 4 of this study (forthcoming)⁷⁵ provides comparative demographic data for the eight case study and benchmark areas referred to in this case study report. This data is summarised in Table 1.2 above for each of the indicators examined. In general, Mildura Rural City's indicators of community resilience and wellbeing, measured in 2006, generally do not compare favourably with the MDB average of areas, and are much less favourable than the national statistics.

It is relatively disadvantaged on key ABS Indexes of social and economic wellbeing, and has become more so over the inter-censal period, though median income is slightly higher than the MDB average and has increased from 2001-06. Health indicators related to premature death and profound or severe disability are slightly worse than the MDB average and much worse than the national situation, despite the relative youth of its population and low proportion of Aboriginal residents. Indicators related to the educational and employment status of the population including those related to underlying human capital are also quite low for a regional area, and again much lower than the national averages, which indicate that the labour force, or segments within it, are likely to be quite vulnerable to changes in the structural economic base in terms of ability to flexibly adapt. Like other areas of the MDB, the income profile is quite polarised. Whilst there are clearly very well off residents, there are also a range of more vulnerable groups within the community, and the overall profile is not affluent.

Moreover, Mildura's socio-economic profile indicates that it is quite vulnerable to changes in irrigated agriculture, notwithstanding its size and reasonable growth from 2001-06. The impacts of the most recent drought years and further reductions in water will be important to monitor, and would be expected to arrest growth and may reverse positive trends in the longer-term unless there is significant growth in alternative employment opportunities.

⁷⁵ JSA (2010) Report 4: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Social and Economic Impacts of Reduced Irrigation Water* (forthcoming).

4 Predicted ‘long term’ impacts of reduced water availability

4.1 Modelling and Quantification of Impacts

4.1.1 Overview

The impact on the Mildura case study area from permanent reductions in the availability of irrigation water that may occur under the forthcoming Basin Plan and permanent trade of water out of area (whether open market, government ‘buyback’ or exit grants) has been modelled using data from Research Strategies 1 and 2 of this study.⁷⁶

The extent to which additional reductions in entitlements or allocations may occur under the Basin Plan is at the time of writing unknown. As such, we have modelled 10%, 25% and 50% cuts in irrigation water from that used in 2006. The results of that modelling in relation to the likely impact on employment, population and other key indicators of wellbeing and resilience are summarised here, and detailed in the table below.

4.1.2 Employment and Population Projected Impacts

The effects of cuts to irrigation water on Mildura are predicted to be significant. This is because irrigated agriculture forms a large proportion of both agricultural industries and the total economy of Mildura. The effects are probably understated, as Mildura contains a number of processing jobs, probably servicing a wider regional economy, and these jobs would be expected to be adversely affected by loss of irrigated agriculture and related jobs in the wider region.

The primary effect of reductions in the availability of irrigation water will be a loss of employment. Our modelling of a permanent reduction in irrigation water by 10%, 25% and 50% on the 2005/06 growing season indicates a minimum loss of 664, 1,513 and 2,927 jobs respectively would be expected in Mildura LGA. Given the job losses experienced during the recent drought in the Northern Basin, the fact that intensive irrigated agriculture is anecdotally stated to have much higher multipliers than the average for agriculture, and the likelihood that some agricultural jobs have not been identified in our analysis, again this is almost certainly an underestimate. Subsequent minimum population loss of 1,860, 4,236 and 8,196 people respectively is projected from a 10%, 25% and 50% reduction in irrigation water. This is equivalent to a decline of 3.2%, 7.3% and 14.2% of jobs in 2006, and 3.7%, 8.5% and 16.5% of the 2006 population.

⁷⁶ JSA (2010) Report 1: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Scoping Paper*; JSA (2010) Report 2: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Understanding Agricultural Employment*; JSA (2010) Report 3: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Irrigated Agriculture and Socio-Economic Indicators*.

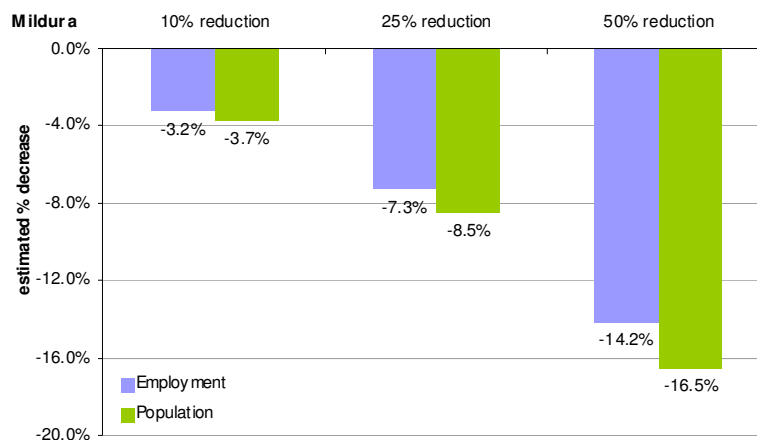


Figure 4.1: Employment and population projections

Source: JSA 2009 derived from ABS Census 2006; and ABS Agricultural Census 2005/06

Although population loss may be expected to be mitigated to some extent by the size and amenity of the town and its popularity as a ‘tree change’ location, it is noted that Mildura is a regional centre for quite a wide geographic area. As such, it is likely to suffer additional jobs and population loss associated with loss of agricultural production in surrounding towns and rural areas. Again, job losses above and associated population decline have only been calculated directly relating to the SLA, and is likely to be a significant underestimate when the cumulative impacts from surrounding agricultural areas are taken into account.

Population loss is likely to have a lag time, and will depend on the extent to which people losing jobs in the hinterland relocate to Mildura compared with larger centres such as Melbourne, Bendigo or Adelaide.

4.1.3 Community Wellbeing and Resilience Projected Impacts

Socio-economic indicators of wellbeing and resilience are not expected to be generally adversely affected as a result of changing water availability, but with some reductions in crime associated with reduced population. Notable changes⁷⁷ are projected to include an increase in labour force participation 65+ and an increase in voluntary work, largely due to the aging of the population who remain, as well as a somewhat higher proportion of people moving into the area (though the number may remain constant) as a more settled group leave town as jobs are lost in agriculture, and a decrease in assault and property crime associated with loss of population and an older population, as our analysis indicates that crime rates generally decrease with decreasing size of town.

The population is predicted to drop below the 50,000 threshold, where an area becomes more reliant on agricultural jobs by comparison with larger centres, suggesting some loss of particular

⁷⁷ More than 5% change at 50% reduction in water availability.

industries. These might include, for example, servicing of administrative functions from elsewhere as a threshold is reached where a service is no longer viable. Such impacts are likely to be cumulative. This may be ameliorated to some extent by recent apparent population growth and Wentworth across the river.

The following table shows these projections in more detail.⁷⁸

⁷⁸ The Murray Valley Citrus Board has advised that the employment figures in fruit appear low, and believe the true figures would be closer to 800-900. This probably reflects census undercounting, and identification problems around category and part time and casual workers.

Table 4.1: Predicted 'long term' impacts of reduced water availability for Mildura VIC

Indicator	Base case	Predicted indicators for 2006 for reduction in irrigation water			
	2006	10% reduction	25% reduction	50% reduction	
irrigation water use (GJ)	168.2	151.4	126.2	84.1	
Employment (total) ⁽¹⁾	20660	19996	19147	17733	
% decrease in employment		3.2%	7.3%	14.2%	
Employment (Vegetables) ⁽²⁾	441	431	416	390	Most of these jobs are in processing and would be affected by cuts in production in surrounding areas
irrigation water use (GJ)	6	5.4	4.5	3.0	
Employment (Fruit) ⁽²⁾	458	386	278	98	
irrigation water use (GJ)	41.9	37.7	31.4	21.0	
Employment (Grapes) ⁽²⁾	2050	1830	1501	952	
irrigation water use (GJ)	117.8	106.0	88.4	58.9	
Employment (Grazing) ⁽²⁾	161	160	160	158	
irrigation water use (GJ)	1.3	1.2	1.0	0.7	
Employment (Cereal) ⁽²⁾	468	473	480	492	Assumed next best use
irrigation water use (GJ)	1.2	1.1	0.9	0.6	
Employment (Rice) ⁽²⁾	0	0	0	0	
irrigation water use (GJ)	0	0.0	0.0	0.0	
Employment (Cotton) ⁽²⁾	14	14	14	14	
irrigation water use (GJ)	0	0.0	0.0	0.0	

Indicator	Base case	Predicted indicators for 2006 for reduction in irrigation water			
	2006	10% reduction	25% reduction	50% reduction	
Employment (Balance Agriculture)	284	284	284	284	
Employment (Total Agriculture)	3928	3578	3132	2387	
Population ⁽³⁾	49817	47957	45581	41621	Population loss will mean a drop below the 50,000 population threshold
estimated % decrease in population		3.7%	8.5%	16.5%	
Indigenous population ⁽⁴⁾	2.9%	2.9%	3.0%	3.1%	
Number of indigenous people	1445	1414	1374	1308	
Dependent variables:					
SEIFA disadvantage	958	958	957	956	
SEIFA Economic Resources	928	928	927	926	
Premature death	314.8	315.1	315.6	316.5	
LFP 15+	59.1%	59.0%	58.9%	58.6%	
Median Household income	\$ 785	\$ 781	\$ 775	\$ 766	
Disability support pensioners	6.8%	6.8%	6.9%	6.9%	
Profound or severe disability	4.7%	4.7%	4.7%	4.8%	
Chronic ill health	207.1	207.1	207.1	207.2	
LFP 65+	8.9%	9.3%	9.8%	10.7%	From changes in agriculture
Median Age	37	37.1	37.2	37.3	
Skills Base	29.4%	29.5%	29.7%	30.0%	

Indicator	Base case	Predicted indicators for 2006 for reduction in irrigation water			
	2006	10% reduction	25% reduction	50% reduction	
Education participation	70.2%	70.2%	70.3%	70.3%	
SEIFA Education and Occupation	932	931	930	928	
Polarisation	0.84	0.84	0.84	0.84	
Youth unemployment	11.8%	11.8%	11.9%	12.0%	
Unemployment	5.7%	5.7%	5.8%	5.8%	
Change of SLA five years ago	15.9%	16.0%	16.3%	16.8%	
Voluntary work	22.4%	22.7%	23.3%	24.3%	From change in agriculture and age
Assault (Non domestic violence)	828	817	803	781	2006 value estimated
Assault (Domestic violence)	326	328	332	339	2006 value estimated
Property Crime	6225	6132	6004	5796	2006 value estimated

Notes:

- (1) Includes factor of 1.11 to account for census under reporting, and allows loss of 0.9 jobs for each lost agricultural job
- (2) Estimates using data from Table 3.1 of report two and using regression analysis data to account for dryland production, factor of 1.11 included)
- (3) Assumed one job per household, 2.8 people per household, unemployed households leave the area
- (4) In 2006, the indigenous LFP rate was 43%, compared to 63% for the non indigenous population

We have assumed that job losses will therefore have a lesser effect on indigenous populations, leading to an increased proportion of indigenous people in the population, at the rate of the loss of one indigenous person for each 1.5 non-indigenous persons.

4.2 Field Work: Understanding Likely Impacts through Responses to the Recent Drought and Other Stressors

4.2.1 Overview

Compared to a ‘long term’ or permanent reduction in water availability that may occur as a result of government policy and climate change, the recent drought represents a relatively short- or medium-term impact. In many ways it represents a ‘real time simulation’ of what may happen if water for consumptive or productive uses is removed permanently from production, and how communities may experience the impacts and respond. The duration and severity of the drought combined with water insecurity in a less regulated system in the Northern Basin also provides valuable insights into the longer-term impacts in the Southern Basin in a future with less water.

The following case study also sheds some light on the way in which government policy and progressive deregulation of the water market is already affecting communities, the ‘winners and losers’ that may be created, and the way in which water policy is experienced and responded to in communities facing significant stress.

Moreover, an understanding of how growers, agricultural sectors and local communities have responded to the ‘short to medium term’ stressor of the drought is necessary to better predict the likely impacts of ‘long term’ stressors like more permanent reductions in water availability in the context of other important issues facing communities.

The following case study firstly focuses on Mildura Rural City LGA, and illustrates responses of key stakeholders, including government, farmers and communities, to the drought and other stressors facing this area. It provides a more detailed understanding of how resilient or vulnerable the region may be to permanent reductions in irrigation water through from the point of view of key stakeholders consulted.

The case study then provides an overview of the differential impacts on Merbein, a small agricultural community in the Mildura Rural City’s hinterland that has undergone significant structural change in the past few years, and where low commodities prices and the nature of farming, combined with opportunities from increased water trade liberalisation and the Small Block Exit Grant have provided the opportunity for those wanting or needing to exit farming to do so.

Each of these areas – provide a different lense through which to understand responses to current challenges, and to understand the likely impacts of more permanent reductions in water availability that may occur under the Basin Plan or climate change.

4.3 Key Issues Raised During Field Work

4.3.1 Overview

Reflections on both the strengths and the potential vulnerabilities of Mildura with less permanent irrigation water were a feature of interviews and workshops held from February to May 2010. Though diverse views were expressed about how resilient the community would be to such a stressor, some common themes emerged.

On the positive side, strong community leadership, Mildura's size and past growth, and a more diverse economy as a regional service centre were often cited as reasons why the area would potentially weather more modest reductions in irrigation water. The long-term resilience of agriculture and communities, and 'fighting spirit' born of isolation and self-reliance were also cited as attributes that could assist the community to be resilient in the face of permanent reductions in irrigation water under Federal policy. Strong and coordinated regional leadership was also obvious from our site visits and consultation.

However, there was also an acute awareness that the area remains heavily reliant upon irrigated agriculture and related value-added processing, warehousing and distribution sectors, including from a very large agricultural hinterland, and that associated economic multipliers were also likely to be significant. Underlying vulnerabilities of the local labour force, the mix of people moving into the area, the relative remoteness of the area, and greater exposure of smaller towns were also often cited as reasons why Mildura could be very exposed to reductions in irrigation water. The extent to which there were additional efficiency gains to be made following more recent on-farm and system efficiencies, and 'shake out' of less efficient operators during the latter part of the drought, and future benefits of open trade in water, were also the subject of debate.

Moreover, though there was a determined optimism among community leaders, most stakeholders were far from complacent about a future with less irrigation water. The need for the Federal Government to provide compensation to individual growers, and adequate resources for structural adjustment for farmers, industry sectors and communities if irrigation water is reduced, was raised in a number of discussions. The need for supportive regional development policy from the Victorian State Government, particularly with regard to support for alternative industries and necessary social and physical infrastructure to relace jobs lost was also noted.

4.3.2 Rural City of Mildura and Hinterland

The complexity of Mildura's future resilience with less permanent irrigation water is reflected in the following extracts from consultation interviews and workshops.

Commenting on the positive growth experienced by Mildura from 2001-06, one civic leader noted,

Mildura is a great place to live, and we're attracting quite diverse groups. That's a real strength, but it's a bit more complex than that. Some people are coming for

the lifestyle from metropolitan areas. Others are coming for health reasons like respiratory problems. There are the attractions of a warm, dry climate, and we're fairly well serviced. In that sense there is a 'sponge city affect' on small towns, particularly for older people moving in for health services from the hinterland...

The cost of living is similar to a city, but cheaper housing is attracting younger first homebuyers and families as well. The first homebuyers grant was a significant incentive. We're building as many houses as we were before the GFC...

But how do you take into consideration people coming into our area for economic reasons - coming for lower housing costs from Melbourne and Adelaide? There are also people coming without a job, and others who are not well qualified expecting to find work... All of this is putting a strain on social services. A contraction in the local economy will make things more difficult for these groups [to find work], and for service provision and community support...

Meanwhile, we still have a skills shortage in 18-35 year old age group in professionals, trades and those with specific skills. We're not attracting enough of these people.

A council officer noted the potential strengths and vulnerabilities from Mildura's role as a regional service centre, and the likely differences in impacts at various scales.

We service Wentworth, Robinvale, right to SA border – even as far out as Balranald. Basically, we're the main service centre for 150 kms. We're reviewing our retail strategy – it says we're servicing in excess of 100,000 people...

It's hard to tell what will happen [with less irrigation water] in the future. If [irrigators in the Lower Murray] get big cuts, we might keep growing at the expense of these areas [as Mildura absorbs its hinterland]...Mildura's future growth depends on whether people [who lose jobs in agriculture] find jobs locally, or move further afield, and how successful we are at attracting alternative industries and investment...

Certainly, a number of places [in the wider hinterland] would be very hard hit. Like Robinvale [in Swan Hill LGA with a pumped district and major expansion in irrigated agriculture in surrounding areas including through in Managed Investment Schemes, outlined above] – they are high users of water, the way they farm. They've had major system upgrades and have a high per megalitre charge...

Dareton is already suffering. The community has just had to take over its fuel outlet. It's got a high Aboriginal population. The town's not looking great. A lot of irrigators surrounding that area probably aren't doing well. There's a lot of stress in the community. These sort of areas would suffer with permanent water reductions. They're pretty worried.

Wentworth seems OK at the moment and there's not as much irrigation and low security water [on the NSW side of the Murray], though irrigators have certainly been suffering [with around 0% allocations for 3 years for the majority of general

security allocations]. People have been moving there from Broken Hill. It is an odd one. Housing costs are very low and there's a lot of itinerant labour moving in. There's tourism with the junction [of the Darling and Murray Rivers], big clubs with pokies, and other things. The town has a high awareness of their community. Still, people are worried there about what the [Basin] Plan will have to say.

Nonetheless, civic and business leaders were also quick to point out the strong collaborative efforts aimed at attracting new industries and investment, the positive attributes of the area, and supportive aspects of State Government regional development policy.

We're worried, but we don't want to paint too bleak a picture. We have been growing, and we're an attractive place to live...We're an isolated area, intensely independent, and have always fought to improve our opportunities...

Given Mildura's size, we've got a better industry mix. There's more people engaged in something that has nothing to do with agriculture, though of course the flow ons from irrigated agriculture are very high. Still, other types of industry are more mature here compared to other areas [in the region]...

We're at the junction of three states [SA, Victoria and NSW]...There are long established relationships with the Melbourne market. But if we are going to attract new industries, we need to have the infrastructure in place and better connectivity [to the capital cities]...We pay 24% more for power than anyone else in the state, and we have no natural gas line. Remoteness and additional cost of power and transportation is a big issue in attracting new businesses...If we're smart we'd be marketing more towards Adelaide than Melbourne, but our transport doesn't line up that way.

A range of efforts aiming to attract new investment to the regional were also noted, including expansion of mineral sands mining, tourism, river front redevelopment, and alternative technologies, such as much-hoped for government investment in a major solar energy initiative capitalising on the area's climate and amount of sunshine.

We're probably sitting on the most valuable piece of Murray River real estate that is not being developed. There's a lot of potential for tourism and high quality development...

The solar industry could be very important to us – two billion dollars in potential investment. Maybe not a lot of jobs [in the operational phase], but there would be in the development phase. Farmers moving off the land could be skilled up in the construction phase. This could be linked to other industries, like manufacturing solar panels. We need to be doing more to more to build our capacity in building. There's probably a dozen or so businesses that we need to sit down with, and their banks, and talk about what people need when an assembly line goes in...If we don't get this [solar investment], then it's a big hit to Mildura's future. Victoria has 100 million [dollars] on the table, so we'll see how we go.

The adaptability of agriculture over at least 100 years was also raised frequently in support of future community resilience. As noted by one civic leader,

It's wrong to say that agriculture in Sunraysia has not been resilient over the long-term. We're one of the first irrigation areas in Australia. Farmers have been dealing with fluctuating commodities prices, changes in the Australian dollar, and variability in growing conditions for many, many years. We've had de-regulation and high interest rates. We've had to deal with all these things. Coping with change is nothing new.

There's been a lot of on-farm efficiency gains made over the years as well. A lot of our growers have been early modernisers, putting in overheads [sprinklers] and drips [irrigation]. There's not a lot of furrow irrigation left now –a bit more in the pumped districts [older areas where there are still smaller blocks].

We've been very resilient in moving to different irrigated agricultural products, like going from dried fruit to wine grapes in the 90s, now transitioning from chardonnay...There's more fresh fruit being planted, and melons, pumpkins, asparagus. Mildura has been a very efficient and robust irrigation district...

That said, it takes a long time for permanent planting to be productive. And of course, there are problems for many gaining access to capital with existing debt and the uncertainty of what is going to happen [to irrigation water]. Still, even small block growers who thought that the Melbourne market was the only one, now they're marketing their own products themselves, and looking for much wider markets, niche markets...

Change is something that farmers here have always dealt with. I think we have a strong ability to transition into new product areas, new markets, and a lot of our growers are ahead of the game in this respect. And there is a large value adding sector servicing a very wide area...

Stakeholders also noted the difference between areas in terms of resilience related to the extent to which they had already achieved various efficiencies including system upgrades, consolidation of blocks, and on-farm efficiency measures. This formed a context to how much more could be achieved in the future. As one irrigation service explained,

There are still some efficiencies gains to be made in some areas, but for others they have been growing smarter for years, and it's hard to see how there wouldn't be major reductions in productivity and of course irrigator's profit with less water...

Merbein hasn't had the infrastructure upgrades others areas have...In some ways, areas like Merbein have gone through 20 years of structural adjustment in 3 years, though some individual irrigators have of course been modernising for years, and there's been a fair bit of consolidation. But that district still has a lot of smaller blocks and a bit more furrow irrigation.

Through the pumped districts, the least efficient operators are going – either selling the water, or selling water as well as the right to farm the land for 5 years [under

the Small Block Exit Grant]. Loss of production is running at around 30-40% in some communities.

Red Cliffs and Robinvale have gone ahead. There's been a lot more consolidation and system modernisation. Areas that are less efficient have often been hardest hit in recent years [with low water allocations and commodities prices]. It's difficult to estimate how much more efficient they could be, but I'm thinking not a lot. You'd have to wonder if the capital cost would be worth it.

Any further cuts in water under future government buyback or SDLs is therefore much more likely to impact upon the more productive or efficient operators...

One senior scientist working in environmental management also picked up this theme.

Agriculture has been innovative here. Always looking for new efficiencies, ways to add value. With new technologies, table grapes use more water but they also grow more grapes per megalitre...Most employment is in the packing shed. Most produce leaves here in a supermarket-ready format.

The low allocations gave people a shock. Water trade, the carry over saved people. My view is that this area has now restructured.

He also commented on the importance of preserving ecological integrity, and the trade offs that would need to be made.

The Salinity Management Plan has worked well. It's an example of a bottom up process that's accepted by almost everyone. Farmers [in the Mallee] always say, 'We've got to manage salinity'. They don't dispute taking no more out of the river. They don't dispute that they need to be more efficient, the need improve their practices.

There is a general understanding when you're talking to technocrats and farmers that the environment is important, and about the complexity of the problem. People are doing a hundred small things that are seeking to make a difference.

But salinity isn't really the issue here. Channel salinity is a controlled problem, but eco-system degradation isn't a controlled problem, but it could be, it's proposed to be...There are real problems – I can show you stressed and dying trees, many of them...

The question is one of optimisation. We've got to work with communities on this. We've got to look at tradeoffs...There are solutions for Hattah [Lakes]⁷⁹ that could cost us a lot less than the SDLs [under the Basin Plan]. We can't just hit it with a sledge hammer.

⁷⁹ It is understood that a capital works program is being carried out to deliver environmental water to Hattah Lakes at a cost of \$24.0 million, that will require significantly less water than would otherwise be required to provide the similar outcomes, which may reduce the amount that would need to be taken from irrigation under SDLs.

With regard to permanent reductions of irrigation water through Federal Government policy or climate change, an irrigation group commented,

There is clearly a need to distinguish between short-term impacts and long-term impacts. Land that's gone out of production now could come back in with a different product, depending on growing and market conditions, though that can take some time depending on whether you've just kept the trees going [in a non-producing state] or what you might plant next. More consolidation is inevitable.

But when you take the water out of the community or system permanently, this is a long-term effect. Permanent will constrain recovery and further restructuring, depending, on how much we lose.

Water trade isn't the solution for everyone. One community gains, but it's at the expense of the community the water is purchased from.

Reflecting on the nature of the local human and economic base in relation to future resilience, one civic leader commented,

In many ways Mildura, I think is very vulnerable because of our skills base...and our reliance on irrigated agriculture, the relationship of so much of what we do to irrigation. This has also shaped the skills base. In many ways, we're here *because* of the river and irrigation, and that's true of lots of the smaller towns as well. There are also restrictions on further urban development...[The State Government] is not going to allow new sites to open for environmental reasons, so future urban development could be constrained [under State planning provisions which limit rezoning to, among other things, reduce loss or fragmentation of prime agricultural land]...

Losing more jobs, and not being able to make up ground on what we've lost in the last few years, will be a real issue. It restricts the ability to recover our agricultural base, and larger, more productive agricultural businesses would also be affected, especially if water supply is more constrained and the cost of water goes up again. Workers in Mildura and surrounding areas would be very exposed if we have major cuts to irrigation water – there's no doubt about it.

Issues related to the relative qualifications of the local labour force were also raised by several community and employment services interviewed. This provided some understanding of statistics related to high relative youth unemployment and relatively low measures of underlying human capital, reported earlier. One service provider commented on the potential vulnerability of segments of the local labour force to structural economic change.

There are far too many local young people not completing high school, or going into low skilled jobs. They take up opportunities in entry-level agriculture, processing and manufacturing jobs, but end up with no qualifications to help them when economic circumstances change or their job is under threat.

Local young people are much less likely to take up tertiary education [than the State average], despite having a local campus of La Trobe University in Mildura.

The uni is great, but it has a relatively narrow range of courses and most young people would prefer to go away to uni in Adelaide or Melbourne, but living away from home costs are expensive. Still it's very positive, especially for mature age students, and it's been a boon for local businesses [like accountancy firms].

He also commented on the ways in which the recent drought years and low commodities prices have exacerbated longer-term educational trends, and the impacts on families and young people.

In the last two years, there's been a rapid decline in the take up of university education among local young people, due mainly to the financial circumstances of the families and the sense of responsibility young people from farming families feel to contribute [to family income]. Deferral has jumped from around 14% to 28% mainly due to the financial circumstances of farming families, unemployment in the family, feelings of insecurity. Families are under enormous strain, and young people are staying to help out or get jobs to contribute in any way they can...

Schools are seeing the social impacts...A survey of school principles in late 2008 showed that many students are lowering their aspirations because of concerns about the amount of stress the family is under. There's been a distinct trend for more kids to leave in years 10 or 11 to get jobs. Kids are leaving not having even finished year 10 to supplement the family income, some of them very good students. Maybe they'll come back and finish later but it becomes all that much harder.

Commenting on more general social impacts, another services noted,

School counsellors are seeing enormous family stress especially in horticulture families from all over the district. They sense a lack of a future for the family, the parents are depressed and the kids are taking all that on. Other families have just walked off the property with nothing after they've paid their debts. It's been very hard in the pumped districts but also in other areas. It's not Mildura that's feeling it, but areas like Robinvale [in Swan Hill LGA] where there are larger enterprises and growing debt.

This is happening at a time when we have a growing skill shortage, and increased water problems looming, and we seem to be getting no support from the government to help us adjust into the future.

The interviewee noted that a recent \$12.8 million application to the Federal Government for a Trade Training Centre with local high schools had not been successful. The importance for support for vocational education in schools as an alternative to more traditional pathways was also raised, and the failure to obtain the trade centre was reported by several interviewees as a significant disappointment, particularly given the need to increase the local skills base and the potential job losses in agriculture projected with permanent reductions in water.

There was also concern that the employment situation has worsened in Mildura more recently. Although Mildura experienced positive employment growth from 2001-06, there was a general view that the latter years of the drought and low water allocations, combined with low

commodities prices and a high Australian dollar, will have had a significant impact on job loss and unemployment since 2006. As noted by a regional development officer

The [2006] Census figures are probably out of date. I think the numbers would have changes – unemployment significantly. There was the CSIRO closure [in Merbein]. That was a blow to employment but also to local agricultural research support. The Qantas closure, two large wineries gone as well as other agricultural service businesses going under or shedding staff. And of course, in some areas, 30-40% of agricultural land has gone out of production in the past two or three years. I think there would have been quite a lot of [job] losses really. We've always had higher than average unemployment rates, but I think things would be a fair bit worse now. There'll be some lag time, but this will flow on to other local industries.

A common theme related to the need for adequate compensation, structural adjustment and regional policy to support replacement industries, retraining and business development. As one peak agricultural body commented,

The government has never rewarded anyone here with structural adjustment money for any of the changes that have occurred over the years – not like rice or sugar. We've never seen anything like that. But if there are going to be major change to food growing in Australia, we're really going to need some help. That will be a massive change for the communities here, and there will need to be some significant funds provided to offset the economic and social loss...

There are a lot of small towns in the Mallee – that's the fabric of our society. A lot of these are suffering, and they'll be far worse hit with permanent cuts to water...I don't get a sense of what the Federal Government's vision for rural Australia is – if there is one at all. The State Government is different - the Victorian plan for our area looks at the sustainability of the regions, and at small town sustainability. But we're saying to government – if small towns are important, what are you going to do to help us?

We're a long way from anywhere. People have a very independent spirit. But there are some things that are maybe beyond just 'pulling yourself up by your boot straps'. We're going to need strong regional development policy, and new industry funding and incentives, and social adjustment resources.

There were also strong concerns raised by regional development offices and employment services regarding the adequacy of support services for farmers faced with choices about leaving farming, currently and in the past few years.

Poor buggers – some of them are really stuck. They need to leave but they've got nothing to go to. Since the unbundling [of water entitlements from land], some have significant liabilities on the land [which is worth much less without the water]. They have to pay out the [water] provider [with fees to exit the irrigation system]. They still haven't adjusted their thinking to the true value of their land, and prices

are still inflated. They've got neighbours – some of the smarter operators – who'd probably buy them out, but they don't want the house and improvements – they just want the land. It will take some time for things to sort themselves out...Some of it will also depend on how much urban development is permitted in areas like Merbein in the future...

Others would prefer to stay, but they need good advice and a realistic assessment of their options. They're asking, Will I keep watering my trees? Should I take the risk and plant something else? Will I be allowed to subdivide in the future? Their block is their livelihood or it's their superannuation, and it's hard to acknowledge that it's not worth as much as they thought, that they've got less options than they thought.

One employment service noted that '72 of 480 farmers' who had been through a recent retraining and skills recognition program had gained either part time or full time employment. They echoed the comments of a range of stakeholders, commenting that,

A big part of adjustment is working through future employment options for the ones not ready to retire or not at retirement age. Often their skills and prior learning are not recognised.

Rather than emphasising exit planning and succession strategies, what about programs that help people and communities get to the next level? What about small business incentive allowance? All that infrastructure stuff [Federal Water for the Future programs] doesn't help our region at all, certainly not people or communities to have positive futures.

However, others believed that the level of stress some are under mean that they have effectively withdrawn from thinking about harder issues.

The Federal Government came out recently – the MDBA, DEWHA, ACCC. The session was extremely well advertised but there were only three irrigators in the room. It was a chance for them to ask as many questions as they wanted to, but some just can't cope with any more information, or it's just not the help they need.

Perhaps less optimistically, another business leader commented,

We're a strong community, but one of the things I've been thinking about over the last few years or so in Mildura is, how many more challenges the community can manage and manage well? Maybe we'll be fine, but maybe there are only so many times that people can fight.

4.3.3 Merbein

Overview

The importance of understanding recent impacts of the drought and market conditions, and future impacts from permanent water reductions, on different types of communities was expressed often during consultations. Impacts in the pumped districts like Merbein, Red Cliffs and First Mildura

Irrigation District (where water is supplied to irrigation blocks from a central system supplied by Lower Murray Water) were also considered to be quite different to those in private diversion areas, related to the smaller size of blocks, degree of modernisation, and viability of enterprises and the like in the older pumped districts.

Merbein provides an example a small community with a high reliance on agriculture that has been undergoing gradual structural change over some years, in terms of farming practices, on-farm efficiencies and product mix, though the modernisation in this older ‘pumped district’ has not been as advanced as in other districts. There has also been an ongoing process of social change related in part to the increased attractiveness of rural lifestyle, structural change in agriculture and generational change among older farmers. This is evident of some gentrification from 2001-06 including a halving of the older workforce, and improved indicators related to social wellbeing and human capital. Increased centralisation of services to Mildura urban centre has been an ongoing process for the past few decades, similar to other smaller towns. Gradual change to agriculture was also facilitated by the liberalisation of the water market over the past decade or so, with around 10% of identified irrigation land going out of production from the mid-1990s to 2006. Despite this, Merbein and its immediate hinterland had a 5% growth in population and a 10% growth in those employed from 2001-2006, which was higher than Mildura LGA and quite different to trends in many other smaller towns.

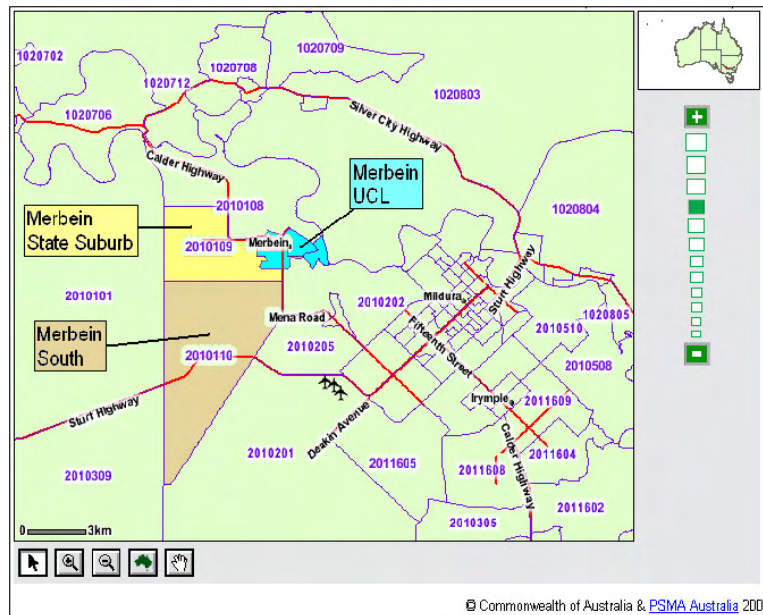
However, the challenges facing communities like Merbein in the past few years have arguably accelerated the rate of change leading, as some have said, ‘to 20 years of structural adjustment in 3 years’. Low commodities prices combined with opportunities from ‘unbundling’ of land and water rights from 2007, and particularly from programs like the Small Block Exit Grant under Water for the Future, have provided a trigger for those wanting or needing to exit the industry. Since 2006, 25% of irrigation land has gone out of production in Merbein, the most of any irrigation district in Mildura LGA. Though there have been benefits to individual growers, especially older producers on smaller blocks, significant concerns about exacerbation of impacts on community and the agricultural sector have often been raised during consultations. In particular, these relate to requirements to decommission irrigation infrastructure and the ‘locking up’ of land for 5 years. This is reported to have had the unintended consequence of limiting sustainable economic restructuring including farm consolidation and use of land for other horticultural uses with surplus water, as well as cumulative impacts perhaps more significant in a small rural economy. Differences in the effectiveness of market- versus government-led interventions in achieving industry restructuring, and the unintended consequences of the latter, are key issues that emerges from this case study.

Demographic Overview

In 2006, Merbein was a town of close to 2,000 people, around 10 kms from Mildura urban centre, and grew by 150 people between 2001 and 2006, going against the trend of many smaller rural towns in this regard. Merbein township and its immediate hinterland (shown in the following map) grew from 2,978 to 3,126 in this time, a 5% increase in the number of people usually resident, and indicating that most growth occurred in the town with the hinterland holding its

own. The growth of those employed ran ahead of population growth, increasing by 10%. The nature of such growth indicates that many of those moving in probably worked in larger centres outside Merbein. It is interesting that the rate growth of both population and those employed was greater than for the LGA as a whole.⁸⁰ Selected indicators are tabulated at Appendix A for 2001 and 2006.

Map 4.1: Merbein UCL & Hinterland



Source: ABS Website 2010

Labour force participation of older people aged 65 years and above in Mildura and its immediate hinterland declined significantly from 2001 to 2006, from 12.9% to 7.8%, and was well below that of Mildura LGA where just over 10% of those aged 65 years or older worked. The decrease in older employed people is particularly marked in Merbein's immediate hinterland, halving from 34% to 17%. Generational change and likely agricultural restructuring is evident from these figures, and the area is also anecdotally reported to be attracting older people and mature families buying blocks for lifestyle reasons. This appears to be supported by changes in other key statistics. Whilst Mildura became somewhat more disadvantaged from 2001-06, Merbein showed some signs of gentrification, with improvements in youth and general unemployment, SEIFA Indexes of Disadvantage, and of Education and Occupation, and the proportion of people with post-secondary qualifications.

Nonetheless, despite these improvements, Merbein remained less advantaged than Mildura in terms of unemployment, median household income and level of qualifications. Merbein urban area typically had lower SEIFA values both for Disadvantage and Education-Occupation than Mildura, although the hinterland had much higher values, typically at or above those for Mildura

⁸⁰ ABS Census (2001; 2006)

LGA and the MDB. Again, this indicates that there may have been some gentrification associated with the purchase of lifestyle blocks in the hinterland of Merbein, though interestingly, this did not translate into major loss of irrigated agricultural land until after 2006-07 (see Section 4.3.4 below).

Employment trends were consistent with those noted above. The following graph shows that, from 2001 to 2006, Merbein experienced a substantial drop in the number of persons working in agriculture, wholesale, and retail, and a smaller decline in manufacturing. It is likely that a large number of these jobs were related to agriculture. The largest growth industries in the area were public administration, health and other services, accommodation and food.

Nonetheless, around 18% of those employed in 2006 worked in agriculture. It is noted that we have not ‘drilled down’ to count related agricultural jobs such as processing and packing as we have in the LGA values. It is also noted that a very high proportion were employed in ‘manufacturing’ (15% or more than twice the MDB average), with much of this anecdotally relating to work in value added processing and other activities related to agricultural products. The same is likely to be true of other sectors such as ‘wholesale’ and ‘transport’, so that at least 30% of jobs in Merbein are likely to be directly related to agriculture in 2006. It is also noted that each job in agriculture is likely to have about one job in another sector in terms of employment flow ons, so that this would be conservatively 60% of employment that has some relationship to the agricultural base. The disproportionate importance of agriculture to smaller rural and regional economies was also noted in previous reports from this study.

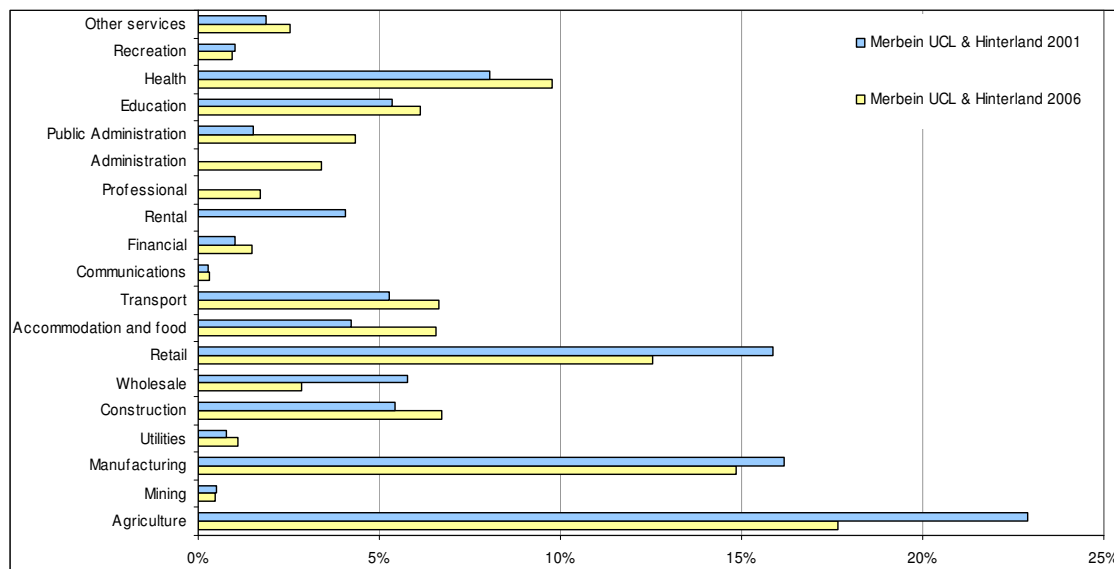


Figure 4.2: Employment Industry Comparison – Merbein UCL & Hinterland

Note: 2001 Census did not include the categories for ‘Professional’ and ‘Administration’

Source: ABS 2001 / 2006 Census

4.3.4 Issues Related to Federal Water Policy

Merbein has just over 3,000 ha of identified irrigation land. Although only 4% of irrigation land was out of production by 2003, and 10% by 2006, by 2009 this had reached 35%, a loss of one-quarter of such land since 2006. We note that at the time of writing the 2009-2010 status report of pumped irrigation districts in the Sunraysia reports that the amount of land out of production in Merbein has continued to increase to 43%.⁸¹ This was the highest proportion of vacant irrigation land in the LGA, and the decline had been the most rapid. By 2009, only 14% of land was still serviced by furrow irrigation, though this was well above the Mildura LGA average (4%), so that sprinkle and drip irrigation had replaced less efficient methods over time, with some furrow irrigated properties also going out of production during this period. A significant contributor to the rapid increase in vacant irrigation land was recent Federal programs under Water for the Future. Of the 80 Small Block Exit Grants reported to be provided to Mildura LGA to 2009, around one-third (27) reportedly went to Merbein pumped district.

As one local irrigator commented,

Things have been changing here for some time. Agriculture has been changing – perhaps not as fast as other areas. There’s been a fair bit of [farm] consolidation, more [on-farm] efficiencies. A few bigger players in the area now....

The community’s been changing, too. You can see it in the town. We’ve got less shops and services than we did 20 years ago, more people doing business in Mildura. It’s only 10 kms drive away, and we’ve still got the basics. It’s inevitable, I guess...

But the last few years we’ve seen much bigger changes in the irrigation area. They say that the motivation is a desire to hasten structural adjustment, like dealing with over-production of grapes or citrus. But you’ve got to ask, is this intervention in the market warranted? Does the government understand better than growers who have been here for years what the impact of their decisions will be?

Another irrigator currently considering his future commented on the flow-on effects and cumulative impacts of the recent exit of so many from irrigation.

Merbein pumped half of its entitlement this last year. That has got to be having a big impact on income of Lower Murray Water. It makes it harder for the [irrigators] who remain. It’s harder to water the land [due to the ‘swiss cheese’ effect], and what happens when you’re the last one at the end of the system? There are less people to pay to maintain and upgrade the system.

If there’s a lot of permanent water cut, it’ll hit Lower Murray Water even harder... There’s a risk to larger producers as well. Merbein’s got 2 or 3 major players that

⁸¹ SunRISE 21 (2010) 2009-2010 Irrigation Status Report – Pumped Irrigation Districts, Report to the Mallee Catchment Management Association, June. Accessed online at www.malleecma.vic.gov.au/resources/reports, 28 July 2010.

are important to it. There's a lot of work at the mushroom farm, asparagus. Full time and casual work picking, packing. If we lose the major players it takes away a big part of the employment from Merbein and will have a very big impact on the town. That's a big thing on top of all the smaller growers we've lost.

Then there's the loss of business confidence, uncertainty about water. How do you take all these things into account?

Merbein was originally opened up as an irrigation district 1909. Mark,⁸² a local dried fruit grower with 44 acres in Merbein and another 20 acres elsewhere, told us about his grandfather who had come to Merbein in 1910. He and his brother had been away to study, worked in professional jobs, and come back to manage the family farm, where they now both worked full time. They had upgraded their on-farm irrigation to drip systems and installed more sophisticated trellis to facilitate easier harvesting. They were considering further trellis upgrades, and commented that, 'It's possible that we could expand [the property] in the long-term'.

Commenting on why the Small Block Exit Grant had been so attractive to others in Merbein, he noted that,

Some of the smaller blocks were stuck with dried fruit, older plantings and older operators. Some hadn't modernised...Others got into trouble diversifying. Our neighbour went into wine grapes, stretched themselves too far and the banks caught up. Two other neighbours nearby took the Exit Package. That's three empty near me.

Mechanisation of the industry, increasing imports from the Middle East and South America and more efficient methods in these countries, and lower prices for locally grown produce were all having an impact, particularly on those on smaller enterprises.

When asked what the future of agriculture in Merbein might look like, he commented,

I'd say we're going to see a lot less smaller growers in the future. People have realised the blocks are too small. There'll be more buy ups [of neighbours' properties]. Maybe we'll see the blocks aggregated into much larger ones...a move away from the family farm to larger enterprises. But some will still stay in family ownership. Different [horticultural] products will be grown. I don't think anyone knows for sure right now.

A strong and frequently expressed sentiment by local people within and outside the pumped districts was the negative impacts arising from the requirements of the Small Block Exit Package, and in particular the loss of productivity and flexibility from requirements that irrigation infrastructure be removed, and that the land not be used for irrigated agriculture for 5 years by those who took 'the package'. The interviews provided an indication that there were benefits to individual growers as well as less positive impacts for communities and industry from such policy.

⁸² Not his real name.

Support for increased efficiency coupled with dismay for the way in which the Small Block Exit Package was implemented was common. As one regional development professional noted,

You'd have to question whether a lot of those 10-acre blocks are efficient. No one's disputing that. The [Small Block] Exit Package has been good for some of the individual blockies, but it's been bad for the communities and certainly for industry restructuring. It's stopped the natural process of farm consolidation that's been happening for some years.

Wine grapes won't always be bad. Dried fruit won't always be down. Farmers have always adjusted to fluctuations in commodities prices. But the government's intervention in the market has stopped the more profitable growers buying their neighbours out as they always have. No one can use the block, agriculture contracts, there's less irrigators to support infrastructure, and that's bad for all those who stay.

The lost opportunity for more sustainable structural adjustment was also a strong theme in consultations. As argued by a scientist engaged in environmental management,

The Small Block [Exit] Program is criminal. It takes away a whole level of flexibility, and removes capacity to adapt. I'm talking socially and environmentally. The land and water could have been used more efficiently, land could have stayed in production where it was economic to do so, the job losses wouldn't have been so bad. It's policy on the run.

The double-edged sword for individuals and communities was also often noted.

The consequences of the [Small Block] Exit Package have been horrendous on some communities. You can understand the attraction in a place like Merbein where you've got more small blockies, who are getting older, facing poor commodities prices in the past few years, increasing their debt. But you can't lose 30 to 40 per cent of agricultural land and not expect major community fall out. Some are walking away with almost nothing when they pay the bank, buy out the [Lower Murray Water] infrastructure fees, rip out all the [irrigation] infrastructure.

On a visit to a number of agricultural operations in Merbein, we met Peter,⁸³ a local asparagus grower on 70 acres with an associated packing and distribution operation employing some 40 people in peak season. He also echoed concerns that we had heard about the Small Block Exit Package from many others, and provided an example of the adjustments that irrigators are making in response to ongoing change, and constraints to adaptation from policy requirements.

We went to asparagus from dried fruit in 1990. A lot of the smaller guys growing dried fruit were living in older houses, not able replace their cars or go on holidays. I went to a meeting with a mate who'd been trying to get me to grow asparagus for years – they were all driving new cars, doing up their houses. So I

⁸³ Not his real name.

put in a few acres [of asparagus] and it didn't take much for me to calculate that I'd be better off if I put in all asparagus, so I made the change.

Asked how he had responded to the recent years of low water allocations, Peter noted that he had bought in water, reduced his cultivated area and rationalised his plantings, for example, taken out the older, less productive plants. He plans to replant the fallow acres after 2-3 years, noting that,

Of course I take notice of long-term [commodity] prices, I watch the market. But this is a long-term investment for me. We don't make our decisions on current commodities prices but on long-term trends – averages. Asparagus grows for 20 years, so really it's like other permanent plantings.

Like other growers, the other area of major uncertainty is about short and long-term water allocations, and costs that can be incurred when policy and market conditions change.

We were very upset when they projected a 20% allocation this year. We purchased water to get a 50% carry over. Then yesterday they announced a 12% increase [in allocations], so we're up to 78%. So I've wasted \$16,000 and I can't get it back.

A lot of people around here panicked. Some were older and wanted to get out, some were too small, but others were overwhelmed with the commodities situation, not knowing what the future held. So commodities prices were bad but in a way the uncertainty and the fact that their neighbours were going was the tipping point.

Asked why others were not moving into higher value crops like asparagus, he commented that,

Some are too old, or they don't have the money to upgrade their irrigation infrastructure, or put up a large packing shed, like this. Or they're carrying too much debt. Others don't want the hassle of employing people. It can be quite hard.

But others are starting to grow all sorts of things. I think you're going to see more diversity in what's grown, after the current shakeout [with low water allocations and commodity prices]. You're going to see more consolidation [in the pumped districts], especially as property prices start to drop [with water sold off]. But some of it's going to depend on what happens with the water in the long term.

Like others interviewed, there were also significant concerns about the conditions of the Small Block Exit Package and its requirements.

Local asparagus growers just can't grow enough to meet local demand, so we're having to import from overseas. I could sell whatever I could grow at the moment. That's why the Exit Package is such poor policy. I've got a neighbour [going through personal problems that are leading to a forced sale]. There's no way he's going to get the asking price [on the block]. It's under dried fruit. So he's looking at the Exit Package. But by the time he takes it, splits the proceeds [with his partner], pays off his debts and exit fees, he'll be leaving with virtually nothing.

Now here's the thing. His land then can't be used for 5 years for agriculture and all the irrigation infrastructure has to be ripped out. So if I have a really good year, and want to buy in some water or use some of my own allocation and run some sprinklers over there, I can't do it. I could lease his land, give him some income – or I could even buy his land without water for a lot less to grow more asparagus. But I can't, because I'm not allowed to use it. So we'll keep importing asparagus, I (or someone else for that matter) won't be able to expand, and my neighbour loses out on income. And the town keeps losing jobs and people. So everyone is a loser. It's just stupid.

Commenting on the social impacts of the significant amount of land that has gone out of production in the past few years on Merbein, Peter noted,

It's really hard to see the changes in the town, the pressure that friends and colleagues have been under. The decisions they're being forced to make at a difficult time, with such uncertainty. For some individuals it's been a good thing, they can get rid of debt and get out. For others it's been absolutely wrenching and they don't know what to do now. They're stuck. They don't want to sell, but what if the government just comes in and takes the water anyway?

Merbein has been hardest hit by the Exit Package. It's terrible to see the water going out of the area and people leaving. There have been changes to the town over the years, but this is a very big blow. It doesn't have to be this bad.

Appendix A: Selected Indicators: Merbein & Benchmarks

Table A1: Merbein UCL & Hinterland Key Indicators

	2006				2001		
	Merbein UCL	Merbein UCL & Hinterland	Mildura Rural City (LGA)	MDB Average of Areas	Merbein UCL	Merbein UCL & Hinterland	Mildura Rural City (LGA)
Population	1,973	3,126	49,817	2,004,560	1,824 ⁸⁴	2,978 ⁸⁵	48,386 ⁸⁶
Persons Employed	742	1,313	21,544	921,300	653	1,218	20,661
Labour Force Participation of persons aged 65+ (%)	5.5%	7.8%	10.1%	15.4%	6.8%	12.9%	10.5%
Youth Unemployment (%)	15.4%	14.1%	11.8%	10.4%	18.5%	16.1%	13.5%
General Unemployment (%)	8.3%	6.7%	5.7%	5.0%	9.9%	8.3%	6.6%
Tertiary Qualification, Certificate or Higher (% of persons aged 15+)	21.7%	24.4%	29.4%	34.1%	17.3%	18.9%	25.8%
Median Age	41	40	37	38	38	37	35
Median Weekly Household Income (CPI Adjusted for 2001)	\$600	\$660	\$785	\$780	\$605	\$670	\$750
Voluntary Work Participation (%)	24.2%	23.0%	22.4%	29.0%	Information not available	Information not available	Information not available
SEIFA: Disadvantage	954 859 851	1008 995	958	953	929 894 868	995 991	980
SEIFA: Education-Occupation	889 833 859	942 927	932	953	886 868 836	935 911	944

Source: ABS Census 2001/2006

Note: Data for 2001 is based on place of enumeration, whereas data for 2006 is based on place of usual residence

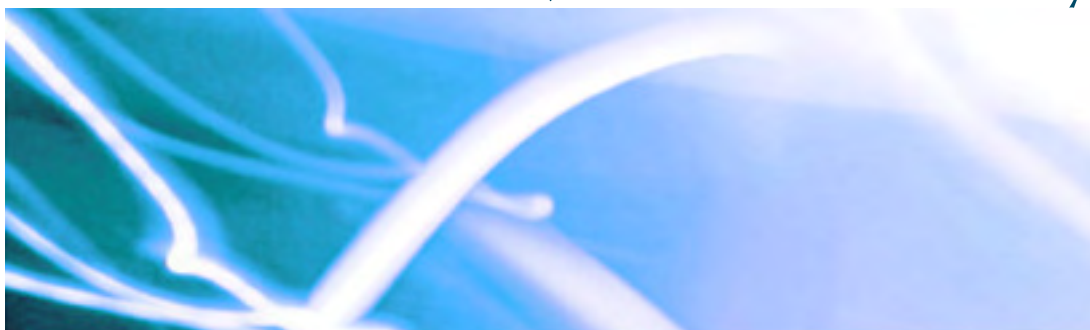
Note: SEIFA values given for Merbein UCL & Hinterland are for the hinterland only

⁸⁴ Note that the 2001 population was based on place of enumeration on the census night, whereas the 2006 population was based on place of usual residence. The 2001 population includes 75 visitors to the area.

⁸⁵ Includes 91 visitors to the area.

⁸⁶ Includes 3,013 visitors to the area.

Appendix 7: Moree Plains, NSW Case Study



Report 4: Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Social and economic impacts of reduced irrigation water

July 2010

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1 Key Findings

1.1 Background

The primary driver for long-term reductions in water availability for irrigation communities in the Murray Darling Basin will be government policy, including the purchase of water entitlements under *Water for the Future* and the setting of new Sustainable Diversion Limits under the forthcoming *Basin Plan*. Climate change is also projected to have an impact on reduced water availability by 2030. Whilst there are likely to be benefits from increased water for the environment, reduced water for irrigation will result in a range of social and economic impacts on agriculturally dependant communities across the Basin. It is important in this regard to distinguish between short-term stressors such as rainfall variation and fluctuating commodities prices, to which agricultural communities have been adapting over many years, and more permanent impacts from a long-term policy-driven and climatic reduction of water for consumptive uses.

In the face of possible permanent reductions in water availability and the associated impacts, this part of the study aims to answer the question, ‘how resilient are communities likely to be to permanent changes to irrigation water?’ A number of factors were found to predict changes in indicators of wellbeing and resilience in earlier stages of this study¹ including changes in employment and population. Our findings for the MDB were generally in line with other research on rural and regional communities, with key indicators that predict wellbeing and resilience including degree of remoteness, degree of urbanisation (population size), proportion of Indigenous people particularly remote populations,² and age of the population.³ Degree of economic diversity and opportunities to diversify were also relevant factors identified in the literature,⁴ though our findings indicate that these factors are largely a function of other more endogenous factors like remoteness, proximity to a large urban centre or to other economic resources like extractive industries. Though things like community leadership and collaborative initiatives are important, it can be difficult for communities to respond to major stressors where they have characteristics that work against their ability to adapt to change.

¹ JSA (2010) Report 2: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Understanding Agricultural Employment*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri; and JSA (2010) Report 3: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Irrigated Agriculture and Socio-Economic Indicators*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri.

² It is noted that, although ‘Indigenous people’ is a proxy indicator, it is not being Aboriginal *per se* that signifies disadvantage but a range of attributes that are more likely to found among Aboriginal people, such as low income, educational and employment status, being sole parent, lower likelihood of home ownership, etc

³ JSA (2010) Report 2: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Understanding Agricultural Employment*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri; and JSA (2010) Report 3: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Irrigated Agriculture and Socio-Economic Indicators*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri.

⁴ JSA (2010) Report 1: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Scoping Paper*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri.

To explore the likely social and economic impacts and degree of resilience to more permanent changes in water at different geographic scales, JSA has researched eight case studies across the Murray Darling Basin in different types of irrigated agricultural communities. The eight case study areas are Dalby-Wambo, Queensland; Balonne, Queensland; Moree Plains, NSW; Bourke, NSW; Griffith, NSW; Campaspe, Victoria; Mildura, Victoria; and Murray Bridge, South Australia. These are augmented by an overview of the regional context, or of smaller communities within these areas, to illustrate some of the impacts that are likely at different scales.

This report presents the findings of the Moree Plains, NSW case study. The key findings from the study, particularly the area's current status against a range of wellbeing and resilience indicators is presented first, and is followed by a detailed discussion of quantitative and qualitative findings from the research. It is important to note that, although we have only been able to focus on eight areas, it is hoped that the case studies will provide information for communities within the Basin facing similar challenges, and draw out the characteristics that are likely to mitigate or exacerbate the impacts of permanent reductions in irrigation water.

1.2 How Resilient is Moree Plains likely to be to permanent reductions in water?

1.2.1 Overview of Findings

Despite the fact that Moree Plains has certain locational and natural advantages compared with more remote case study areas in the Northern Basin like Bourke and Balonne, its very high level of reliance on agriculture, lack of economic alternatives such as mining, energy or manufacturing, relative remoteness and attributes that make it less attractive as a 'tree change' location make it more vulnerable to permanent changes to water availability under the forthcoming *Basin Plan* and government water policy more generally.

The vulnerabilities of the area to permanent changes in water availability can be seen in the area's reliance on agriculture and public sector employment, and the declines in employment and population that occurred during the period of recent drought between 2001 and 2006. Water available for irrigation in the Gwydir Valley, including the Moree Plains case study area, has dramatically reduced as the result of the drought and resultant low allocations since the 2002/03 season.

Though not as significant as Bourke, Moree Plains' relatively heavy reliance on public or community sector employment and high proportion of residents in receipt of welfare payments also make it particularly vulnerable to ongoing changes in government policies related to centralisation of services and administrative functions. It is noted that over 60% of employment appears to be in agriculture and industries related to public or quasi-public sector funded employment.

Moree Plains' net loss of employment between 2001 and 2006 was far greater than its population loss (-16% job loss compared to a -10% change in population), and was much closer to the

experience of Bourke and Balonne over the same period. This tends to indicate that people remain in Moree, to a greater extent, when faced with job loss than they do in smaller, more remote areas, possibly due to its status as a larger centre, service opportunities and the potential for employment to ‘bounce back’ after, for example, prolonged periods of drought. Again, it is also noted that the *quantum* of employment loss (or number of jobs) experienced by Moree Plains was far greater in absolute terms than that experienced by Bourke and Balonne.

Employment trends were markedly different for Dalby-Wambo and the Southern Basin case study areas. Apart from a small employment decline in Griffith, all remaining case study areas experienced positive employment growth from 2001 to 2006. The influence of location, size, degree of urbanisation, proximity to larger centres, as well as relatively higher levels of water security are evident in these trends.

Based on the status of Moree Plains against key indicators of wellbeing and resilience, as well as our projections for impacts to employment and population as a result of permanent reductions in water availability, the trends that have been experienced in the short term are likely to be exacerbated by long-term or permanent reductions in water.

Key concerns were expressed by study participants regarding the large proportion (at least 20% is estimated⁵) of entitlements in the Gwydir have so far been purchased through a combination of federal and state government initiatives for environmental purposes.⁶ These sales represent a long-term and permanent reduction in water. The impact of these sales, including the resultant ‘loss’ of irrigation water for production in the area, is not fully understood. While the proceeds from the sales have largely been used to retire debt and benefit the seller, study participants and others have raised considerable concerns about the long-term impact of these sales on lost production and the local economy’s capacity to ‘bounce back’ from short-medium term stressors like drought. The NSW government has indicated its intention to trade water from its general security environmental allocation to irrigators on a seasonal basis when conditions are favourable and environmental objectives are able to be achieved.⁷

⁵ Study participants reported that 20% of entitlements had been purchased out of the Gwydir to date. We note that based on figures reported on DEWHA and NSW DECCW websites, a combination of 105,612 ML of general security shares and 16,765 ML of supplementary access shares have been purchased, as proportions of all unit shares reported in the Gwydir Water Sharing Plan this equates to 20.7% of general security and 9.8% of supplementary access shares. For more information see: NSW Department of Environment, Climate Change and Water (2010) Water for the environment’s achievements, www.environment.nsw.gov.au/environmentalwater/achievements.htm. Department of Environment, Water, Heritage and the Arts (2010) Progress of water recovery under the Restoring the Balance in the Murray-Darling Basin program, www.environment.gov.au/water/policy-programs/entitlement-purchasing/2008-09.html.

⁶ It is our understanding that while 6,832 ML of ‘medium security’ entitlements have been purchased from the Queensland Border Rivers, there have been no purchases from the NSW Border Rivers. Data obtained from Department of Environment, Water, Heritage and the Arts, accessed online at www.environment.gov.au/water/policy-programs/entitlement-purchasing/borderrivers.html, 14 July 2010.

⁷ Correspondence with Senior Conservation Officer & Gwydir Environmental Water Manager, 30 June 2010.

1.2.2 Moree Plains 'Resilience' Report Card

The following provides an overview of key factors that have led to this assessment of how resilient Moree Plains is likely to be in the face of further permanent reductions in water availability. Key factors are reviewed as a 'report card' on resilience, and include:

- Projected changes in employment, population, and indicators of community wellbeing modelled for 10%, 25% and 50% cuts in irrigation water on the 2005/06 growing season;
- Degree of reliance upon agriculture and in particular irrigated agriculture and related industries;
- Factors that have a statistically significant relationship to wellbeing and resilience;
- The current status of Moree Plains in terms of existing socio-economic indicators; and
- Factors which are likely to mitigate or worsen projected impacts identified during field research.

Each of these is looked at in turn below. This is followed by detailed data and information from desktop analysis and fieldwork undertaken by JSA from January to May 2010.

Population and Employment Impact Forecast

The 'long term' impacts of reduced water availability on Moree Plains are likely to be significant, particularly with regard to employment and population change. This is because irrigated agriculture forms a large proportion of both agricultural industries and the total economy of the area.

The primary effect will be a loss of employment, ranging from at least a 1.5% loss (94 jobs) predicted from a 10% reduction in water availability, a 3.8% loss (232 jobs) predicted from a 25% reduction in water availability, to a 7.6% loss (461 jobs) predicted from a 50% reduction in water availability, including direct and indirect employment in agriculture and multipliers. Given the job loss experienced during the recent drought (prior to 2005/2006), the fact that irrigated agriculture is anecdotally stated to have higher multipliers than the average for agriculture, and the likelihood that some agricultural jobs have not been identified in our analysis, this is almost certainly an underestimate. Subsequent population loss is estimated as at least a 1.9% loss (263 people) predicted from a 10% reduction in water availability, a 4.6% loss (649 people) predicted from a 25% reduction in water availability, to at least a 9.2% loss (1292 people) predicted from a 50% reduction in water availability.

Permanent reductions in irrigation water are likely to significantly constrain post-drought recovery, including regaining employment and population lost during the recent drought, and significantly entrench higher levels of disadvantage.

Predicted Changes in Indicators of Wellbeing and Resilience

Modelling of impacts on indicators of community wellbeing and resilience for Moree Plains from reduced water availability also predicts that there will be significant adverse impacts on such indicators as a result of employment and population loss (or failure to regain population and jobs in a post-drought period). Such adverse socio-economic impacts are generally a result of a more residualised population which is both older and has a greater proportion of disadvantaged Indigenous people. Notable changes⁸ are likely to be:

- a decrease in median household income;
- an increase in disability support pension rates;
- an increase in residents with a profound or severe disability;
- a decrease in labour force participation 65+;
- an increase in youth and general unemployment; and
- decreased in-migration or population replacement.

Factors Affecting Wellbeing and Resilience

A number of factors were found to predict changes in indicators of wellbeing and resilience in earlier stages of this study,⁹ including changes in employment and population. These included degree of remoteness, degree of urbanisation (population size), proportion of Indigenous people particularly in remote populations,¹⁰ and age of the population.¹¹ Degree of economic diversity and opportunities to diversify were also relevant factors identified in the literature,¹² though our findings indicate that these factors are largely a function of other more endogenous factors like remoteness, proximity to a large urban centre or to other economic resources like extractive industries.

⁸ More than 5% change at 50% level of reduction.

⁹ JSA (2010) Report 2: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Understanding Agricultural Employment*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri; and JSA (2010) Report 3: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Irrigated Agriculture and Socio-Economic Indicators*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri.

¹⁰ It is noted that, although 'Indigenous people' is a proxy indicator, it is not being Aboriginal *per se* that signifies disadvantage but a range of attributes that are more likely to found among Aboriginal people, such as low income, educational and employment status, being sole parent, lower likelihood of home ownership, etc.

¹¹ JSA (2010) Report 2: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Understanding Agricultural Employment*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri; and JSA (2010) Report 3: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Irrigated Agriculture and Socio-Economic Indicators*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri.

¹² JSA (2010) Report 1: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Scoping Paper*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri.

In summary, Moree Plains performs poorly against the key factors that indicate how resilient a community is likely to be in the face of change. It is a relatively 'remote area', with a very high proportion of Indigenous residents who are likely to be more disadvantaged than average. Its population of just fewer than 14,000 in 2006 follows a dramatic decline from 2001. As a result, it has not achieved the critical mass that makes it in any way independent of the fortunes of its predominantly agricultural economy. It lacks economic diversity and has few alternative economic options to replace a significant loss of jobs predicted with permanent reductions in irrigation water. It has a younger than average age profile, which is likely due to its youthful Indigenous population.

Moreover, it is an area that cannot afford to lose employment or population through permanent reductions in water for consumptive uses, and whose post-drought recovery is likely to be severely constrained by such permanent reductions in water. As such, the drought and resultant years of low allocations can be seen as a real time simulation for more permanent reductions in water. The following table provides an overview of these key factors, which are discussed in more detail in the body of the case study report.

Table 1.1: Key Factors in Community Resilience

Statistically Significant Factors	Resilient?	Comment
Remoteness	X	More remote than MDB average, but not as remote as Bourke and Balonne.
Degree of Urbanisation:	X	It is positive that its population is greater than 10,000 (14,000 in 2006) thus enabling its status as a district service centre. However, it is vulnerable to further employment and population loss and resultant loss of services should population thresholds be reached.
- Population Size - Proximity to a large regional centre	X	Locational disadvantage is evident as Moree is not close to a capital city or major regional centre. Brisbane is approximately 6 hours away, while Sydney is 8 hours. Tamworth, with around 35,000 residents (still below the 50,000 population threshold) is 3.5 hrs away.
Indigenous Population	X	19.5% of the population which equates to around 5 times the MDB average and 9 times the national average. Strongly associated with increased disadvantage, poor health outcomes, etc. Any contraction in economic base and resultant loss of opportunities are predicted to exacerbate these trends.
Age	√?	Much younger median age than MDB and Australia, largely due to its large Indigenous population. However, this median likely masks the older age profile of non-Indigenous residents, particularly among farmers and smaller communities within the LGA. Any contraction in economic base is also predicted to exacerbate ageing of non-Indigenous population as young and middle-aged residents leave the area in search of work.

Statistically Significant Factors	Resilient?	Comment
% of employment by industry compared with Australian benchmark	X?	Highly reliant upon agriculture and related industries. Some benefits from being a district service centre are evident such as the higher % of public sector and retail jobs, but this also indicates vulnerability to ongoing centralisation of public services and jobs to other larger centres such as Tamworth and Dubbo.

Current Status on Community Resilience Indicators

The current status of Moree Plains regarding key socio-economic indicators is necessary to understand its resilience or vulnerability to changes in employment related to reduced water availability. The following provides a 'report card' on the extent to which the current status of Moree Plains compares with the MDB and National benchmarks. Findings show a community that has significant indicators of vulnerability in terms of disadvantage, employment loss, low education and occupation index, low skills base, low level of school participation at 16 years and mixed health indicators. These factors indicate the likelihood that the local labour force will be less adaptive to changes in the economic base. There also appears to be a lower than average rate of volunteering coupled with low in-migration from outside the area, which does not necessarily suggest strong connection and engagement in the area across the board, but rather a residualisation of the population when the recent decline in employment and population is taken into consideration.

Table 1.2: Current Status Report on Indicators of Community Resilience

Proxy Indicator of Resilience	Resilient?	Comment
Community Wellbeing:		
SEIFA Disadvantage	X	Very disadvantaged compared with MDB and Australia, most likely due to its high Indigenous population.
SEIFA Economic Resources	X	Much lower than the MDB and Australian average in relation to overall level of economic resources in the community. Residents have reduced access to economic resources, indicates lower incomes, lower level of home ownership and more households paying low rents.
Median Household Income	√	Much higher than the MDB average and close to the Australian median, and a notable contrast to the low level on the SEIFA Index of Economic Resources. This probably indicates the presence of sufficient higher income households to influence the median.
Social Capital /Volunteering rate	X?	Well below the MDB average, but higher than Australia. Lowest rate among the northern basin case study areas.

Proxy Indicator of Resilience	Resilient?	Comment
Disability Support Pension	✓	Lower than MDB average but slightly higher than Australia, likely due to a younger median age.
Premature Death	X	Much higher than MDB and Australian averages, possibly related to its large Indigenous population, higher rate of chronic ill health; more road, workplace and other accidents, injury and suicide.
Profound or severe disability	✓	Much lower than both the MDB and Australian averages, most likely due to much lower median age.
Chronic Ill Health	X	Much higher than both the MDB and Australian averages, most likely due to the high proportion of Indigenous people, despite its much younger median age.
Economic growth/Human Capital		
Change in Total Employment 2001-06	X	Very high rate of employment loss (-16.1%), which was strongly against the Australian and MDB trends (+10% and +1.2% growth respectively).
Labour force participation 15+ years	✓	Slightly higher than MDB and national average. Likely influenced by the large older workforce, remoteness of the area, and opportunities for entry-level jobs in agriculture and related sectors.
Labour force participation 65+ years	X?	3 times the national average, much higher than MDB average and similar to other remote northern basin case study areas. Negative aspects include limited succession planning and less retention of younger workers. Positive aspects reported to include ability to use skills of older people, who find it easier to find employment in rural areas.
Post-school qualification (skills base)	X	Lower than MDB and much lower than the national average. Likely related to predominance of agriculture and related industries in the local economy, Indigenous people and lower skills of those remaining that have not left the area for work or study.
School participation at 16 years	X	Very low school participation rate compared with both MDB and Australia, possibly due to entry level job opportunities in the local economy and high proportion of Indigenous young people.
SEIFA Index of Education and Occupation (brings together relevant Census variables on the general level of education and occupation-related skills of people within an area)	X	Well below MDB average and much lower than Australia, reflecting underlying human capital resources and nature of local employment, and high proportion of Indigenous residents. Likely to limit the ability to flexibly adapt to structural changes in the economy.
GINI co-efficient of household income distribution/polarisation	X	Polarised area like most Basin areas, and slightly higher than MBD average with regard to household income.

Proxy Indicator of Resilience	Resilient?	Comment
Youth unemployment rate	√?	Much lower than average, which likely reflects entry level employment opportunities. Unemployment actually decreased from 2001 to 2006, which indicates that employable people are more likely to leave the town to seek jobs elsewhere including in mining. Problems with employability of those remaining was noted in consultations and indicates increased residualisation of those who remain.
General unemployment rate	√?	Lower than average, though a perception that this may have worsened with reduced agricultural production since 2006. Decrease in u/e from 2001-06 indicates that more employable people are less likely to stay, which is consistent with other research on rural and remote areas.
Amenity:		
Population Growth /Retention	X	Very high population loss accompanying even higher employment loss related to remoteness and size. A high % of people will leave town when jobs are lost, though a lag time in their departure is likely.
In-migration	X	Relatively low rate of in-migration from outside the LGA compared with movement within the MDB and nationally. Also lowest of the northern basin case studies.

Other Factors that indicate vulnerability or resilience from consultation

Fieldwork and other consultations have provided valuable insights into other aspects of current and future vulnerability or resilience, as well as other factors that are likely to mitigate or worsen projected impacts. See **Section 5** for a detailed discussion of fieldwork findings.

In summary, Moree Plains is largely dependent on dryland and irrigated agriculture. There are likely to be limited benefit of expanded trade in temporary and permanent water licenses. To date there have been significant state and federal government purchase of entitlements from 'willing sellers' through buyback programs. The NSW government has been particularly focused on the purchase of water and land for the restoration and long term preservation of the Gwydir Wetlands, which are internationally significant and Ramsar listed wetlands. Study participants noted that many 'willing sellers', particularly to the federal buyback, were often making choices about the sale of their entitlements at a particularly vulnerable time following many years of drought, low allocations and reduced output, where the decision to sell appears to be more out of necessity than choice. Study participants and others have also raised considerable concerns about the inability of these sales to benefit the community in the short term, as most of the proceeds have been used to retire personal debts, and to reduce the community's capacity in the long term. The NSW government has stated their intention to trade water from their general security

environmental accounts to irrigators if conditions are favourable and environmental watering objectives are able to be achieved for a season.¹³

The area suffers from locational disadvantage due to its relative remoteness. However, these disadvantages are mitigated to some extent by good air, rail and road transport and services; its location at the intersection of major highways; and its location and access to the Great Artesian Basin enabling it to be a popular 'spa' destination. However, jobs in 'Recreation' and 'Accommodation & Food' are lower than average and suggest that there are likely to be limitations to tourism flow-ons. Despite the area's relative remoteness, it is not 'far enough' away from Tamworth and risks further loss of public services and jobs through state government policy decisions and centralisation to Tamworth as opposed to Moree. Overall, the future of the area appears to be closely linked to its agricultural base and mitigating factors are not sufficient to off-set significant risks from reduced water.

Table 1.3: Other factors of vulnerability and resilience relevant to Moree Plains

Factor	Resilient?	Comment
Nature of 'next best' land use with reduced water	?	Next best use to irrigated agriculture is generally dryland grazing and cropping, which have lower employment, though the gap in employment numbers between these uses is not as great as areas where soil and/or rainfall is less favourable. Dryland agriculture remains the predominant use, and contributes to Moree's status as a highly productive agricultural area. The strength of this sector is a mitigating factor. More limited opportunities for horticulture due to low water security, cost of infrastructure development, suitability of soils, and market risks. Reported that the current 1,200 ha under cultivation could increase to around 4,000 ha, though an additional feasibility analysis would be required. The CMA and the NSW state government are providing a limited amount of funding for cotton growers interested in diversifying in horticultural alternatives.¹⁴
Potential benefits of water trade	X?	Limited ability to benefit from future water trade out of area due to limited connectivity between the Gwydir Valley and Border Rivers with the rest of the MD system. Sale of permanent entitlements through state and federal government 'buyback' programs in the Gwydir is estimated at 20% to date. These sales are likely to benefit individual sellers, but to have adverse impacts at the community level, and reduce the ability 'recover' jobs lost during drought years. Reinvestment of the proceeds from these sales in the community appears to be limited, with much of the proceeds reported to be used to retire debt. The buyback has taken land out of production for

¹³ Correspondence with Senior Conservation Officer & Gwydir Environmental Water Manager, 30 June 2010.

¹⁴ Correspondence with Border-Rivers Gwydir Catchment Management Authority, 15 July 2010.

Factor	Resilient?	Comment
		irrigated uses, with permanent direct job loss and flow-ons as reported during consultations. Further cuts to SDLs across the board will compromise long-term viability of farmers as their long-term average profitability will be reduced. NSW government has stated that they intend to trade water from their general security environmental account to irrigators if conditions are favourable and environmental objectives are able to be achieved.
Past responses to 'stressors' e.g. drought	?	Drought can be seen as a real time simulation for permanent cuts to water. A loss of jobs and population has occurred in response to recent drought. Permanent water reduction will limit ability to 'bounce back' when conditions improve. At the enterprise level, irrigators have changed crops and sought gains in water and production efficiency, and have become 'opportunistic irrigators' not solely 'cotton growers' for example. Nonetheless, periodic full production of irrigated crops remains important for the 'average' business year and enables viability and in-roads into debt. Graziers in the Gwydir watercourse country have converted grazing land to cereal cropping due to continued 'drying' of the area both due to drought and upstream use by irrigators. There are very few graziers left in the area as a result.
Ability to make further efficiency gains	?	Range of on-farm efficiencies have been undertaken over time which are reported to have led to significant improvements. Border Rivers-Gwydir CMA Water Use Efficiency Program has provided funds for 60 landholders to upgrade water use efficiency infrastructure.¹⁵ NSW Sustaining the Basin: Border Rivers – Gwydir program using federal funds for on-farm infrastructure efficiency upgrades if farmers share the savings with the Commonwealth Environmental Water Holder. Growers report that further efficiency gains would require major capital investment, and are unlikely to generate sufficient return to warrant private expenditure. Matching of government funds is also problematic due to levels of debt and required returns. The climate of uncertainty also limits such investment.
Access to Other Economic Opportunities	X	No major replacement industries are reported to be 'on the horizon'. Disadvantages from loss of employees to mining outside LGA (e.g. Narrabri, Gunnedah), including inability to

¹⁵ Correspondence with Border-Rivers Gwydir Catchment Management Authority, 15 July 2010.

Factor	Resilient?	Comment
Natural attributes	X?	compete with higher mining wages. Lacks locational or other attractions to make it a 'tree change' location. Locational disadvantage due to remoteness, but not far enough away from Tamworth to avoid centralisation of services there. Locational disadvantages mitigated to some extent by: • Good air, rail and road transport and services, but poor Internet access. • Advantages from location at intersection of Gwydir, Carnarvon and Newell Highways, with the latter a major link between Brisbane and Melbourne. • Location on Great Artesian Basin, and popular 'Spa' destination, but lower than average jobs in 'Recreation' and 'Accommodation & Food' indicate limitations to tourism flow-ons. Overall, lacks an 'alternate future' without agriculture. In particular, alternative employment and economic opportunities would need to be significant to off-set job loss from irrigated agriculture.
Leadership /Social Capital	√	Clear indications of strong civic, community and industry leadership, networking and action in local consultations. Strong indications of community pride and leadership in high amenity public domain and civic services. Reported to be strong social capital in fund-raising, community support in Moree and smaller towns like Mungindi.
Other factors in vulnerability /resilience identified in consultations	X	Small towns within the LGA are likely to be particularly vulnerable to permanent reductions in water. Risk of further loss of public services and jobs through state government policy decisions and centralisation. Concern that Moree is, 'not remote enough for special funding, but too remote to keep retain key services'.

2 Introduction

In June 2009, Judith Stubbs and Associates (JSA) were engaged by the Cotton Catchment Communities Co-operative Research Centre to undertake a significant research project investigating wellbeing and resilience of communities, particularly those engaged in irrigated agriculture including cotton, within the Murray Darling Basin (MDB). The study seeks to understand the likely social and economic impacts on communities at different scales arising from changes in government water policy, in particular, *Water for the Future* and the forthcoming *Basin Plan*, and projected climate change. This project included three research strategies and has so far produced three reports.¹⁶

2.1 Rationale

Given findings from the literature and the first three reports of this study, it is likely that the social and economic impacts related to changes in water availability will be experienced differently at different geographic scales (eg. farm, local community, region, MDB, national), and by different groups within a community (e.g. farmers, Aboriginal people, businesses). Key factors will include the existing wellbeing and resilience of these communities, and other mitigating factors such as access to the water market and alternative economic opportunities.

In order to understand the differential impacts upon areas and groups, we have carried out a cost-benefit analysis to determine impacts at the MDB and national levels and prepared eight case studies to explore the likely impacts at the farm, regional and local community levels. These documents comprise the fourth and final report for this study.

The eight case study areas were selected in order to represent different states, different CSIRO Sustainable Yields Regions, cotton and non-cotton producing areas, a diversity of irrigated agricultural uses and diversity across three key attributes including population size, remoteness and Indigenous population. The eight case study areas include Dalby-Wambo, Queensland; Balonne, Queensland; Moree Plains, NSW; Bourke, NSW; Griffith, NSW; Campaspe, Victoria; Mildura, Victoria; and Murray Bridge, South Australia.

¹⁶ JSA (2010) Report 1: Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Scoping Paper, JSA (2010) Report 2: Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Understanding Agricultural Employment, and JSA (2010) Report 3: Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Irrigated Agriculture and Socio-Economic Indicators.

2.2 Case study methodology

This case study is informed by JSA's extensive analysis of agriculture and population data; a review of policy, relevant document and reports; and a series of telephone and face-to-face interviews with individuals from a range of perspectives and organisations.¹⁷

Interviews and field visits to Moree Plains were conducted between January and May 2010 in order to understand how water availability, agricultural land use and agricultural employment has changed in recent years as a result of government policy and short term climatic change (eg, the recent drought), how these changes resulted in social and economic impacts at the farm and wider community levels, and therefore how more permanent reductions in irrigation water are likely to affect wellbeing and resilience at the farm and community level.

2.3 Case study overview

This case study provides:

- A description of the case study area including its location, land and water use, water policy, and relative social and economic wellbeing and resilience against key indicators;
- A prediction of impacts to community wellbeing and resilience based on hypothetical reductions in water availability of 10%, 25% and 50% from the most recent year for which comparative agricultural and population data is available (the 2005/06 growing year and 2006 Census);
- An exploration of the 'short term' social and economic impacts that have been experienced as a result of the recent drought, fluctuations in commodities prices, water market and other relevant factors affecting communities; and
- An analysis of how the attributes of the area and other factors have exacerbated and/or helped to mitigate the impacts already experienced as an indicator of the area's resilience, and how it may therefore respond to more permanent changes in water availability under the forthcoming Basin Plan or permanent trade out of area.

¹⁷ Participants included cotton growers, grazier, Moree Plains Shire Council staff and councillors, Border Rivers-Gwydir Catchment Management Authority, Aboriginal Employment Strategy (Moree), Gwydir Valley Irrigators Association, Boyce Chartered Accountants, Mungindi Water Users & Cotton Growers Association, NSW Department of Environment, Climate Change and Water – Wetlands Conservation for the Northern Catchments.

3 Description of the Case Study Area

3.1 Location

Moree Plains is located in the Gwydir and Border Rivers catchments within the Gwydir and Border Rivers Sustainable Yield Regions as defined by the CSIRO. The LGA covers an area of over 18,000 km and is one of the largest local government areas in NSW in spatial terms,¹⁸ and had a total population of around 14,000 people in 2006.¹⁹ The Shire is situated at the crossroads of the Newell and Gwydir Highways, both major inland transport corridors for Eastern Australia.²⁰ The town of Moree sits at the south-eastern extremity of the Great Artesian Basin, a vast underground water resource covering much of eastern and central Australia.

The town of Moree, with just over 8,000 residents in 2006,²¹ is a regional centre with daily air and rail links to Sydney, around 600 kms or 8 hrs drive. The Shire's proximity to other townships of the north western region, such as Inverell, Narrabri, Walgett and Goondiwindi, together with a high tourism component, is reported to swell this figure for a large proportion of the year.²² Known as the 'Spa Capital of Australia', the Moree Hot Artesian Pool Complex was first established in 1896, and attracts visitors from around Australia and overseas to 'take the waters'.²³

Tamworth, with a population of around 33,000 people, is the closest major regional centre at around 3.5 hours drive from Moree. Goondiwindi on the Queensland border, around 1.5 hours drive from Moree, was reported in consultations to be a popular centre for shopping and service trips by local residents, although it has a smaller population than Moree town at around 6,000 people in 2006.

The map below shows the location of the four northern basin case study areas in the context of the CSIRO Sustainable Yield Regions.

¹⁸ Moree Shire Council website, accessed 8 March 2010

¹⁹ ABS 2006 Census

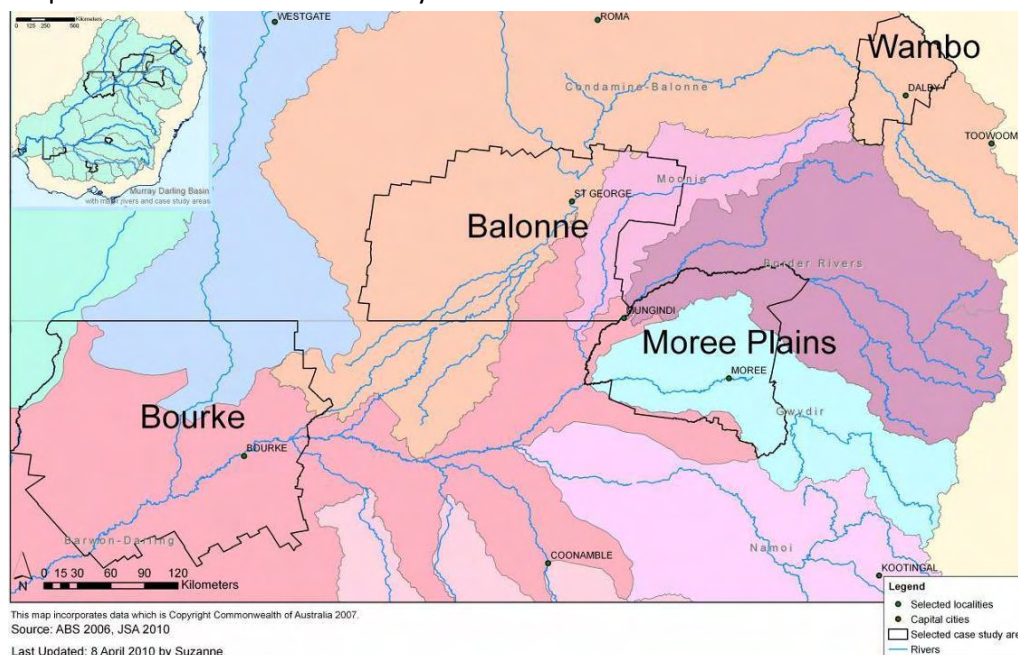
²⁰ Moree Shire Council website, accessed 8 March 2010

²¹ ABS 2006 Census

²² Moree Shire Council website, accessed 8 March 2010

²³ Moree Shire Council website, accessed 8 March 2010

Map 3.1: Moree Plains Case Study Area



3.2 Water and Land Use Context

The Moree Plains case study area is located primarily within the **Gwydir sustainable yield region**, and also within the **Border Rivers sustainable yield region**, in southern QLD and north-eastern NSW.

3.2.1 Gwydir Sustainable Yield Region

The Gwydir region is based around the Gwydir River, with Moree located on the Gwydir River a short distance upstream of where the River divides into a range of streams including Carole Creek, the Mehi River and Moomin Creek.

The Gwydir sustainable yield region covers 2% of the land area of the MDB. The region uses 3.5% of surface water diverted in the MDB, and 2.8% of groundwater extracted in the Basin. The region accounts for 3.4% of runoff in the MDB.²⁴

On average, nearly 90% of water for irrigation is **diverted from the Gwydir River**, which is regulated by Copeton Dam upstream of Moree in the south-east of the region, and the River is reported to be 'affected by major water extractions'.²⁵ There are also numerous farm dams and

²⁴ CSIRO (2008) *Water Availability in the Gwydir, Summary Sheet from the CSIRO MDB Sustainable Yields Project*, p.1.

²⁵ CSIRO (2008) *Water Availability in the Gwydir, Summary Sheet from the CSIRO MDB Sustainable Yields Project*, p.1.

ring tanks in the region.²⁶ The current average surface water availability in the Gwydir Region is 782 GL per year and 41% of this is diverted for use, which is assessed by the CSIRO as a 'very high' level of diversion.^{27 28}

The **recent climate** (1997 to 2006) is reported to be similar to the long-term average climate (1895 to 2006), whilst the most likely estimate on climate change by 2030 would 'reduce average surface water availability by 10% and reduce surface water diversions by 8%'.²⁹

Groundwater use within the Gwydir sustainable yield region is calculated at around 46 GL per year, and mainly extracted from the Lower Gwydir Alluvium GMU. This represents around 12% of average total water use, and 55% in years of minimum surface water diversion.³⁰ The current level of extraction is reported to be at a 'moderate to high level of development'.

Gwydir Wetlands

The Moree Plains case study area also contains the **Gwydir Wetlands**, a nationally and internationally important Ramsar site on the floodplain of the lower Gwydir and Gingham that include four privately owned components. As a result of water resource development in the region,

Prior to large scale irrigation development including diversions and dams in the 1980s and 1990s, there was an estimated 250,000 hectares of native vegetation in the Gingham and Lower Gwydir watercourses that are described as a 'giant sponge' with water flowing through a network of tributaries that benefitted from periodic flooding that allowed it to remain 'continually wet in the centre'.³¹ The characteristics of this 'watercourse country' provided optimal conditions for graziers and prime habitat to support large resident populations of water birds such as ibis, egrets and spoonbills.

The combination of large scale irrigation development and the recent dry period has seen the area of wetlands decline significantly to around 71,230 hectares remaining.³² It is reported that there has been an increase of more than 75% in the average time between flood events that inundate 20,000 ha (around 20%) of the Gwydir Wetlands, and an increase from 7 years to 11.5 years in the maximum period between flood events.³³ In spite of floods being 'larger on average', the

²⁶ CSIRO (2008) *Water Availability in the Gwydir, Summary Sheet from the CSIRO MDB Sustainable Yields Project*, p.1.

²⁷ CSIRO (2008) *Water Availability in the Border Rivers, Summary Sheet from the CSIRO MDB Sustainable Yields Project*, p.1.

²⁸ We understand that the CSIRO findings for the Gwydir SYR for surface water diversions are at odds with the Gwydir Water Sharing Plan, which states that average surface water available is 1141 GL with 34% diverted for use, and that these issues have been raised with the CSIRO by organisations such as the Gwydir Valley Irrigators Association.

²⁹ CSIRO (2008) *Water Availability in the Border Rivers, Summary Sheet from the CSIRO MDB Sustainable Yields Project*, p.1.

³⁰ CSIRO (2008) *Water Availability in the Border Rivers, Summary Sheet from the CSIRO MDB Sustainable Yields Project*, p.1.

³¹ Interview with Senior Conservation Officer & Gwydir Environmental Water Manager, 20 January 2010.

³² Correspondence with Senior Conservation Officer & Gwydir Environmental Water Manager, 30 June 2010.

³³ CSIRO (2008) *Water Availability in the Border Rivers, Summary Sheet from the CSIRO MDB Sustainable Yields Project*, p.1.

reduction in flood frequency is reported to have reduced the average flood volume entering the wetlands by 42%, which is 'consistent with the stressed ecological condition of the wetlands'.³⁴

The reduction in area and frequency of wetting has resulted in significant impacts to the ecosystem, such that the area no longer supports any permanently resident waterbird populations. These changes have also had significant impacts on the graziers of the 'watercourse country' who have increasingly turned to cropping due to the 'drying' of the area.

The NSW and federal governments have purchased both water and land from landholders in the area for the preservation and long-term remediation of remaining habitat of the Gwydir Wetlands. Plans for the recent purchase of *Big Leather at Old Dromana*, a key property within the Ramsar area of the Gwydir Wetlands that will eventually be managed by NSW National Parks and Wildlife, will focus not only on improving the natural assets of the area but also its cultural assets by developing programs and employment opportunities for the local Aboriginal community to reconnect with this landscape.³⁵

3.2.2 Border Rivers Sustainable Yield Region

The Border Rivers sustainable yield region, in Queensland and NSW, is based around the Macintyre Brook and Dumaresq River, which join the Macintyre River and continue to become the Barwon River. The NSW portion of the Border Rivers includes a nationally significant wetland Morella Watercourse/Boobera Lagoon/Pungbougul Lagoon located near Goondiwindi, which is considered to be one of the most important Aboriginal places in eastern Australia.³⁶

The Border Rivers sustainable yield region covers 4% of the land area of the MDB. The region uses 4.4% of surface water diverted in the MDB, and 2% of groundwater extracted in the Basin. The region accounts for 3.4% of runoff in the MDB.³⁷

On average, nearly 90% of water for irrigation is diverted from surface water resources, which is regulated by Glenlyon Dam and Pindari Dam.³⁸ There are also numerous farm dams and ring tanks in the region.³⁹ The current average surface water availability in the Border Rivers Region is 1208 GL per year and 34% of this is diverted for use, which is assessed by the CSIRO as a 'high' level of diversion.⁴⁰

³⁴ CSIRO (2008) *Water Availability in the Border Rivers, Summary Sheet from the CSIRO MDB Sustainable Yields Project*, p.1.

³⁵ Interview with Senior Conservation Officer & Gwydir Environmental Water Manager, 20 January 2010.

³⁶ CSIRO (2008) *Water Availability in the Border Rivers, Summary Sheet from the CSIRO MDB Sustainable Yields Project*, p.1.

³⁷ CSIRO (2008) *Water Availability in the Border Rivers, Summary Sheet from the CSIRO MDB Sustainable Yields Project*, p.1.

³⁸ CSIRO (2008) *Water Availability in the Gwydir, Summary Sheet from the CSIRO MDB Sustainable Yields Project*, p.1.

³⁹ CSIRO (2008) *Water Availability in the Gwydir, Summary Sheet from the CSIRO MDB Sustainable Yields Project*, p.1.

⁴⁰ CSIRO (2008) *Water Availability in the Gwydir, Summary Sheet from the CSIRO MDB Sustainable Yields Project*, p.1.

The **recent climate** (1997 to 2006) is reported to be similar to the long-term average climate (1895 to 2006), whilst the most likely estimate on climate change by 2030 would 'reduce average surface water availability by 10% and reduce surface water diversions by 2%'.⁴¹

Groundwater use within the Border Rivers sustainable yield region is calculated at around 34 GL/year, with over one-third of this extracted from the Border Rivers Alluvium GMU. Future projections for 2030 indicate that an additional 12 GL/year of the Border Rivers Alluvium GMU could be extracted. The CSIRO warns that prolonged extraction at this level could lead to large reductions in the groundwater level, and without appropriate management responses lead to complete drying of the aquifer.

Likely **future development** of farm dams and groundwater extraction is expected to reduce surface water availability by 22 GL/year in addition to the impacts of the best estimate 2030 climate projections. Additional river leakage due to increased groundwater use of 9 GL/year would further reduce surface water availability.⁴²

3.2.3 Overview of land & water use in Moree Plains

In 2006, there were 1,501,276 hectares of land under cultivation in Moree Plains. The majority of land was used for grazing and broadacre crops with irrigated cotton a smaller but significant use. It is likely that cotton was by far the main irrigated crop grown in this season, with irrigated grain and oilseed appearing to account for around 2% of water used, and a small amount of fruit grown including pecans (which reportedly grows 95% of Australia's pecans),⁴³ and olives. The following table shows the number of hectares and proportion of agricultural land devoted to each type. Note that it is likely that 2005/2006 was not necessarily an 'average' year due to drought effects. We also note that a larger proportion of the cotton crop planted in this year was in the NSW Border Rivers rather than in the Gwydir where an estimated 30,000 to 40,000 hectares were grown.⁴⁴

Table 3.1: Agricultural Land Uses, Moree Plains

Agricultural Use	# Hectares	% of Agricultural Use Hectares
Vegetables	3	0.00%
Fruit	1,710	0.11%
Grapes	0	0.00%
Grazing	673,964	44.89%

⁴¹ CSIRO (2008) *Water Availability in the Gwydir, Summary Sheet from the CSIRO MDB Sustainable Yields Project*, p.1.

⁴² CSIRO (2008) *Water Availability in the Gwydir, Summary Sheet from the CSIRO MDB Sustainable Yields Project*, p.1.

⁴³ http://www.sydney.com/town/Moree/Pecan_Nut_Farm/info.aspx

⁴⁴ Correspondence with Gwydir Valley Irrigators Association, 08 July 2010.

Agricultural Use	# Hectares	% of Agricultural Use Hectares
Cereal, oilseeds, other broadacre	741,067	49.36%
Rice	0	0.00%
Cotton	84,532	5.63%

Source: ABS (2006) and JSA (2009)

Note: See JSA (2010) Report 2: Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Understanding Agricultural Employment, Appendix 2: Data sources and methods used, for an explanation of how each agricultural use has been determined.

Around 438 GL of water was used for irrigated crops and pasture in the Moree Plains case study area in 2005/06. Of this 98% was used for irrigated cotton, and represented 22.8% of agricultural employment in this sector. Cereals used 2% of irrigated water use, and represented 42.5% of agricultural employment. While the employment derived from dryland cereals is a more significant proportion of all agricultural employment than cotton, the land use devoted to cereals is nearly 10 times greater than the land use devoted to cotton. Therefore, if the land and water devoted to cotton was 'lost' and replaced with dryland cereals the jobs would not be replaced at an equivalent rate. These findings show that Moree Plains has a more diverse agricultural economy, with a productive mix of dry and irrigated uses (cotton), compared to many of the other case study areas explored for this study.

Table 3.2: Irrigated Water Use and Employment in Moree Plains LGA 2005/06

Employment & Water Use	2005/06	% Ag Employment / % Irrigated water use
Employment in Vegetables	8	0.4%
Irrigation water use (GL)	0	0%
Employment in Fruit	61	3.4%
Irrigation water use (GL)	0	0%
Employment in Grapes	3	0.2%
Irrigation water use (GL)	0	0%
Employment in Grazing	345	19.4%
Irrigation water use (GL)	0	0%
Employment in Cereals (incl. feed, oilseeds, etc)	755	42.5%
Irrigation water use (GL)	9.4	2.1%
Employment in Cotton	406	22.8%
Irrigation water use (GL)	428.8	97.9%
Employment (Balance Agriculture)	199	11.2%
Total Agricultural Employment	1778	100%
Total Irrigation Water Use (GL)	438.2	100%

Employment & Water Use	2005/06	% Ag Employment / % Irrigated water use
Total Employment	6094	N/A

Source: ABS (2006) and JSA (2009)

3.3 Water Policy Context

3.3.1 Relevant NSW Water Policy and Regulation

The two key pieces of legislation for water management in NSW are the *Water Management Act 2000* and the *Water Act 1912*. Although some of its provisions are still in force, the *Water Act 1912* is being progressively phased out and replaced by the *Water Management Act 2000*.

In 1995, the Murray-Darling Basin Ministerial Council introduced a Cap on diversions of water from the Basin. For New South Wales, the Cap is defined in terms of long term average diversions and represents the volume of water that would have been diverted under 1993/94 levels of development. In response to these limits, the government also developed a set of Cap management rules which placed limits on the amount of water available in a valley in any given year. Limits on extractions imposed under the Murray Darling Basin Cap were included in the limits on annual water extractions established under the water sharing plans as required under the *Water Management Act 2000*.

The *Water Management Act 2000* recognised the right of the environment to water for the first time in NSW. The Act aims to create a system for “the sustainable and integrated management of the State's water for the benefit of both present and future generations”.⁴⁵ The Act laid out a path for the separation of water licenses from land and the requirement for water sharing plans between users and the environment across different catchments and systems in the state. The Act has been progressively implemented across the state. As water sharing plans have been completed, licensing provisions and environmental rules of the Act have come into effect.

Water Sharing in the Gwydir

The *Water Sharing Plan for the Gwydir Regulated River Water Source* commenced in 2004 and applies until 2014. The plan refers to the water between the banks of all rivers, from the wall of Copeton Dam water storage downstream to the junction of the Gwydir River and its effluent rivers with the Barwon River.⁴⁶ The plan sets out the environmental needs in the catchment and directs how water is to be shared between the environment and other users. The Plan sets rules that relate to water access licenses, water allocation accounts, the trading or dealing of licenses and allocations, water extraction, operation of dams and the management of water flows.

⁴⁵ NSW Office of Water website, www.water.nsw.gov.au/Water-management/Law-and-Policy/default.aspx, accessed 26 March 2010.

⁴⁶ NSW DIPNR (2004) A guide to the Water Sharing Plan for the Gwydir Regulated River Water Source, September.

All other extraction of surface water must be authorised by an access license expressed by a share component. There has been an embargo on any new applications for commercial water access licenses for the Gwydir Regulated River since 1982. The categories of access licenses and their respective share components in the Gwydir Regulated River system are detailed in the table below.⁴⁷

Table 3.3: Gwydir River System Access Licenses

Access license category	Total share component
General security	509,500 unit shares
High security	19,293 unit shares
Domestic and stock	4,245 ML per year
Local water utility	3,836 ML per year
Supplementary water	170,000 unit shares

Source: NSW DIPNR (2004)

The plan establishes a long-term average annual extraction limit in order to comply with Murray Darling Basin Cap requirements, which in the case of the Gwydir is estimated to be 392,000 megalitres per year in order to ensure that 66% of the long-term average annual flow in the water source will be available to maintain basic ecosystem health.⁴⁸

The Gwydir catchment has a continuous accounting system that was implemented in 1998, which allows licensees with general security accounts to be credited with up to (and no more than) 150% of their allocation or 1.5 megalitres per unit share. The maximum volume that may be extracted under a general security license in any water year is 1.25 megalitres per unit share, or 3 megalitres per unit share over any consecutive three years. With regard to supplementary water access licenses, no more than 50% of the flows can be extracted.⁴⁹

Management of groundwater in the Moree Plains case study area within the Gwydir catchment is determined by the *Water Sharing Plan for the Lower Gwydir Groundwater Source 2006*. The water sharing plan provides a framework for groundwater management in the Lower Gwydir until 2017. There are three types of groundwater access licenses; Local Water Utility Access Licenses, Aquifer Access Licenses and Supplementary Water Access Licenses. The extraction limit for the resources is 32,300 ML/yr, plus water available under supplementary water access licenses and requirements for basic landholder rights. Every year, an Available Water Determination is made to set allocation limits for groundwater for the different license categories.⁵⁰

⁴⁷ Ibid.

⁴⁸ Ibid.

⁴⁹ NSW DIPNR (2004) A guide to the Water Sharing Plan for the Gwydir Regulated River Water Source, September.

⁵⁰ NSW Department of Water & Energy (2009) Lower Gwydir groundwater, February.

It is important to note that study participants reported that 20% of entitlements or unit shares in the Gwydir have been purchased through a combination of state and federal water purchasing initiatives to date. We note that based on figures reported on DEWHA and NSW DECCW websites, a combination of 105,612 ML of general security shares and 16,765 ML of supplementary access shares have been purchased, as proportions of all unit shares reported in the Gwydir Water Sharing Plan this equates to 20.7% of general security and 9.8% of supplementary access shares.⁵¹

How the outcomes and benefits to the environment from the implementation of the Gwydir Water Sharing Plan and the purchase of entitlements from the Gwydir Valley will be taken into account regarding the setting of new SDLs under the Basin Plan is unknown.

Water Sharing in the Border Rivers

The *Water Sharing Plan for the NSW Border Rivers Regulated Water Source* commenced in July 2009 and will have effect until 2014. The NSW portion of the Border Rivers includes an area of approximately 24,000 km². The major 'regulated' river systems are on the Dumaresq, Severn and Macintyre Rivers; with 'unregulated' systems on Tenterfield Creek, Mole River, Severn River, Macintyre River and Frazers Creek. The Water Sharing Plan applies to all regulated river sections in the NSW Border Rivers Water Management Area.

As with the Gwydir Water Sharing Plan, the Border Rivers plan sets out the environmental needs in the catchment and directs how water is to be shared between the environment and other users. The Plan sets rules that relate to water access licenses, water allocation accounts, the trading or dealing of licenses and allocations, water extraction, operation of dams and the management of water flows. All other extractions of surface water must be authorised by an access license expressed by a share component. The categories of access licenses and their respective share components in the Border Rivers Regulated River system are detailed in the table below.⁵²

Table 3.4: NSW Border Rivers System Access Licenses

Access license category	Total share component
General security (A Class)	21,000 unit shares
General security (B Class)	244,000 unit shares
High security	1,233 unit shares
Domestic and stock	1,205 ML per year

⁵¹ For more information see: NSW Department of Environment, Climate Change and Water (2010) Water for the environment's achievements, www.environment.nsw.gov.au/environmentalwater/achievements.htm. Department of Environment, Water, Heritage and the Arts (2010) Progress of water recovery under the Restoring the Balance in the Murray-Darling Basin program, www.environment.gov.au/water/policy-programs/entitlement-purchasing/2008-09.html.

⁵² NSW Department of Water and Energy (2009) Water Sharing Plan NSW Border Rivers regulated water source: guide, June.

Access license category	Total share component
Local water utility	620 ML per year
Supplementary water	120,000 unit shares

Source: Water Sharing Plan for the NSW Border Rivers Regulated Water Source 2009

The plan establishes a long-term average annual extraction limit in order to comply with Murray Darling Basin Cap requirements, which in the case of the NSW Border Rivers is estimated to be 194,500 megalitres per year in order to ensure that 60% of the long-term average annual flow in the water source at Mungindi will be available to maintain basic ecosystem health.⁵³

Management of groundwater in the Moree Plains case study area within the NSW Border Rivers is determined by the *Water Sharing Plan for the NSW Great Artesian Basin Groundwater Sources 2008 Order*.⁵⁴

While in the Gwydir has been a target area for state and federal government purchase of water access licenses, it is our understanding that there have not been any purchases in the NSW Border Rivers and a relatively small portion (6,832 ML) purchased by the federal government from the Queensland Border Rivers.⁵⁵

3.4 Social and Economic Context

3.4.1 Population Profile

The Moree Plains region has a long history of pastoralism. In January 1832, Sir Thomas Mitchell reached the Mehi River, ten miles or so from where Moree is today, and by 1848 most of the North-West of NSW was held under pastoral licences. Growth of Moree township soon followed, with the first store opened in 1852, followed by a post office the following year. In 1861 the first hotel opened (later called the Bank Hotel), and the following year the site was gazetted as Moree. Severe flooding hit the town in 1864, submerging the entire town, in some places up the roofs of the houses.

Growth in other legal and civic functions followed. The first policeman was stationed in Moree in 1865, and the town's first Police Station was built soon afterwards. In 1867 the first Church was built in Moree (Methodist), at which time the town had a population of 43 residents. Five years later, in 1872, the first school began to teach, with an enrolment of 33 children. Moree's

⁵³ NSW Department of Water and Energy (2009) Water Sharing Plan NSW Border Rivers regulated water source: guide, June.

⁵⁴ Water Sharing Plan for the NSW Great Artesian Basin Groundwater Sources 2008 Order, Published in Gazette No 74 of 23 June 2008, page 5713.

⁵⁵ Based on data reported by NSW with regard to the Riverbank, Wetland Recovery and Living Murray programs accessed online at www.environment.nsw.gov.au/environmentalwater/achievements.htm, 14 July 2010 and Department of Environment, Water, Heritage and the Arts, Progress of water recovery under the Restoring the Balance in the Murray-Darling Basin program, accessed online at www.environment.gov.au/water/policy-programs/entitlement-purchasing/2008-09.html, 14 July 2010.

first bank opened in 1876, and the town's first newspaper, the Gwydir examiner, was established in 1881. By this time the town's population had grown to 295 residents. The first hospital opened in 1885. Six years later, in 1891, the town's first election was held and town's first mayor, John Cameron, was elected. In 1897 a railway from Moree to Narrabri was opened, connecting Moree by rail to outside areas.

Moree's bore was completed in 1895, with baths in which the public could bathe built soon after. The bore water was also used by the Government to set up a 200-acre crop farm, 80 acres of which were irrigated with bore water. The farm yielded as much as 1500 pounds of cotton per season, but was abandoned after several years after the bore water was found to have a detrimental effect on the soil due to its high salt content. The town's first well was completed in 1900. Before this, water had to be brought in from the nearby Mehi River.

In December of 1928, two fires ripped through Moree within days of each other, destroying much of the town. The rebuilding occurred within a year and a half of the fires, an enormous effort on the part of the townspeople.

Grazing within the 'watercourse' country of the Gwydir Wetlands along the lower Gwydir and Gingham flourished due to the characteristics of the landscape. The Moree area was dominated by grazing and dryland cropping prior to the development of large-scale irrigation with the construction of Copeton Dam (capacity 1,364,000 ML) in the 1970s, about 150 km upstream of Moree and 30 km southwest of Inverell. Upon its completion and the completion of number of other weirs in the mid to late 1970's, irrigated agriculture and cotton production around Moree increased greatly. As at 2007, yield from the dam was averaging around 340,000 ML per year.⁵⁶

The expansion of irrigated agriculture had a tremendous impact on the landscape and communities within the area. The development of weirs, dams and diversions altered the flow of water from the wetlands and grazing lands of the 'watercourse country' and into storages used to produce significant yields of broadacre crops like cotton. The shift from grazing to irrigated agriculture has brought financial and employment benefits to the area that facilitated growth and development, as demonstrated by the population trends for both Moree town and LGA that show peaks in the 1980s and early 1990s during the period of development of the industry. However, this shift has also increased the area's reliance on the irrigation industry as other agricultural industries like grazing have declined over time due to reduced water availability and drought.

Moree Township

The following graph indicates that the population of Moree town reached its peak of 10,459 people in 1981, and since then has been gradually declining, losing on average 95 people (1.1%) per annum. The town's relative reliance on agriculture is also evident in significant population drops from 1991 to 1996 (-7.9%) and 2001 to 2006 (-10.5%), which were periods of drought and technological change. Nonetheless, it has fared much better than the more remote town of

⁵⁶ Hassell and Associates (2007) Technical Review of Irrigated Agriculture in the Macquarie and Gwydir River Catchments, Report prepared for the NSW Department of Environment and Climate Change, June.

Bourke and Moree's importance as a regional centre and critical mass of service and employment is evident in this regard.

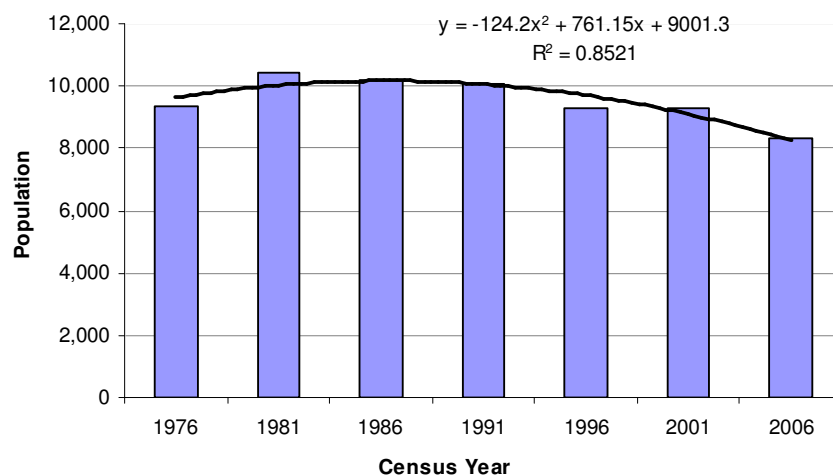


Figure 3.1: Population Change 1976-2006 for Moree Town

Source: ABS Census of Population and Housing, by Place of Enumeration

Moree Plains LGA

Moree Plains LGA followed roughly the same pattern as did the township, peaking in population in 1981 at 17,229 people, and then generally decreasing thereafter, losing on average 130 people (0.8%) per year. Nonetheless, it has lost only 1,244 people in net terms (-8%) in the 30 years since 1976, and population fluctuations associated with changing agricultural use such as the introduction and development of irrigated agriculture in the 1970s and 1980s, technological change and periods of drought are evident.

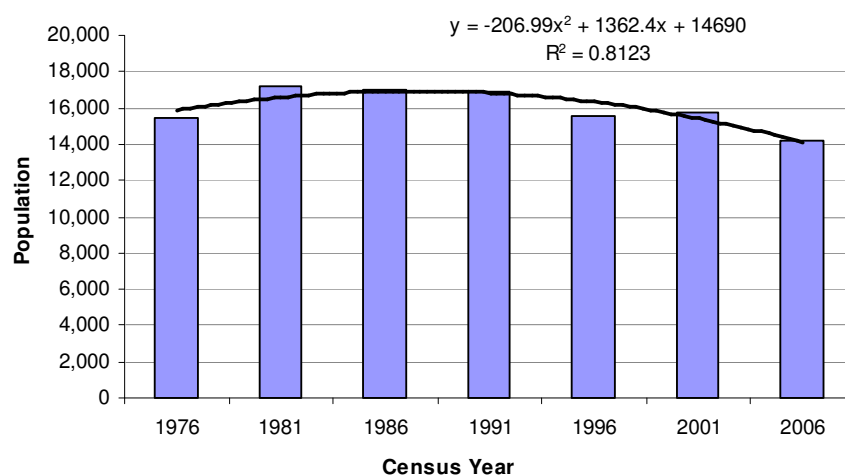


Figure 3.2: Population Change 1976-2006 for Moree Plains LGA

Source: ABS Census of Population and Housing, by Place of Enumeration

The next largest towns in the Moree Plains LGA are Mungindi and Boggabilla at around 550 and 650 residents respectively at the time of the 2006 Census. These towns both lost population between 2001 and 2006, though Boggabilla lost fewer people (3% compared with 15% for Mungindi), which may be due to Boggabilla's proximity to Goondawindi and/or its large and youthful Aboriginal population. Other smaller villages in the LGA include Ashley, Boomi, Garah, Pallamallawa, Gurley and Weemelah.

The population of Moree Plains was much larger than the two more remote Northern Basin case study areas (3 times that of Balonne Shire and 5 times larger than Bourke Shire). It was considerably less remote on the ABS Census remoteness index than these two areas, though still more remote than the MDB area average (2.2 compared with 1.8). Its locational advantage, larger size and district level service centre status are also evident in a lower level of population decline from 2001 to 2006 (-10% compared with -15% for Bourke or Balonne Shires). It is also noted that *quantum* of population loss experienced by Moree Plains was far greater in absolute terms than that experienced by Bourke and Balonne Shires due to its much higher population base.

Nonetheless, Moree Plains was more remote than the other case study areas in the MDB, and experienced very different population trends. Moree's significant population decline for the period strongly contrasted with most of the case study areas in the Southern Basin, where Murray Bridge, Mildura and Campaspe grew by 2.4%, 4.3% and 5.4% respectively, and the MDB grew by 1.1% overall. The other less remote and more urbanised Northern Basin case study area (Dalby-Wambo) grew by around 1.4% for the period.

3.4.2 Employment and Industry Profile

In 2006, there were 5,490 people employed in Moree Plains LGA. Of these, 1,602 people (29%) were employed in agriculture (12% in cereals, 7% cotton and 6% grazing), which reflected the MDB average of areas. The majority of people employed in the agricultural industry were in jobs related to cereals, oilseeds and other broadacre land uses (43% of all agriculture employment). Lesser but relatively high proportions were represented by cotton (23% of all agriculture employment), grazing (19% of all agricultural) and balance of other agricultural services (11% of all agriculture employment).

The various service sectors (including Health, Education, Public Administration, Financial and Other Services) accounted for around 32% of employment which was similar to that in the MDB generally though somewhat lower than Australia. Industries associated with tourism (Recreation and accommodation and Food) were lower than the national and MDB average of areas (around 6% compared with 8% and 8.5% for Australia and the MDB), despite the importance of facilities like the Spa Baths and associated facilities to the local economy and its obvious promotion.

Retail was also a significant employer (11%), but there was limited evidence of diversification into other industries, with Construction, Manufacturing, Utilities, Transport and Communications well below the national average.

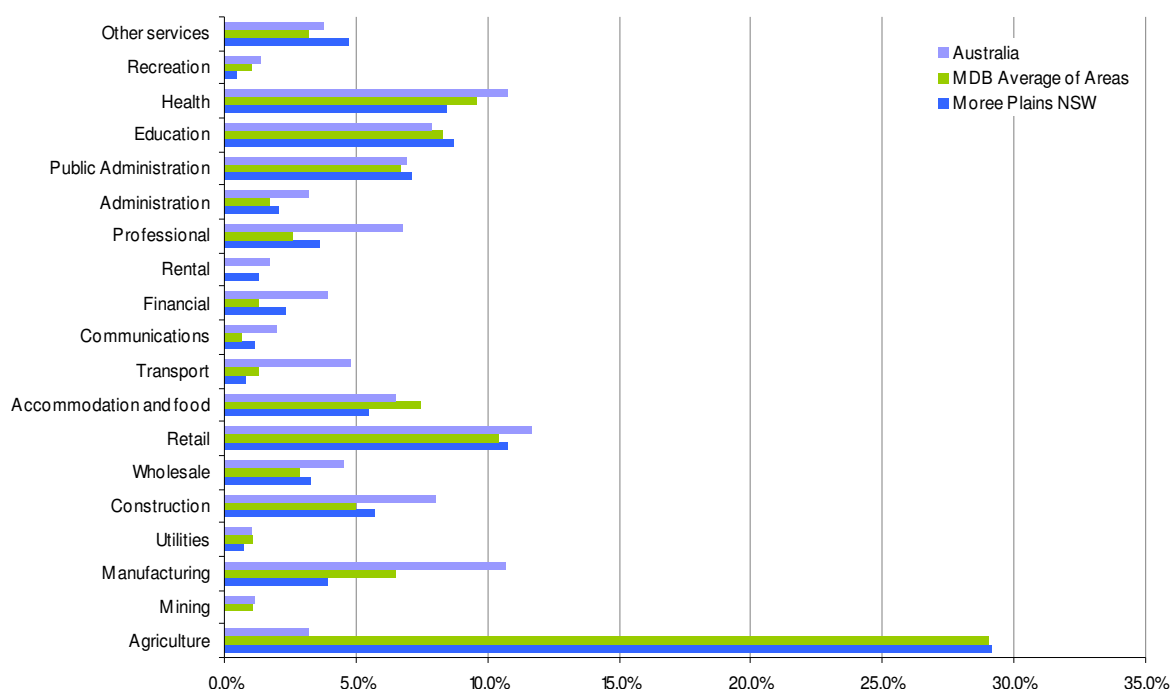


Figure 3.3: Employment Profile, Moree Plains NSW

Source: ABS (2006) Census of Population and Housing, JSA (2009)

3.4.3 Indicators of Community Wellbeing and Resilience

Comparative indicators for the eight case study areas are reviewed in detail in Report 4 of this study (JSA 2010 forthcoming), of which this case study will form a part.

The findings against each of these indicators is summarised in **Section 1, Table 2 above**, and the reader is referred to this section, as well as to Report 4 when issued.

A key issue in relation to the 'resilience' or adaptive capacity of a community is its ability to attract and retain population, and to expand or at least adapt its economic and employment base to changing conditions. As noted, Moree Plains experienced a significant decline in population and an even greater decline in employment from 2001 to 2006. This was strongly against the MDB and particularly the national growth trends. Moree Plains Shire lacks the diversity of either agriculture or its general economic base to support employment and population retention during periods of prolonged stress, including the recent drought. However, it is noted that it has some advantages related to its size, service and retail base, and less remote location compared with Bourke, Balonne and other more remote locations in the MDB. This can be seen in historical population trends outlined above, where a recent downward trend is evident, but is quite different to that of Bourke where relentless population decline over the past 30 years is evident. A relatively low proportion of people moved into Moree Plains Shire from 2001 to 2006 (17% compared with 25% for Australia), and a reasonably high level of net outward migration was likely during this period. This is not surprising given the impact of the drought and the heavy reliance upon agriculture in the local economy.

The extent to which Moree will ‘bounce back’ after more recent rains, particularly if followed by a few more ‘good years’ is a moot point, but some population and employment resilience seems likely in the absence of further stressors (for example, more permanent cuts to water under the forthcoming Basin Plan or under the current water buyback). As such, some population and particularly employment ‘recovery’ or at the least stability could be expected in the next Census (2011) if there were no further cuts to water availability on the 2006 levels.

In terms of other selected indicators of community wellbeing and resilience, an equally mixed picture emerges. Moree Plains has a slightly higher than average employment participation rate, though this appears to be in part related to its much higher than average participation of people aged 65+ years (2.5 times the national average). General unemployment is lower than the national average (6.3% compared with 7.3%), though youth unemployment is quite high (13% compared with 10% for the Australian and MDB benchmarks). Less positively, the area has a very low level of participation in secondary education past the age of 16 years (51% compared with 71% for the MDB and 74% for Australia), a very low level of post-secondary skills (29%, somewhat lower than the MDB at 32% and 39% nationally), and a low SEIFA Index of Education and Occupation score (938 compared with 953 for MDB average and 1000 for Australia).

In terms of other indicators of community wellbeing, some less positive aspects also emerge. As well as employment and educational disadvantages noted above, Moree Plains has a more disadvantaged socio-economic profile than Australia, the MDB and most other case study areas in relation to SEIFA Disadvantage, level of Chronic Ill Health, and Premature Death. Likewise, selected indicators indicate a community under stress, but nowhere near the extent to which more remote areas like Bourke are. The crime rate in Moree Plains is very high, with almost 4 times the NSW average for domestic violence, more than 3 times the NSW rate for assaultive violence (non-domestic), and more than twice the rate of aggregate property crime⁵⁷ compared with NSW (note that comparative national crime figures were not available).

Like the indicators of employment and educational disadvantage noted above, these trends are likely to be related to the high proportion of Indigenous residents (19.4% compared with 2.3% nationally), as well as its more remote location. Domestic violence and premature death are also related to severe stress and would be expected to rise during the recent period of prolonged drought. The fact that Moree is not a major regional centre and its location means that it is not generally a ‘population attractor’, and it is less likely to retain people than areas with highly diversified economies, though it is far more likely to retain population than areas like Bourke and Balonne in times of prolonged stress.

More positively, Moree Plains has a relatively low level of residents reliant upon Disability Support Pensions and with a Profound or Severe Disability, which could be expected due to its

⁵⁷ “Aggregate property crime” is a total value of rates per 100,000 for the following: Break and enter dwelling; Break and enter non-dwelling; Incidents of motor vehicle theft; Steal from motor vehicle; Steal from retail store; Steal from dwelling; Steal from person.; and Malicious damage to property.

relatively youthful population (a median age of 34 compared with the national average of 37 and MDB area average of 40 years) and the fact that it is not a major regional centre where people with long-term disability tend to move to access key services. Its level of social engagement as measured by participation in voluntary work is high compared with Australia (22% compared with around 18%), but quite low for a rural area (an MDB average of 29%).

It is also interesting to note that the socio-economic profile of the area appears to have become slightly less disadvantaged during the 5 years from 2001 to 2006. SEIFA Disadvantage increased 7 points from 929, and SEIFA Education and Occupation increased 10 points from 928 in 2001. Median household income (adjusted for CPI) increased from \$880 in 2001 to \$946 in 2006. It is also positive that median household income in Moree Plains was higher than most areas in the MDB in the most recent Census, and much higher than the MDB average (\$779), though slightly lower than Australia in 2006 (\$1027). It is interesting to note that the proportion of Aboriginal people increased slightly during this time (from 17.8% to 19.4% of the population), which would normally increase the level of disadvantage in relation to key indicators.

Youth and General Unemployment also decreased in the inter-censal period (from 16% to 13% for Youth Unemployment and from 9.3% to 6.3% for General Unemployment). The much lower participation rate of Aboriginal people is also noted in this regard, with only 43% of Aboriginal people reporting that they were employed or unemployed and actively seeking work compared with 73% for the non-Aboriginal population.

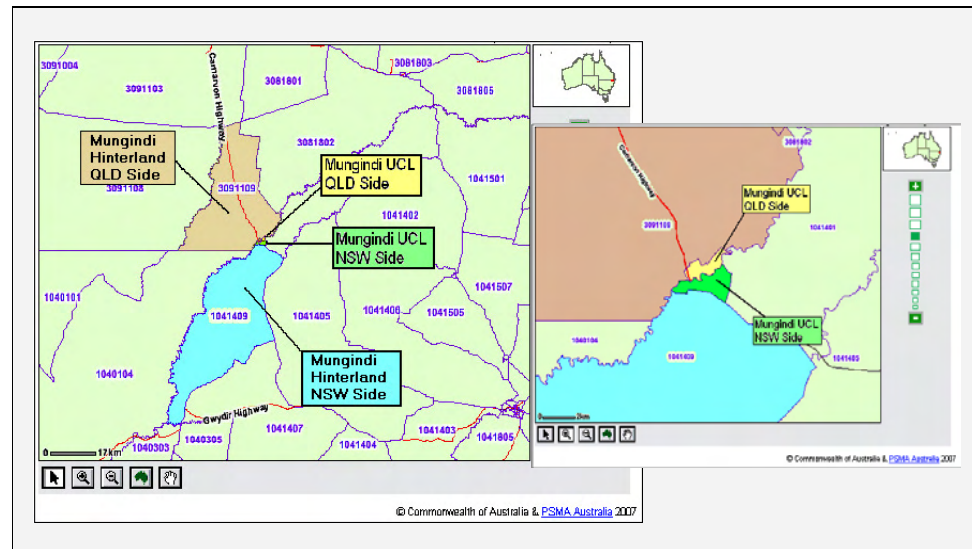
Moreover, though still experiencing high levels of relative socio-economic disadvantage, the above findings indicate that the local population may have become somewhat less residualised between 2001 and 2006, and that those leaving Moree in net terms (e.g. due to retrenchment during the drought) may be those less skilled and more likely to face unemployment. The trend for both Aboriginal and non-Aboriginal people to move up the regional hierarchy has been noted in other studies, including during periods of economic downturn, though other research indicates that those who unemployed people and others reliant upon Centrelink payments who remain are often severely disadvantaged and have few options. More skilled Aboriginal and non-Aboriginal people (for example in public and community sector jobs) are also likely to remain. It may also indicate that an increasing number of Aboriginal people are moving out of the labour market altogether during a period when there was much more limited work opportunities available (e.g. onto sole parent benefits or disability support pension). It is likely that both forces have been at work during the period of drought in Moree. Implications for the future labour market, particularly in relation to semi- and unskilled work have been noted.

3.4.4 Profile of a small town in the LGA: Mungindi

Mungindi is a small town 120 kilometres drive north-west of Moree, on the NSW and QLD border, in the Border Rivers catchment area. At the time of the 2006 Census, the township (NSW and QLD sides) had a population of 649, down from 737 persons in 2001 (a 12% decrease). In population in the area that has been included as the Mungindi hinterland (see the map below), was 151 persons in 2006, a decrease of 32% from 223 persons in 2001.

Information on Mungindi is provided here in order to provide a context to discussions on the disproportionate impact of loss of agriculture, as well as illustrating some important factors in community leadership in the resilience of such a town.

Map 3.2: Mungindi UCL & Hinterland



Source: ABS Website 2010

The Mungindi area is very dependant on agriculture, accounting for over 40% of all jobs, a much larger proportion than for Moree Plains LGA and the MDB. Other leading employment industries in the area were education and health.

In comparison with the MDB, Mungindi had a low number of manufacturing and construction jobs, quite a low number of jobs in trade, both retail and wholesale. On the other hand, Mungindi had a comparatively large number of recreation jobs.

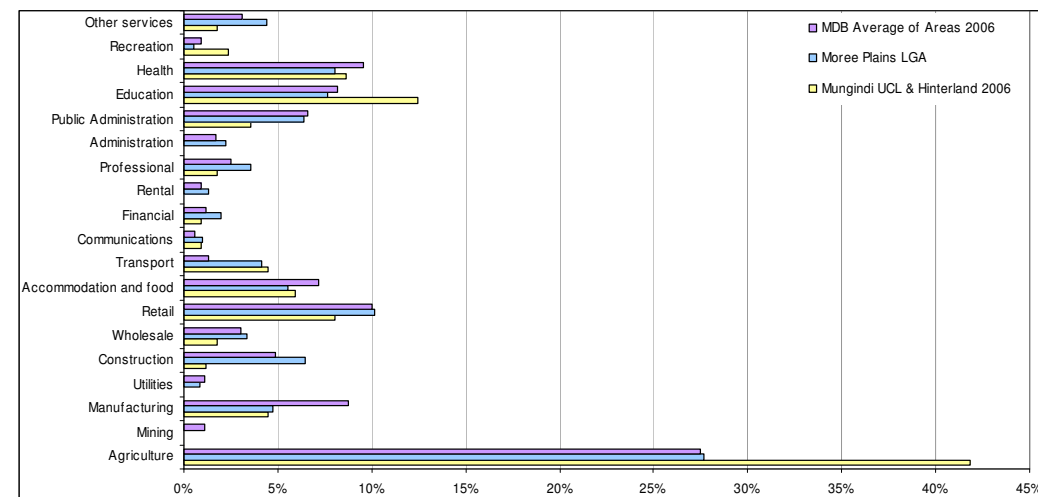


Figure 3.4: Employment Industry Breakdown – Mungindi UCL & Hinterland 2006

Source: ABS 2001 / 2006 Census

Despite the drought, jobs in agriculture in Mungindi grew substantially from 2001 to 2006, as did manufacturing, education and transport. The largest job decreases in the five-year period were in construction, retail, communications and public administration.

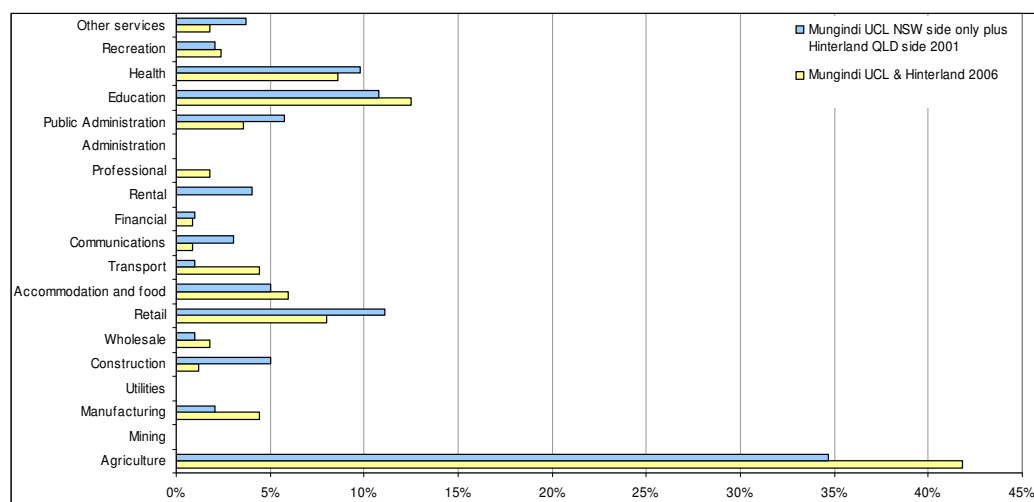


Figure 3.5: Employment Industry Comparison – Mungindi UCL & Hinterland

Note: 2001 Census did not include the categories for 'Professional' and 'Administration'

Source: ABS 2001 / 2006 Census

The table below shows the status of Mungindi against a selection of wellbeing and resilience indicators for 2001 and 2006.

Table 3.5: Mungindi UCL & Hinterland Key Indicators

	2006				2001		
	Mungindi UCL (NSW side only)	Mungindi UCL & Hinterland	Moree Plains LGA	MDB Average of Areas	Mungindi UCL (NSW side only)	Mungindi UCL NSW plus Mungindi Hinterland QLD ⁵⁸	Moree Plains LGA
Population	649 ⁵⁹	800	13,975	2,004,560	737 ⁶⁰	960 ⁶¹	15,737 ⁶²
Persons Employed	203	348	6,091	921,300	261	322	6,988
Labour Force Participation of persons aged 65+ (%)	24.0%	24.6%	23.8%	15.4%	25.5%	29.3%	18.0%
Youth Unemployment (%)	22.2%	21.7%	13.2%	10.4%	17.6%	15.0%	15.9%
General Unemployment (%)	13.6%	10.5%	6.3%	5.0%	8.7%	7.2%	9.3%
Tertiary Qualification, Certificate or Higher (% of persons aged 15+)	25.4%	24.3%	28.9%	34.1%	20.8%	23.4%	26.3%
Median Age	33	33	34	38	32	33	32
Median Weekly Household Income (CPI Adjusted for 2001)	\$770	\$855	\$945	\$780	\$740	\$795	\$880
Voluntary Work Participation (%)	30.3%	30.4%	25.4%	29.0%	Data not available	Data not available	Data not available
SEIFA: Disadvantage	875	896 (NSW SS) 979 (QLD SS)	936	953	911	879 (QLD UCL) 1013 (NSW Hnt) 1071 (QLD Hint)	929
SEIFA: Education-Occupation	916	928 (NSW SS) 957 (QLD SS)	938	953	939	802 (QLD UCL) 928 (NSW Hint) 1026 (QLD Hint)	928

Source: ABS Census 2001/2006

⁵⁸ In the 2001 census, apart from populations, data was unavailable for the CCDs relating to Mungindi UCL on QLD side and Mungindi hinterland on NSW side since the populations of these two CCDs were very small, and ABS do not release BCPs for areas with very small populations. In the 2006 census the UCLs on each side of the border and the hinterlands on the respective sides were combined into 'State Suburbs', one each for NSW and QLD, and so the 'full' UCL & hinterland was able to be analysed for 2006 by adding these two 'State Suburbs' together.

⁵⁹ Population is for UCL on both NSW and QLD sides.

⁶⁰ Population is for UCL on both NSW and QLD sides. Includes 37 visitors to the area.

⁶¹ Population is for UCL and hinterland on both NSW and QLD sides. Includes 174 visitors to the area.

⁶² Includes 1,299 visitors to the area.

Note: Data for 2001 is based on place of enumeration, whereas data for 2006 is based on place of usual residence

The labour force participation rate of persons aged 65 years and above was average for the LGA, although much higher than for the MDB. However between 2001 and 2006, this rate dropped in Mungindi while there was a substantial increase the LGA. Unemployment in Mungindi was becoming a larger problem between 2001 and 2006, with both youth and general unemployment increasing. By 2006, youth unemployment was over 60% higher than in the LGA as a whole, and double that for the MDB. General unemployment was also severe, being twice that for both Moree Plains LGA and the MDB.

While a relatively low skills base amongst residents was reported in 2006, this had increased from 2001. Mungindi's median age was similar to that for the LGA, although several years younger than for the MDB. The median household income in Mungindi was substantially lower than for the LGA, although less so when the hinterland was included – likely to reflect higher earning amongst primary producers. The SEIFA Index of Disadvantage and Education-Occupation scores for Mungindi UCL in 2006 were low compared with Moree Plains LGA, although when the hinterland was included the scores were similar to the LGA.

Residents of Mungindi were much more likely than residents of the LGA to participate in voluntary work, although only slightly more likely than the MDB average.

4 Potential Impacts of the Long-Term or Permanent Reductions in Water

4.1 Modelling and Quantification of Impacts

The impact on the Moree Plains case study area from reductions in the availability of irrigation water has been modelled using data from Research Strategies 1 and 2. Such reductions may arise under the forthcoming Basin Plan. The extent to which additional reductions in entitlements or allocations may occur under the Basin Plan is at the time of writing unknown. As such, we have modelled 10%, 25% and 50% cuts in irrigation water from that used in 2006. The results of that modelling in relation to the likely impact on employment, population and other key indicators of wellbeing and resilience are summarised here, and detailed in the table below.

The effects of cuts to irrigation water on Moree Plains are likely to be significant; however effects are offset to some degree by a wider agricultural base, with irrigation around 25% of agricultural jobs and the remainder in dryland cropping and grazing.

4.1.1 Employment and Population

The primary effect of reductions in the availability of irrigation water will be a loss of employment – a minimum decline of 7.6% in the 2006 employment level (or a loss of 461 jobs) predicted from a 50% reduction in irrigated water use based on 2006 data including direct and indirect employment in agriculture and multipliers. Given the job loss experienced during the recent drought and the fact that irrigated agriculture is anecdotally stated to have higher multipliers than the average for agriculture, and the likelihood that some agricultural jobs have not been identified in our analysis, this is almost certainly an underestimate.

Subsequent direct population loss is estimated at least 9.2% (1,292 people). However, cumulative impacts of ongoing population decline are also predicted in relation to a town the size of Moree, which is discussed below.

4.1.2 Community Wellbeing and Resilience

Socio-economic indicators of resilience and wellbeing are expected to be generally adversely affected as a result of changing water availability, generally as a result of an increasingly residualised population among those who stay, which is likely to be both older and have a greater proportion of more disadvantaged Indigenous people. Notable changes⁶³ are likely to be:

- a decrease in median household income,

⁶³ More than 5% change at 50% level of reduction

- an increase in disability support pension rates,
- an increase in profound or severe disability,
- a decrease in labour force participation 65+,
- an increase in youth and general unemployment, and
- decreased in-migration or population replacement in the Shire.

Further decline in population Moree Plains could also have an impact in a cumulative sense. The progressive loss of population and employment is important under further reductions in water availability, whether through a further prolonged drought that comes on top of the previous one, or more permanent reduction in water availability related to government policy. Study participants report that early responses to recent rains indicate some population and employment 'recovery' or at least stability could be expected if there were no further cuts to water availability on the 2006 levels, and that conditions improve in order to provide the area with a few 'good seasons'.

However, ongoing reductions in water availability (climatic or human-induced) are likely to mean that Moree Plains may well reach a turning point related to its size and the nature of its service and settlement pattern over the next decade or so. Our analysis of threshold sizes for case study areas indicates that areas above 10,000 people have significant advantages regarding the degree of reliance on agriculture and issues such as their attractiveness to current and potential residents. Moree Plains is at an important stage, with a population of around 14,000 at the time of the 2006 Census and a predicted loss of a further 1,300 under a 50% reduction in water availability. The one-off cuts to water and therefore population and employment are likely to have cumulative impacts over time, and an ongoing decrease in population and employment is likely past a certain threshold for towns with the locational and natural characteristics of Moree Plains. A further decline in indicators of wellbeing and resilience would also be expected.

Keeping Moree above a population threshold is important for its future resilience and status as a district-level service centre.

The following table provides a summary of the statistical analysis in support of the above findings on likely quantifiable social and economic impacts of potential and/or actual changes to water availability under government policy.

Table 4.1: Predicted 'long term' impacts of reduced water availability for Moree Plains

Indicator	Base case	Predicted indicators for 2006 for reduction in irrigation water			Comments
	2006	10% reduction	25% reduction	50% reduction	
Irrigation water use (GJ)	438.2	394.4	328.7	219.1	
Employment (total) (1)	6094	6000	5862	5633	
% Decrease in employment		1.5%	3.8%	7.6%	
Employment (Vegetables) (2)	8	8	8	8	
Irrigation water use (GJ)	0	0.0	0.0	0.0	
Employment (Fruit) (2)	61	61	61	61	
Irrigation water use (GJ)	0	0.0	0.0	0.0	
Employment (Grapes) (2)	3	3	3	3	
Irrigation water use (GJ)	0	0.0	0.0	0.0	
Employment (Grazing) (2)	345	347	350	356	Assumed next best use
Irrigation water use (GJ)	0	0.0	0.0	0.0	
Employment (Cereal) (2)	755	762	771	788	Assumed next best use
Irrigation water use (GJ)	9.4	8.5	7.1	4.7	
Employment (Rice) (2)	0	0	0	0	
Irrigation water use (GJ)	0	0.0	0.0	0.0	
Employment (Cotton) (2)	406	349	263	120	
Irrigation water use (GJ)	428.8	385.9	321.6	214.4	
Employment (Balance Agriculture)	199	199	199	199	

Indicator	Base case	Predicted indicators for 2006 for reduction in irrigation water			Comments
	2006	10% reduction	25% reduction	50% reduction	
Employment (Total Agriculture)	1778	1729	1656	1535	
Population (3)	13975	13712	13326	12683	remains above 10,000 threshold
Estimated % decrease in population		1.9%	4.6%	9.2%	
Indigenous population (4)	19.4%	19.6%	19.9%	20.4%	
Number of indigenous people	2711	2685	2647	2583	
Dependent variables:					
SEIFA Disadvantage	936	934	931	926	from changing age and indigenous structure
SEIFA Economic Resources	928	926	923	917	
Premature death	388.3	389.6	391.5	395.1	from changing indigenous structure
LFP 15+	61.8%	61.3%	60.6%	59.2%	from changing age and indigenous structure
Median Household income	\$ 946	\$ 933	\$ 914	\$ 879	from changing age and indigenous structure
Disability support pensioners	5.8%	5.9%	6.1%	6.5%	from changing age and indigenous structure
Dependent variables:					
Profound or severe disability	3.3%	3.4%	3.5%	3.7%	from changing age structure
Chronic ill health	236.9	236.1	234.8	232.5	from reduced cotton employment
LFP 65+	20.4%	20.1%	19.7%	18.9%	from changing age structure
Median Age	34	34.4	34.9	35.9	from change in agriculture and indigenous structure

Indicator	Base case	Predicted indicators for 2006 for reduction in irrigation water			Comments
	2006	10% reduction	25% reduction	50% reduction	
Skills Base	28.9%	28.7%	28.3%	27.6%	from changing agriculture and age and indigenous structure
Education participation	51.4%	51.4%	51.4%	51.5%	
SEIFA Education and Occupation	938	937	937	935	
Polarisation	0.85	0.85	0.85	0.86	
Youth unemployment	13.1%	13.3%	13.5%	14.0%	from changing age and indigenous structure
Unemployment	6.3%	6.4%	6.6%	6.9%	from changing age and indigenous structure
Change of SLA five years ago	17.2%	16.8%	16.1%	15.0%	
Voluntary work	22.0%	22.2%	22.6%	23.2%	from change in agriculture and age
Assault (Non domestic violence)	1900	1909	1922	1947	
Assault (Domestic violence)	1434	1445	1463	1494	
Property Crime	10974	10958	10883	10767	

(1) Includes factor of 1.11 to account for census under reporting, and allows loss of 0.9 jobs for each lost agricultural job

(2) Estimates using data from Table 3.1 of report two and using regression analysis data to account for dryland production, factor of 1.11 included)

(3) Assumed one job per household, 2.8 people per household, unemployed households leave the area

(4) In 2006, the Aboriginal LFP rate was 43%, compared to 73% for the non- Aboriginal population

We have assumed that job losses will therefore have a lesser effect on Aboriginal populations, leading to an increased proportion of Aboriginal people in the population, at the rate of the loss of one Aboriginal person for each 1.6 non- Aboriginal persons.

5 Field Work: Understanding likely impacts through responses to recent drought and other stressors

5.1 Overview

Compared to a ‘long term’ or permanent reduction in water availability that may occur as a result of government policy and climate change, the recent drought represents a relatively short- or medium-term impact. Given its duration and severity, in many ways it represents a ‘real time simulation’ of what may happen if water for consumptive or productive uses is removed permanently from production, and how communities may experience the impacts and respond.

It also sheds some light on the way in which government policy and progressive deregulation of the water market is already affecting communities, the ‘winners and losers’ that may be created, and the way in which water policy is experienced and responded to in communities facing significant stress.

Moreover, an understanding of how farms, agricultural industries and the local community have responded to the ‘short to medium term’ stressor of the drought is necessary to better predict the likely impacts of ‘long term’ stressors like more permanent reductions in water availability in the context of other important issues facing communities.

This case study focuses on Moree Plains, and illustrates responses of key stakeholders, including government, farmers and communities, to the drought and other stressors facing this area. The case study then provides an overview of the likely differential impacts on Mungindi, a small agricultural community in the Shire’s hinterland.

Each of these areas provide a different lens through which to understand the likely impacts of and responses to more permanent reductions in water availability that may occur under the Basin Plan or climate change.

5.2 Reduced water availability experienced

The Gwydir Valley has experienced drought conditions since the 2002/03 season. The drought has reduced general security and supplementary allocations for irrigators and reduced inflows to the wetlands for environmental purposes and graziers that rely on watercourse country. It is acknowledged that water availability in the watercourse country has reduced not only from the recent drought, but also from the development of large scale irrigated agriculture in the area in the 1970s through the 1990s. The combination of drought and the development of irrigation has

altered the landscape of the watercourse country with an estimated reduction in the size of the wetlands in the Gingham and Lower Gwydir watercourses from 250,000 to 71,230 hectares.⁶⁴

The following figure, reproduced from Boyce Chartered Accountants use of Gwydir Valley Irrigators data, shows the reduced level of regulated and supplementary extractions in the Gwydir Valley since the 2002/03 season as result of the drought and subsequent low allocations.

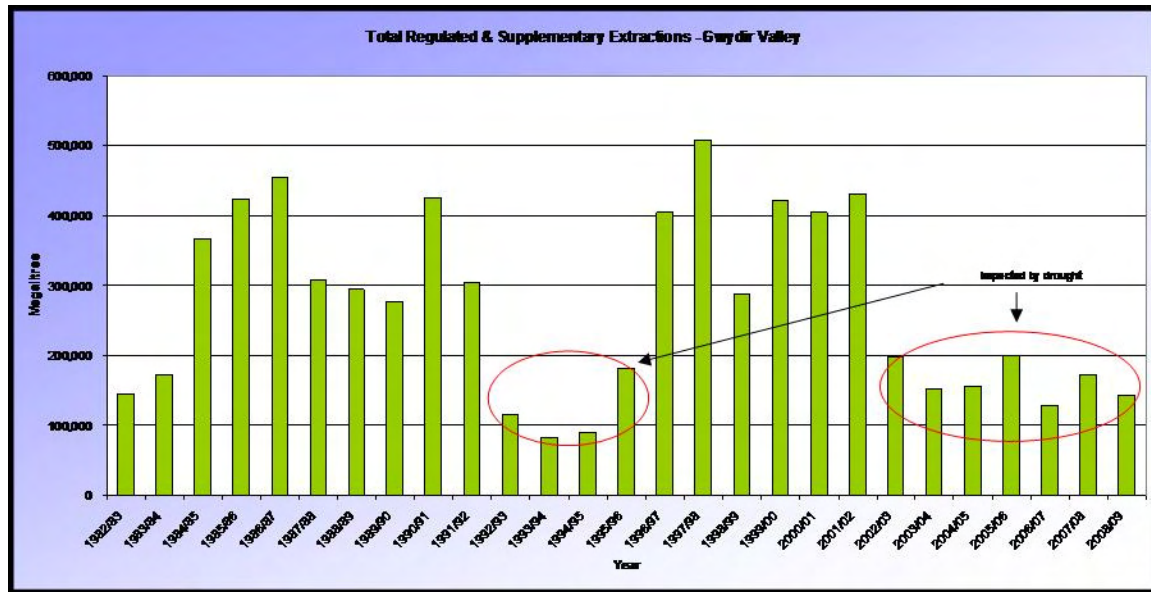


Figure 5.1: Total Regulated & Supplementary Extractions – Gwydir Valley

Source: Boyce Chartered Accountants (2010) utilising data from Gwydir Valley Irrigators Association.

According to the work of Boyce Chartered Accountants, average extractions between 2002/03 and 2008/09 were roughly 56% of the average extraction rate for the proceeding ten year period of 1992/93 to 2001/02, and 61% of the average extraction rate for the 27 year period from 1982/83 to 2008/09.⁶⁵

5.3 Agricultural responses to reduced water availability

Study participants report that as a result of the recent drought period there has been a considerable change in thinking amongst irrigators about the value of water, and how to best use their land based on the water that is available to them. As one participant said, *“We are always thinking about where water can add the most value to our business.”* Drought, as well as the continued

⁶⁴ Correspondence with Senior Conservation Officer & Gwydir Environmental Water Manager, 30 June 2010.

⁶⁵ Boyce Chartered Accountants (2010) Impact of drought and government water buy-back on the Moree community, presentation given to the *Sustaining Rural Communities Conference*, 19-21 April, Narrabri.

push to improve efficiencies in all aspects of agricultural production, have resulted in significant responses from agriculture in Moree Plains through technological change, crop diversification and government initiatives to improve infrastructure efficiencies and purchase land and water for environmental purposes.

5.3.1 Shift from grazing to cropping

Reduced water availability for graziers in the watercourse country due to drought and irrigation development, as well as an economic imperative, has prompted many to devote more of their land to dryland cereal cropping. Areas that were once floodplain wetland areas have become ‘dry enough’ to be converted to area suitable for cereal cropping. As a result, there few properties in the watercourse country that would be solely dedicated to grazing.⁶⁶

5.3.2 Technological change

Study participants report that technological change, particularly related to irrigated cotton production, has been rapid over the last 10 to 15 years (and particularly during the recent drought) across farming practices that have resulted in improved labour efficiencies and consequently fewer low-skilled on-farm jobs. Low till practices and more efficient machinery such as the baling picker are noted examples of changes that have resulted in less demand for contract employees.

5.3.3 Crop diversification by irrigators

Study participants report that while there have been some small shifts by irrigators into horticultural products, such as oranges, olives and nuts, it has not been substantial. The large capital and maintenance costs required are significant, plus the infrastructure required such as packing sheds etc require additional investment. The efficiency and productivity of cotton has remained the mainstay of irrigated agriculture in the area. Irrigators have tried to supplement with different types of grain (barley, wheat, sunflowers, etc), however allocations have often arrived too late in the season to produce viable crops. As one study participant said, *“Cotton is the only thing that keeps us viable. Other crops use just as much water and do not produce the returns.”*

As a result, the low allocation years of the recent drought are mainly reflected in reduced cotton production. Even if this land is utilised for dryland cereal production, there is a considerable reduction in employment likely (as demonstrated through our modelling) as well as reduced expenditure in direct operating costs (as demonstrated by Boyce Chartered Accountants). Boyce Chartered Accountants estimate that the difference in direct operating costs between cotton and dryland wheat has ranged from approximately \$30 million to \$60 million across the seasons of the recent drought, as shown in the figure below.

⁶⁶ Interview with Senior Conservation Officer & Gwydir Environmental Water Manager, 20 January 2010.

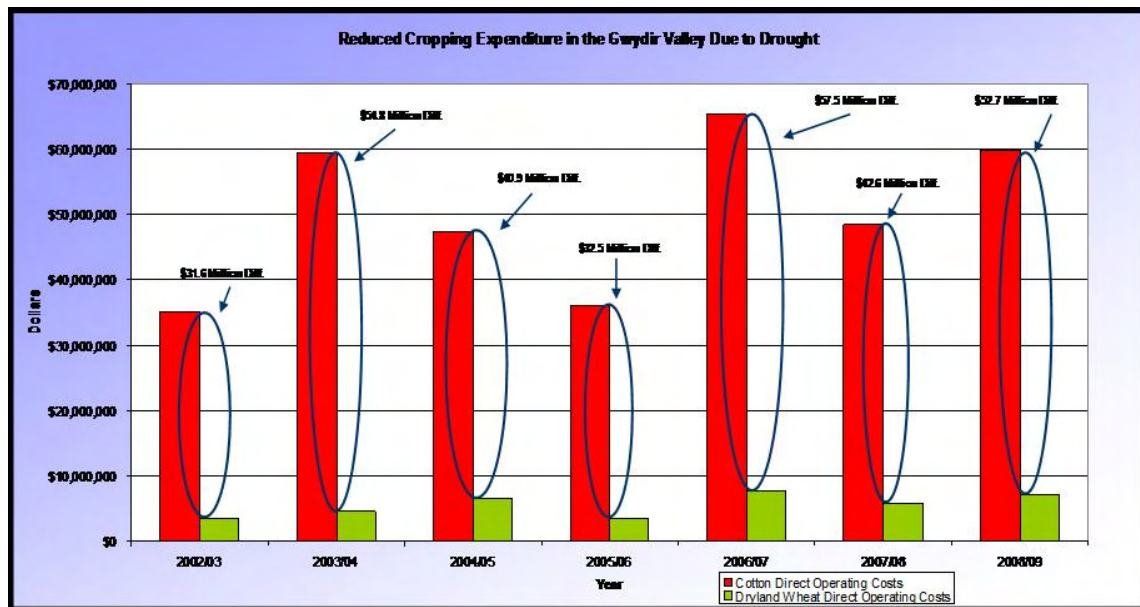


Figure 5.2: Reduced cropping expenditure between cotton and dryland wheat in the Gwydir Valley due to drought

Source: Boyce Chartered Accountants (2010)

Growing cotton on fewer hectares and producing fewer bales has numerous flow-on impacts, including reduced funding for research and development due to a levy per bale contribution system from growers.

5.3.4 Government initiatives – efficiency upgrades, land and water purchases

In addition to the ‘short term’ reduction in water due to drought conditions and subsequent low allocations, there have been a series of government policy decisions that have reduced water availability for irrigation in a more ‘permanent’ sense through the purchase of land and entitlements.

The Border Rivers-Gwydir Catchment Management Authority has run a number of programs, funded jointly by the state and federal governments, to improve water use efficiencies on farm. The recent Water Use Efficiency Program, which ran from 2007 to mid-2010, provided funding to landowners ranging from \$2,000 to \$2.7 million for on-farm efficiency projects such as increasing storage dam heights, soil testing, surveys and improvements to channels, gates and pipes. The CMA and the state government are also providing small amounts of funding to cotton growers in the Lower Gwydir interested in investing in horticultural alternatives, based on soil

feasibility studies that have been conducted that show where there may be areas suitable for diversification.⁶⁷

As part of *Water for the Future*, infrastructure upgrade funding is being offered in the Moree Plains area through the *Sustaining the Basin: Border Rivers-Gwydir* program where \$21.7 million has been allocated to upgrade irrigation infrastructure in order to improve productivity for irrigators with regulated river water access entitlements. Participation in the program requires a 20% contribution from the irrigator, as well as an agreement to permanently transfer 50% of agreed water savings as water access entitlements to the Commonwealth Environmental Water Holder. While the Border Rivers-Gwydir Catchment Management Authority reports that there has been interest amongst irrigators to participate in the program, there have also been significant concerns expressed about the difficulty in producing a plan and providing the up-front capital contribution that is required to participate in the program during this period of uncertainty prior to the release of the Basin Plan.

The federal government's Restoring the Balance in the MDB program, known as the 'buyback', plus various NSW state government land and water purchase programs have obtained a significant proportion of general security and supplementary access licenses in the Gwydir Valley. Study participants report that nearly 20% of entitlements have been purchased through a combination of the programs. Based on information obtained via government websites, to date 105,612 ML of general security licenses and 16,765 ML of supplementary access licenses have been purchased from the Gwydir.⁶⁸ As mentioned, the NSW state government has also purchased water and a key grazing property for conservation purposes in the Gwydir Wetlands. Study participants and others have raised considerable concerns about the future impacts of these sales on lost production and capacity within the local economy to 'bounce back' from short-medium term stressors like drought, as well as the environmental benefits that are able to be achieved from this investment. The NSW government has stated that it intends to trade general security water from its environmental accounts to irrigators on a seasonal basis when conditions are favourable and environmental objectives are able to be achieved.⁶⁹

5.4 Community responses to reduced water availability

As mentioned, there was significant population and employment loss in Moree Plains during the recent drought period (2001-2006). Consultations confirm the quantitative findings, as participants report that many people have left the area for education or employment

⁶⁷ Correspondence with Border-Rivers Gwydir Catchment Management Authority, 15 July 2010.

⁶⁸ NSW Department of Environment, Climate Change and Water (2010) Water for the environment's achievements, accessed online at www.environment.nsw.gov.au/environmentalwater/achievements.htm, 29 June. Department of Environment, Water, Heritage and the Arts (2010) Progress of water recovery under the Restoring the Balance in the Murray-Darling Basin program, accessed online at www.environment.gov.au/water/policy-programs/entitlement-purchasing/2008-09.html, 29 June.

⁶⁹ Correspondence with Senior Conservation Officer & Gwydir Environmental Water Manager, 30 June 2010.

opportunities or moved from properties to town as employment on farms contracted. Participants reported reduced discretionary spending in town, which has reduced the variety of retail available. Particular services that support the irrigated cotton industry have also reduced during the drought period.

In addition, participants reported that there is a skilled labour shortage in Moree town. Boyce Chartered Accountants conducted a local business survey which showed that out of 88 local businesses 55 were looking for 1 full-time employee. Despite this shortage, the unemployment rate remains relatively high in Moree. There is a perception that there is both difficulty in attracting skilled workers to the area due to competition from other areas with job opportunities in the mining and energy sector, plus the low skill level and high rates of disability and drug and alcohol dependency amongst the unemployed resident population in Moree.

Study participants who are running properties spoke about the difficulty of trying to ensure security of employment for on-farm staff, often residing on-farm with their families, during the drought period. When it no longer becomes possible to retain skilled staff, they are often forced to leave the district to seek employment and are unlikely to return if and when conditions were to improve. Some growers in the Moree Plains area have sourced skilled labour from overseas due to the lack of skilled on-farm labour.

5.4.1 Resilience to change in Mungindi

For long term residents of Mungindi, on the border of NSW and Queensland within the Border Rivers catchment, the community has changed significantly since the development of the irrigation industry in the 1980s and 1990s through the drought period of the 2000s. Prior to the drought, many were attracted to the area during the development of the irrigation industry. These families moved to the area and set about establishing their businesses, growing their families, and contributing to the community.

As our findings from section 3.4.4 show, the drought has had a significant impact on Mungindi particularly with regard to population and employment loss and rising unemployment levels. During this time, many long term residents waged a constant battle against the loss of services that unfortunately often accompanies declining population. Residents lobbied to attract a chemist to town when the only chemist retired, as well as campaigned to attract a credit union when Westpac Bank closed its premises. They also invested considerable time and energy to support the local school when the numbers of teachers was reduced.

While a few successful seasons for local dryland farmers have had a positive impact on the local area, there is concern for the future resilience of the community to withstand sustained or 'permanent' reductions in water availability. Community leaders who have contributed to the area's resilience to the drought are seeing their community age, with fewer and fewer young families who are in the position to 'fight to keep things going' in terms retaining and attracting services to town. Despite these challenges, study participants stressed that the community has a 'fair idea about what it wants and needs' which is healthy and vibrant rural sector that is able to support local families and benefit the wider community. In their view, any mitigation against

permanent reductions in water availability should encourage and assist the community to achieve these objectives.

Appendix 8: City of Murray Bridge, SA Case Study



Report 4: Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Social and economic impacts of reduced irrigation water

July 2010

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1. Key Findings

1.1. Background

The primary driver for long-term reductions in water availability for irrigation communities in the Murray Darling Basin will be government policy, including the purchase of water entitlements under *Water for the Future* and the setting of new Sustainable Diversion Limits under the forthcoming *Basin Plan*. Climate change is also projected to have an impact on reduced water availability by 2030. Whilst there are likely to be benefits from increased water for the environment, reduced water for irrigation will result in a range of social and economic impacts on agriculturally dependant communities across the Basin. It is important in this regard to distinguish between short-term stressors such as rainfall variation and fluctuating commodities prices, to which agricultural communities have been adapting over many years, and more permanent impacts from a long-term policy-driven and climatic reduction of water for consumptive uses.

In the face of possible permanent reductions in water availability and the associated impacts, this part of the study aims to answer the question, ‘how resilient are communities likely to be to change?’ A number of factors were found to predict changes in indicators of wellbeing and resilience in earlier stages of this study¹ including changes in employment and population. Our findings for the MDB were generally in line with other research on rural and regional communities, with key indicators that predict wellbeing and resilience including degree of remoteness, degree of urbanisation (population size), proportion of Indigenous people particularly remote populations,² and age of the population.³ Degree of economic diversity and opportunities to diversify were also relevant factors identified in the literature,⁴ though our findings indicate that these factors are largely a function of other more endogenous factors like remoteness, proximity to a large urban centre or to other economic resources like extractive industries. Though things like community leadership and collaborative initiatives are important,

¹ JSA (2010) Report 2: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Understanding Agricultural Employment*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri; and JSA (2010) Report 3: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Irrigated Agriculture and Socio-Economic Indicators*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri

² JSA (2010) Report 2: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Understanding Agricultural Employment*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri; and JSA (2010) Report 3: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Irrigated Agriculture and Socio-Economic Indicators*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri.

³ JSA (2010) Report 2: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Understanding Agricultural Employment*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri; and JSA (2010) Report 3: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Irrigated Agriculture and Socio-Economic Indicators*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri

⁴ JSA (2010) Report 1: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Scoping Paper*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri

it can be difficult for communities to respond to major stressors where they have characteristics that work against their ability to adapt to change.

To explore the likely social and economic impacts and degree of resilience to more permanent changes in water at different geographic scales, JSA has researched eight case studies across the Murray Darling Basin in different types of irrigated agricultural communities. The eight case study areas are Dalby-Wambo, Queensland; Balonne, Queensland; Moree Plains, NSW; Bourke, NSW; Griffith, NSW; Campaspe, Victoria; Mildura, Victoria; and Murray Bridge, South Australia. These are augmented by an overview of the regional context or of smaller communities within these areas to illustrate some of the impacts that are likely at different scales.

This report presents the findings of the Murray Bridge SA case study. The key findings from the study, particularly the area's current status against a range of wellbeing and resilience indicators is presented first, and is followed by a detailed discussion of quantitative and qualitative findings from the research. It is important to note that, although we have only been able to focus on eight areas, it is hoped that the case studies will provide some learnings for communities within the Basin facing similar challenges, and draw out the characteristics that are likely to mitigate or exacerbate the impacts of permanent reductions in irrigation water.

1.2. How Resilient is Murray Bridge Likely to be to Permanent Reductions in Water?

1.2.1. Overview of Findings

Modelling of various irrigation water reduction scenarios for **City of Murray Bridge case study area** indicates that impacts of such reductions are likely to be significant, but lesser in magnitude than for other selected case study areas, as irrigated agriculture forms a relatively small proportion of agricultural industries in Murray Bridge. That said, the effects on Murray Bridge are likely to be understated due to Census undercounting, and its role as a major service centre for the **Murraylands Region** and the relatively high rate of jobs in value-adding agricultural processing, transportation, storage, packing and distribution. Impacts are likely to be more significant in the regional context, where most areas are highly dependent on agriculture. Smaller, more remote and agriculturally dependent areas are likely to be far more seriously affected, as has been the case in the latter part of the drought.

A number of factors are likely to mitigate or exacerbate projected impacts on Murray Bridge. Mitigating factors include that it is far less remote than most other MDB case study areas, its proximity to Adelaide, feasible commuting distance to Adelaide and other larger centres, lower Indigenous population, more diverse economy, current and projected employment and population growth under SA planning frameworks, and opportunities related to liberalised water trade. Strong community leadership in the area's regional development, business, civic and NRM institutions is also evident, with clear evidence of agencies and communities working together to respond to ongoing challenges observed during field visits.

Exacerbating factors include existing indicators of significant community vulnerability including very high levels of disadvantage, unemployment, educational and employment status, disability and ill health. Such factors point to limited adaptive capacity of some people and communities to changes in its economic base. A further factor that is likely to limit adaptation of irrigated agricultural is the limited next best use for agricultural land with less water. The fact that many efficiency gains appear to have been made over the past two decades in irrigated dairy and horticulture also calls into question the extent to which further efficiency gains can be made to offset further reductions in irrigation water. The relatively low level of participation in existing Federal Government programs is reported to be due to the size or relative profitability of agricultural enterprises and limited remaining efficiency gains. The extent to which Murray Bridge's value-adding industries source produce from the MDB, and level of commitment by the SA Government to regional economic development including the future growth of Murray Bridge will also play a role in the future resilience of Murray Bridge if there are significant permanent reductions to irrigation water.

The impacts on smaller, more remote and agriculturally dependent towns and LGAs in the wider Murraylands Region are likely to be more severe, and a range of social and economic impacts have already been experienced in the last few years. Until 2006, the area below Lock 1 was relatively cushioned from the worst effects of the drought due largely to high levels of water security. However, the combined effects of prolonged drought followed by three historically low flow years, low river and lake levels, related additional costs of extending infrastructure or buying in feed, and fluctuations in various commodities prices, have had significant economic impacts since this time. This includes major reductions in irrigated agricultural production, and flow on to related industries and communities. Tourism and recreation industries are also reported to be adversely affected. Significant social impacts include individual and family stress, health and psychological impacts, suicide, and loss of community and industry leaders at a critical time. The statement that, 'we are now losing the efficient operators and industry leaders' was heard frequently in fieldwork, as well as concerns about such loss for post-drought recovery. In many respects, reduced access to water in the latter part of the drought may be regarded as a real time simulation for permanent reductions in water under Federal policy including *Water for the Future* and the forthcoming *Basin Plan*.

Despite reported social and economic impacts during the latter part of the drought, however, responses by farmers, industries and communities also indicate ongoing resilience in the face of significant stress, and there is some optimism about the future of agriculture and related industries 'when the water comes back'. Most noted the 'long-term resilience of agriculture' to ongoing changes in the internal land external environment. Nonetheless, there is considerable concern that more permanent reductions in allocations will limit the ability for industry and communities to 'bounce back' and severely reduce post-drought recovery for agriculture and related industries and communities. As well as the environment, however, a winner from increased water below Lock 1 may also be recreational boating, marina and other urban developments and tourism with if river and lake levels are restored.

Overall, and by comparison with other case study areas, the outcome of reduced water availability in Murray Bridge is likely to be continued existence and growth, but in a different

form, changing from an agricultural economy to one that is increasingly dominated by manufacturing, services and retail and by overspill from the Adelaide housing and labour market, albeit generally at the lower cost and potentially lower skilled end of the spectrum. Although growth is likely to continue, rates of growth with reduced water will likely be less than would otherwise be expected. However, other areas in the region are reported to have been ‘devastated’ by the recent drought, and to some extent Murray Bridge will grow at the expense of these areas, particularly if water for irrigation is permanently reduced in the future. For smaller centres attractive as new urban settlement areas (like Woodlane), it is likely that the demographic mix and character of the area will change significantly.

1.2.2. City of Murray Bridge’s Resilience ‘Report Card’

The following provides an overview of key factors that have led to this assessment of how resilient Murray Bridge is likely to be in the face of permanent reductions in water availability. Key factors are reviewed as a ‘report card’ on resilience, and include:

- Projected changes in employment, population, and indicators of community wellbeing modelled for 10%, 25% and 50% cuts in irrigation water on the 2005/06 growing season;
- Degree of reliance upon agriculture and in particular irrigated agriculture and related industries;
- Factors that have a statistically significant relationship on wellbeing and resilience;
- The current status of Murray Bridge in terms of existing socio-economic indicators; and
- Factors that are likely to mitigate or worsen projected impacts.

Each of these is looked at in turn below. This is followed by detailed data and information from desktop analysis and fieldwork undertaken from November 2009 to June 2010.

1.2.3. Population and Employment Impacts Forecast

Modelling carried out by JSA indicates that, with a permanent reduction in water availability ranging from 10%, 25% and 50%, the **City of Murray Bridge case study area** could lose between 120 and 550 people, and between 40 and 200 jobs. This represents a loss of 7% of employment on the 2006 base year, and an 8% population loss with reductions of 50% of irrigation water. The impacts of such water reductions on Murray Bridge are likely to be significant, but lesser in magnitude than for other selected case study areas, as irrigated agriculture forms a relatively small proportion of agricultural industries in Murray Bridge. The effects of cuts to irrigation water on Murray Bridge are thus significant, but lesser in scale than for other case study areas, as irrigated agriculture forms a relatively small proportion of agricultural industries in Murray Bridge.

However, Murray Bridge also acts as the major regional centre for the five LGAs in the **Murraylands Region**, with the LGA making up half of the population of the region. Around 40%

of the region's workforce was employed in agriculture including diverse irrigated agriculture in 2006, with some LGAs having up to 70% of their employment in agriculture. Modelling of a 10%, 25% or 50% reduction in water across the Murraylands Region indicates that there would be related job losses of around 200 (1.4%), 500 (3.5%) or 1,000 (7%) jobs respectively. Population loss of around 560 (1.6%), 1,500 (4%) or 2,800 (8%) on 10%, 25% and 50% reduction in permanent water is also projected depending on the amount of water lost.

The effects on the Murray Bridge case study area are also likely to be understated due its role as a regional centre and the relatively high rate of jobs in value-adding agricultural processing, transportation, storage, packing and distribution. Recent studies indicate that these jobs have already been adversely affected by the drought, with significant impacts projected into the future.⁵ The extent to which such industries will be resilient to future changes in agricultural production will depend upon the extent to which such industries are sourcing produce from outside the Murraylands region and the MDB more generally. Population and employment loss will also depend on the extent to which people from the region settle in City of Murray Bridge versus other centres outside the region such as Adelaide.

Finally, the impacts of permanent reductions in irrigation water are likely to be disproportionately experienced by smaller, more remote and more agriculturally dependent communities within Murray Bridge LGA and the Murraylands, hastening trends to urbanisation or rural decline, exacerbating existing levels of disadvantage and the aging of the population in such communities.

1.2.4. Factors Affecting Wellbeing and Resilience

A number of factors were found to predict changes in indicators of wellbeing and resilience in earlier stages of this study,⁶ including changes in employment and population. Our findings for the MDB were generally in line with other research on rural and regional communities, and included the degree of 'remoteness', degree of urbanisation (population size), proportion of Aboriginal people particularly remote populations, and age of the population.⁷ The degree of economic diversity and opportunities to diversify were also relevant factors identified in the literature,⁸ though our findings indicate that these are largely a function of other factors such as

⁵ Murraylands Regional Development Board (2009) *Murraylands Growth Update 2009*

⁶ JSA (2010) Report 2: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Understanding Agricultural Employment*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri; and JSA (2010) Report 3: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Irrigated Agriculture and Socio-Economic Indicators*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri

⁷ JSA (2010) Report 2: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Understanding Agricultural Employment*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri; and JSA (2010) Report 3: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Irrigated Agriculture and Socio-Economic Indicators*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri

⁸ JSA (2010) Report 1: *Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Scoping Paper*, Cotton Catchment Communities Co-Operative Research Centre, Narrabri

remoteness, proximity to a large urban centre, or the presence of other economic resources such as extractive industries.

Table 1.2 below provides an overview of these key factors. In summary, City of Murray Bridge is likely to be more resilient in the face of changes to water allocations than most of the other case study communities, and certainly compared to areas that are smaller, more remote and more dependent on local agricultural production including some of those in the wider Murraylands Region. Murray Bridge's advantages include its relative degree of urbanisation (including size and proximity to Adelaide), relatively low level of Aboriginal people, and relative economic diversity compared with the MDB average. Its continued population and employment growth over the last census period and the fact that it is targeted for growth under the State Government's strategic planning framework⁹ also indicate that it is likely to be relatively resilient.

That said, Murray Bridge has not yet achieved the size or critical mass found to be important in the previous stage of this study to make it fully independent of the fortunes of its agricultural base and related industries,¹⁰ and remains somewhat vulnerable in this regard. Supportive State Government regional development policy remains important to the future of the area.

Table 1.1: Key Factors in Community Resilience

Statistically Significant Factors	Likely to be Resilient	Comment
Remoteness	✓	Murray Bridge is much less remote on the ABS Remoteness classification than the MDB average of areas, and has the status of 'Inner Regional Australia'.
Degree of Urbanisation:	?	At around 18,000 people, Murray Bridge has not achieved the critical mass to be a stand alone service centre. Nonetheless, it acts a service centre for a wide agricultural hinterland.
• Population Size		
• Proximity to a large regional centre	✓	Murray Bridge is less than 1 hr from Adelaide by expressway.
Indigenous Population	✓	Though almost double the national average (4.2% compared with 2.3%), Murray Bridge's Aboriginal population is lower than the MDB average (4.9%), and much lower than most of the Northern Basin areas.
Age	?	Older than the national average (39 compared with 37 years), but younger than the MDB average of areas (40 years).
Degree of economic diversity	✓?	20% of jobs in agriculture, which was lower than the MDB (29%) but much higher than Australia (3.5%). A more diversified rural economy than the MDB average, though considerably less diverse than the national economy, indicating its role as a regional service centre; and a strong value-adding manufacturing sector that sources agricultural produce and livestock from a wide hinterland and in some cases interstate, and related transport, storage and

⁹ SA Department of Planning and Local Government (2010), *The 30 Year Plan for Greater Adelaide: A volume of the South Australian Planning Strategy*.

¹⁰ JSA (2010) *Report 3: Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Irrigated Agriculture and Socio-Economic Indicators*.

Statistically Significant Factors	Likely to be Resilient	Comment
		wholesaling sectors. Continued economic growth will depend upon ongoing population growth, confidence of existing businesses, relocation of projected new businesses, and the extent to which sectors related to agricultural production source their produce from the hinterland and areas within the MDB affected by reductions in water.

1.2.5. Current Status on Community Resilience Indicators

The current status of City of Murray Bridge regarding key indicators of community wellbeing and resilience are also important in understanding its vulnerability to changes in water.

Despite the generally positive outlook for Murray Bridge noted in Table 1.2 above, Murray Bridge is the most disadvantaged of the eight case study areas when indicators related to socio-economic status and health are considered. The area also performs poorly against a number of key indicators of resilience, including having a relatively low-skilled labour force, very low indices of economic, educational and occupational resources, high unemployment and low levels of labour force participation. These indicate the presence of very vulnerable populations, and a potentially less adaptive work force, so that the area cannot necessarily be complacent about its future wellbeing despite projected housing and employment growth. The nature of its housing and employment sectors means that it is likely to continue to absorb less advantaged groups from the Adelaide housing and labour market, and it is not a typical 'tree change' location.

Table 1.2: Current Status Report on Indicators of Community Resilience

Proxy Indicator of Resilience	Likely to be Resilient?	Comment
Community Wellbeing:		
SEIFA Disadvantage (includes indicators related to people's access to material and social resources, and their ability to participate in society)	✗	The most disadvantaged of the eight case study areas on the index of SEIFA Disadvantage at 900 compared with 1000 for Australia.
SEIFA Economic Resources (including income, housing expenditure and assets of households)	✗	Low at 928, compared with 1000 for Australia, most likely related to low skilled jobs and availability of cheaper housing including social rental accommodation.
Median Household Income	✗	Very low compared with MBD and the national median (\$672 compared with \$779 and \$1027 respectively), probably as a result of the high level of employment in low skilled and entry level jobs (e.g. in manufacturing, warehousing, value adding processing), high unemployment, relatively low work force participation rate, and high reliance on pensions and benefits.
Social Capital / Volunteering rate	✓?	Much higher than Australia, but low for a regional area (25% compared with 29% for the MDB). Very

Proxy Indicator of Resilience	Likely to be Resilient?	Comment
		high in some smaller communities.
Disability Support Pension	✗	Much higher than the MDB and national average, likely due to high proportion of social housing and low cost accommodation, an older population, as well as a better level of services than much of the hinterland.
Premature Death	✓	Higher than Australia, but slightly lower than the MDB average of areas, signalling less accidents and suicide, but also likely due to a lower % of Aboriginal people.
Profound or severe disability	✗	Highest of the case study areas and considerably more than the MDB and national average (5.2% compared with 4.6% and 4.1% respectively), likely due to the presence of older people, high proportion of social housing, low cost accommodation, and MB's role as a service centre.
Chronic Ill Health	✗	Somewhat higher than the MDB and national average, and likely due to higher than average social housing, age structure and general disadvantage.
Economic growth:		
Change in Total Employment 2001-06	✓	Much higher than the MDB average (7.1% compared with 1.2%) though lower than Australia (9.7%), likely due to the proximity to Adelaide, its attractiveness for industry relocation, and the growth in retail, manufacturing and wholesale/distribution jobs
Labour force participation 15+ years	✗	Lower level labour force participation compared with the MDB and national averages (57% compared with 60% and 61% respectively), likely due to higher levels of welfare dependence, disability and lower skilled people including in social housing and the local prison.
Labour force participation 65+ years	✓	Very low level of participation by older people, despite its large agricultural base, and less than half the MDB average (7% compared with 15%).
Post-school qualification (skills base)	✗	Very low level of post-school qualifications among the local labour force (26% compared with 32% for MDB and 39% for Australia).
School participation at 16 years	✗	Somewhat lower than MDB and Australia (70% compared with 71% for MDB and 75% for Australia).
SEIFA Index of Education and Occupation (includes relevant Census variables on the general level of education and occupation-related skills and status of a community)	✗	Very low at 876 compared with 953 for MDB and 1000 for Australia. The ABS (2006) SEIFA Index of Education and Occupation focuses on the general level of education and occupation-related skills of people within an area, and brings together relevant Census variables.

Proxy Indicator of Resilience	Likely to be Resilient?	Comment
GINI co-efficient of household income distribution/polarisation	✗	Like other areas of the MBD, the Murray Bridge shows quite a high level of polarisation between the 'haves' and 'have nots' based on household income.
Youth unemployment rate	✗	Much higher than the national and MDB average (around 14% compared with 10% for the MDB and Australia), despite the presence of opportunities in low skilled and entry level jobs.
General unemployment rate	✗	Much higher than the MDB average (7% compared with 5%), and among the highest of the case study areas, despite the presence of opportunities in low skilled and entry level jobs.
Amenity		
Population Growth /Retention 2001-06	✓	MB's 5.4% growth was almost equal to national growth (5.8%) from 2001-06, and around 5 times the MDB average, likely due to MB's proximity to Adelaide, low cost housing, availability of entry-level and low skilled jobs, industrial land, etc. A 70% population increase for City of Murray Bridge is forecast over the next 30 years under the <i>30 Year Plan for Greater Adelaide</i> , with commensurate job growth also an aim of the Plan.
In-migration 2001-06	✗	Shows a relatively low level of in-migration compared with MDB and Australia (19% compared with 23% for the MDB and 24% for Australia), which indicates that a reasonable amount of the change in population may be from natural increase and retention of the existing population from 2001-06.

1.2.6. Predicted Changes in Indicators of Wellbeing and Resilience

As noted above, Murray Bridge is the most disadvantaged of the eight case study areas in relation to most socio-economic status, health, income, education and employment indicators measured. Our modelling reported in Section 3.2 below indicates that there is not likely to be any significant deterioration in its socio-economic profile as a result of reduced water availability. However, its already highly disadvantaged profile and reliance upon agriculture and related sectors could make it more vulnerable than projected to changes in its agricultural base. The loss of established residents and community leaders engaged in farming and related sectors is also a likely impact of permanent reductions in water for irrigation.

1.2.7. Other factors indicating vulnerability or resilience

Fieldwork and other consultations have provided valuable insights into other aspects of current and future vulnerability or resilience, and other factors that are likely to mitigate or worsen projected impacts. This is reported in detail including in **Section 4.2** below, with key issues summarised in the following table.

Table 1.3: Other Factors in Resilience from Consultations

Factor	Likely to be Resilient?	Comment
Nature of 'next best' land use with reduced water	✗?	Irrigated agriculture is the next best use, as all water licences are high security and existing uses are generally high value (fruit, vegetables, grapes, irrigated dairy). Although there has already been much farm consultation with various modernisation programs over the past two decades, total land used for horticulture and the like would generally not make broad acre or dryland uses viable.
Potential benefits of water trade	✓?	Open trade in water is likely to be beneficial, and the area has been a net importer of water due to high value uses, permanent plantings, etc. Trade has also allowed for increased flexibility in production and financial management (e.g. increased sophistication regarding sale of entitlements, leasing in seasonal water, etc). However, this can be a double-edged sword for some, particularly where water has been purchased at inflated prices in early trading rounds, increasing potentially unsustainable levels of debt .
Ability to 'recover' from drought and past responses	✓?	Unlike the Northern Basin, Murray Bridge was largely cushioned from early years of drought by highly regulated river system and upstream storages, and predominance of high security licences. Serious impacts have been felt since 2006/07 with historically low allocations and low flows, and low water levels, the latter making it impossible to access allocations and increasing costs through extending infrastructure for those who have been able to do so. This has been exacerbated by fluctuations in commodities prices in various sectors. Area reported to have had significant reductions in agricultural production in the past 3 years. Loss of permanent plantings, lowering of the water table, cracking in river banks and river flats, and damage to infrastructure will require significant replanting or remediation and make it difficult to bring some land back into production. Nonetheless, there is a general view that agricultural has been resilient over the long-term, changing crop mix depending on growing and market conditions, increasing land and water efficiency, and responding to fluctuations in commodities prices. As such, it is reported that much of what has been lost since 2006 may come back into production provided there are a 'few good seasons' provided there is not a permanent loss of water. Vegetable

Factor	Likely to be Resilient?	Comment
		growers, for example, have relocated significant production to groundwater irrigation (e.g. onions in the Southern Mallee), but intend to move production back to Murray Bridge if conditions improve. There has been increased farm consolidation, and most report that they are ‘playing a waiting game’ regarding the Basin Plan and winter snow/rainfalls. Significant uncertainty is affecting the decisions of irrigators regarding sale of water and business investment at the time of writing.
Ability to make efficiency gains	✗	Reported to be difficult due to previous rounds of modernisation in horticulture and later dairying, with system losses through pump and pipe schemes reported to be as low as 1-2%. Lack of participation in recent federal infrastructure upgrades through Water for the Future (e.g. PIIP SA) reportedly due to difficulties finding further gains. Further, whilst liberalisation of the water market since 2009 and the opportunity to participate in Federal government programs has been a boon for some, the fact that SA has undergone an extensive modernisation process in recent decades means that many of those currently selling water to government and on the open market are reported to be among the ‘more efficient operators’. Few in the Murray Bridge area are reported to be eligible for either the Small Block Exit Package nor the Exceptional Circumstances program as a result.
Access to Other Economic Opportunities	✓	Proximity to Adelaide and inclusion in the <i>30 Year Plan for Adelaide</i> has benefits including residential and employment development, industry relocation, etc. Will in part depend on continued support from SA regional development policy.
Natural attributes	✓	Located at the end of the end of the South Eastern Freeway, and near the junction of interstate transport links. Beautiful part of the Lower Murray River, with high amenity recreational opportunities in houseboats, recreational craft, fishing etc, and in reasonable proximity to the Coorong and other natural attractions.
Leadership	✓	Strong leadership evident in all consultations, including from City of Murray Bridge Council and the Murraylands Regional Development Board, local politicians and agricultural and irrigator groups.
Other factors in future resilience from consultations	✓?	Potential for urban development in smaller areas may also add to income opportunities for farmers and retention of population, though this will also significantly change the composition and character of such small communities.
Other factors in future vulnerability from consultations	✗	Smaller, agriculturally dependent areas within Murray Bridge like Mypolonga (see Section 3.2.2 below) and smaller LGAs in the Murraylands Region are particularly vulnerable to reductions in irrigation water (surface or groundwater), and such reductions are likely to hasten trends to urbanisation, rural decline and socio-economic disadvantage

2. Introduction

2.1. Overview

In June 2009, Judith Stubbs and Associates (JSA) were engaged by the Cotton Catchment Communities Co-operative Research Centre to undertake a significant research project investigating wellbeing and resilience of communities, particularly those engaged in irrigated agriculture including cotton, within the Murray Darling Basin (MDB). The study seeks to understand the likely social and economic impacts on communities at different scales arising from changes in government water policy, in particular, Water for the Future and the forthcoming Basin Plan, and projected climate change. This project included three research strategies and has so far produced three reports.¹¹

2.2. Rationale

Given findings from the literature and the first three reports of this study, it is likely that the social and economic impacts related to changes in water availability will be experienced differently at different geographic scales (eg. farm, local community, region, MDB, national), and by different groups within a community (e.g. farmers, Aboriginal people, businesses). Key factors will include the existing wellbeing and resilience of these communities, and other mitigating factors such as access to the water market and alternative economic opportunities.

In order to understand the differential impacts upon areas and groups, we have carried out a cost-benefit analysis to determine impacts at the MDB and national levels and prepared eight case studies to explore the likely impacts at the farm, regional and local community levels. These documents comprise the fourth and final report for this study.

The eight case study areas were selected in order to represent different states, different CSIRO Sustainable Yields Regions, cotton and non-cotton producing areas, a diversity of irrigated agricultural uses and diversity across three key attributes including population size, remoteness and Indigenous population. The eight case study areas include Dalby-Wambo, Queensland; Balonne, Queensland; Moree Plains, NSW; Bourke, NSW; Griffith, NSW; Campaspe, Victoria; Mildura, Victoria; and Murray Bridge, South Australia.

¹¹ JSA (2010) Report 1: Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Scoping Paper, JSA (2010) Report 2: Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Understanding Agricultural Employment, and JSA (2010) Report 3: Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Irrigated Agriculture and Socio-Economic Indicators.

2.3. Case study methodology

This case study is informed by JSA's extensive analysis of agriculture and population data; a review of policy, relevant document and reports; and a series of telephone and face-to-face interviews with individuals from a range of perspectives and organisations. These included a wide range of staff and elected or appointed representatives of the following agencies/ groups:

- City of Murray Bridge Council
- Central Irrigation Trust
- Murraylands Drought and Rural Support Centre
- South Australian Murray-Darling Basin Natural Resources Management Board
- Drought advisor to the Premier of South Australia
- Price Merrett Consulting
- Murray Futures Project
- Wellington Local Action Planning Committee
- SA Murray Irrigation
- Lower Murray Irrigators
- Individual irrigators and industry groups
- Interested community members who attended workshops and report back sessions

Interviews, workshops and field visits to the Murray Bridge area were conducted from February to May 2010 in order to understand how water availability, agricultural land use and agricultural employment has changed in recent years as a result of government policy and short term climatic change (eg, the recent drought); how these changes resulted in social and economic impacts at the farm and wider community levels; and therefore how permanent reductions in water availability (eg, new SDLs through the MDBA Basin Plan) are likely to affect wellbeing and resilience at the farm and community level.

2.4. Case study content overview

This case study provides:

- A description of the case study area including its location, land and water use, water policy, and relative social and economic wellbeing and resilience against key indicators;
- A prediction of impacts to community wellbeing and resilience based on hypothetical reductions in water availability of 10%, 25% and 50% from the most recent year for which comparative agricultural and population data is available (the 2005/06 growing year and 2006 Census);

- An exploration of the 'short term' social and economic impacts that have been experienced as a result of the recent drought, fluctuations in commodities prices, water market and other relevant factors affecting communities; and
- An analysis of how the attributes of the area and other factors have exacerbated and/or helped to mitigate the impacts already experienced as an indicator of the area's resilience, and how it may therefore respond to more permanent changes in water availability under the forthcoming Basin Plan or permanent trade out of area.

3. Description of the Case Study Area

3.1. Location



The **Murray Bridge** case study area (Rural City of Murray Bridge LGA) is located in southeastern South Australia in the catchment of the Lower Murray River within the **Murray Sustainable Yield Region**.¹² It covers an area of over 1,800 sq kms including part of Lake Alexandrina, and is around 80 kms from Adelaide at the end of the South Eastern Freeway.

Murray Bridge is also at the heart of the **Murraylands Region**, made up of Mid Murray, Coorong, Karoonda East Murray, Southern Mallee and Rural City of Murray Bridge LGAs, for which Murray Bridge acts as the major regional centre. The region's income is mainly sourced from agriculture and associated industries such as value adding in meat production. Though there has been growth in diverse economic sectors over the past decade or so, agriculture is the primary source of direct employment, with flow-ons to many other sectors.¹³



Map 3.1: Murraylands Economic Development Region

Source: Murraylands Regional Development Board Inc

¹² For more information see <http://www.csiro.au/partnerships/MDBSY.html>.

¹³ <http://www.murraylands.org.au>

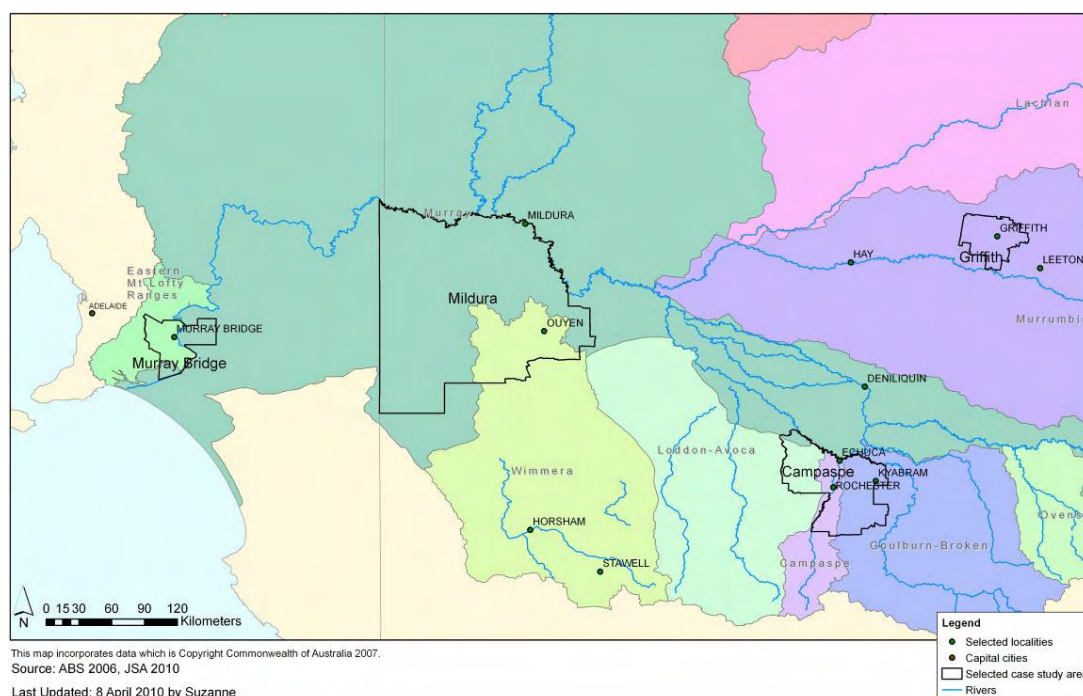
3.2. Water and Land Use Context

3.2.1. Overview of Current and Projected Water Use

The Murray Bridge case study area is located in the **Murray Sustainable Yield Region (SYR)**,¹⁴ which straddles the NSW-Victorian and SA borders. The SYR is based around the Murray and the Lower Darling Rivers below Menindee, and runs the full length of the Southern Basin from east to west.¹⁵

The Murray SYR covers 19.5% of the total land area of the MDB, and uses over 36% of water diverted for irrigation in the MDB. It uses around 14% of groundwater extracted in the Basin under current levels of development.¹⁶ The SYR has a 'high' assessed level of usage of available surface water,¹⁷ while groundwater makes up only 5% of total water used.¹⁸

Map 3.2: City of Murray Bridge and Other Southern Basin Case Study Areas



¹⁴ In 2008, the CSIRO completed a series of reports through the Sustainable Yields Project, which assessed the current and future water availability in the Murray-Darling Basin in terms of catchment development, changing groundwater extraction, climate variability and climate change. For more information on the CSIRO Murray-Darling Basin Sustainable Yields Project, see <http://www.csiro.au/partnerships/MDBSY.html>.

¹⁵ CSIRO (2008) *Water Availability in the Murray, Summary Sheet from the CSIRO MDB Sustainable Yields Project*, p.1.

¹⁶ CSIRO (2008) *Water Availability in the Murray, Summary Sheet from the CSIRO MDB Sustainable Yields Project*, p.1.

¹⁷ Average surface water availability for the Murray region is 11,162 Gt per year under the **historical climate** (1895 to 2006), of which 36% is reported to be used under current levels of development aggregated to Wentworth. This is assessed as a 'high' level of available surface water usage in the region (CSIRO (2008) *Water Availability in the Murray, Summary Sheet from the CSIRO MDB Sustainable Yields Project*, p.1).

¹⁸ CSIRO (2008) *Water Availability in the Murray, Summary Sheet from the CSIRO MDB Sustainable Yields Project*, p.1.

Of note, the Southern Basin has been in severe drought since 1997 and the catchment runoff in the southernmost parts of the MDB to 2006 was the lowest on record.¹⁹ This event is reported to occur only once in more than 300 years, although such conditions may become increasingly common with climate change.²⁰ Drought conditions in the south of the MDB worsened from 2007,²¹ and rainfall that brought relief to parts of the Northern Basin in early 2009, and particularly early 2010, has generally not been experienced in the Southern Basin at the time of writing.²²

The most likely estimate of **climate change** assumes that impacts on surface water availability will be less severe than the recent past,²³ with availability predicted to fall 14% by 2030, average diversions by 4%, and end of system flows by 24%.²⁴ Likely **future development** of farm dams and plantations for the Murray SYR is expected to be 'negligible', although groundwater use is expected to treble by 2030.²⁵

3.2.2. Overview of River Systems and Regulation

The **Murray SYR** receives inflows from the Barwon-Darling system, which joins the Murray at Wentworth in NSW (350 kms upstream from Murray Bridge), having collected water from most river systems in the Northern Basin. The Murray River is also strongly affected by upstream flows from the Murrumbidgee, Ovens, Goulburn-Broken, Campaspe and Loddon-Avoca river systems in the Southern Basin.²⁶

Compared with the Northern Basin, the river systems of the Southern Basin are highly regulated, with an extensive system of dams and weirs the length of the Murray River, and major upstream storages east of Albury (Hume Weir completed in 1931) and in the Victorian Alps (Dartmouth Dam completed in 1979).²⁷ These have provided for a relatively constant water level since the 1930s and (until recently) a high level of water security to facilitate intensive irrigation for horticulture, dairying, viticulture, feed and other irrigated crops in the surrounding otherwise semi-arid areas, where dryland wheat and grazing are the predominant land uses. A smaller storage is located upstream at Lake Victoria, just east of the NSW-SA border.²⁸

¹⁹ CSIRO (2008) *Water Availability in the MDB: A Report from the CSIRO to the Australian Government*, p. 5.

²⁰ CSIRO (2008) *Water Availability in the MDB: A Report from the CSIRO to the Australian Government*, p. 5.

²¹ CSIRO (2008) *Water Availability in the MDB: A Report from the CSIRO to the Australian Government*, p. 5.

²² Site Visit, Southern Basin April 2010.

²³ The duration and severity of the recent drought is reflected in projections based on the **recent climate** (1997 to 2006), with regional surface water availability forecast to fall by 30%, diversions by 13%, and end of surface flow by 50% (CSIRO (2008) *Water Availability in the Murray, Summary Sheet from the CSIRO MDB Sustainable Yields Project*, p.1).

²⁴ CSIRO (2008) *Water Availability in the Murray, Summary Sheet from the CSIRO MDB Sustainable Yields Project*, p.1.

²⁵ CSIRO (2008) *Water Availability in the Murray, Summary Sheet from the CSIRO MDB Sustainable Yields Project*, p.1.

²⁶ CSIRO (2008) *Water Availability in the Murray, Summary Sheet from the CSIRO MDB Sustainable Yields Project*, p.1.

²⁷ These have respectively 3038 Gt and 3906 Gt of storage capacity (MDBA April 2010).

²⁸ Storage capacity of 547 Gt (MDBA April 2010)

In addition to weirs, there are also 11 locks from Mildura (Lock 11), around 500 km upstream of the **Murray Bridge case study area**, to Blanchetown (Lock 1), around 150 km upstream. The Murray River enters the Southern Ocean about 70 km south of Murray Bridge at the Murray Mouth, downstream of Lake Alexandrina and adjacent Lake Albert, two important Ramsar-listed wetlands. The SA Government constructed a system of barrages across Lake Alexandrina where it discharges into the Coorong and thence the Southern Ocean. These were completed in 1940 to guarantee a source of permanent fresh water for surrounding communities for domestic and irrigation uses. These barrages effectively form another weir at the end of the system below Lock 1, and separate Lake Alexandrina from the Murray Mouth and the estuarine environment of the Coorong, another Ramsar-listed site of considerable ecological importance for fish and bird breeding.

Barrages at Lake Alexandrina have also generally kept water below Lock 1 at levels suitable for extraction by irrigators and for other uses. However, current development combined with historically low flows on top of a severe drought have lowered the river level to the point where extraction of even their reduced water allocations has not been possible for many irrigators below Lock 1 over the past 18 months or so. At the time of writing, the River was at 1.5 metres below 'pond level'.²⁹ Administrative decisions, that provided for almost 100% allocations throughout the River Murray Prescribed Water Course³⁰ during the drought until 2006/07 may also have contributed to the depletion of water from major upstream storages,³¹ and the need for the sharp cut in water allocations over the past three years.

It is also noted that the SA Water pipeline from Murray Bridge and downstream at Tailm Bend currently boosts Adelaide's water supply, without which it is reported Adelaide could not support its current population.³² The Adelaide desalination plant will upon completion provide for around half of Adelaide's potable water supply,³³ which will no doubt affect the relative importance of water sourced from below Lock 1.

²⁹ The point at which the river reaches the top of the weir, observed during Site Visit Murray Bridge March 2010.

³⁰ SA uses a system of 'prescribed management areas' under the *Natural Resources Management Act 2004 (SA)*. An area is prescribed under the Act when the level of water use in the area indicates that a regulatory control is needed to secure sustainable management and support water-dependent ecosystems. Once a water resource is prescribed, users need to be authorised by a licence (or other approval) to extract water (see for example National Water Commission (NWC) (2009) *Australian Water Markets Report 2008-2009*, p.108).

³¹ In April 2009, Hume was at around 4% of capacity, and Dartmouth and Lake Victoria at around 20% (see Figure 4.3.2 in NWC *op cit*, p.112).

³² <http://www.murraybridge.sa.gov.au/>

³³ SA Department of Planning and Local Government (2010), *The 30 Year Plan for Greater Adelaide: A volume of the South Australian Planning Strategy*.

3.2.3. Key Environmental Issues



Without the barrages, the historically low water level of Lake Alexandrina³⁴ would likely lead to an inflow of seawater, turning a long-term freshwater ecology into a marine one and removing fresh water for consumptive uses for communities surrounding both Lake Alexandrina and adjacent Lake Albert.³⁵ Likewise, water levels in Lake Albert are extremely low, and there are risks from prolonged exposure of acid sulphate soils to the long-term health of the

Lake.³⁶ Exceptionally low flows in recent years combined with historical development have also contributed to the silting up of the Murray Mouth, which means that the naturally saline environment of the Coorong is in danger of becoming hyper-saline.³⁷

Debate about the future of the Lower Lakes is complex, and includes the pros and cons of removing the barrages, potentially hastening a marine ecology, and the extent to which this may occur with the intensification of climate change in the future. Farmers who use the Lakes for irrigation extraction, recreational boating enthusiasts, developers and local community members often have differing view regarding the best future for the Lower Lakes.³⁸

Although protecting the social and economic life of communities to a far greater extent than in the Northern Basin during times of drought or low flows, the downside of such a highly regulated river system in the Southern Basin includes ecological impacts associated with increased time between flood events to water key environmental assets. Water resource development is reported to have caused ‘major changes in flooding regimes that support’ such wetland systems.³⁹ Of relevance to the Murray Bridge case study area (below Lock 1), modelling indicates that total flow at the Murray Mouth from development throughout the Basin has been reduced by 61%, so that the River now ceases to flow through the Mouth 40% the time compared with 1% of the time in the absence of water resource development.⁴⁰

³⁴ Around 0.7 metres below sea-level in early 2010 (Site Visit Lower Lakes March 2010).

³⁵ Photo of Lake Alexandrina at the Barrages (JSA March 2010).

³⁶ Government of SA (2009) *The Future for Lake Albert: An adaptive Management Plan*, October 2009

³⁷ *Ibid.*

³⁸ SA Government (2009) *Murray Futures Lower Lakes & Coorong Recovery: Community Consultation Stage 2 Report*.

³⁹ CSIRO (2008) *Water Availability in the MDB: A Report from the CSIRO to the Australian Government*, p. 5.

⁴⁰ CSIRO (2008) *Water Availability in the MDB: A Report from the CSIRO to the Australian Government*, p. 5.



At the time of writing in early 2010, fresh water was being pumped from Lake Alexandrina to Lake Albert by the South Australian Government to address what is perceived to be the greater ecological need,⁴¹ and the Murray Mouth is being kept open by round-the-clock dredging to protect the environment of the Coorong.⁴²

The Murray SYR also includes other large and important wetlands along the Murray River, the Lower Darling River,

the Great Darling Anabranch, and the Edward Wakool system. A number of these are also listed as sites of international importance under the Ramsar Convention including those upstream of the Murray Bridge case study area – the Hattah-Kulkyne Lakes near Mildura LGA, the Riverland Wetland Complex near Renmark, and Barmah-Millewa Forest and Gunbower Forest further east.⁴³ Increased time between flood events related to current levels of development exacerbated by the protracted severe drought is also reported to be affecting these sites, doubling the average time between flood events and significantly reducing flood volumes.⁴⁴

3.2.4. Overview of Relevant Policy and Water Regulation

The SA Department of Water, Land and Biodiversity Conservation (DWLBC) is responsible for issuing water licences and permits (entitlements) and managing the allocation of SA water resources. The nature of agricultural production combined with local climatic conditions means that virtually all water entitlements are ‘high security’ in SA.⁴⁵

Relevant to the case study area of Murray Bridge, there are several delivery mechanisms for irrigation water in this part of River Murray Prescribed Water Course (PWC). Irrigation water to the extensive ‘dairy swamps’, which have supported the irrigated dairy industry for at least a century,⁴⁶ is delivered to irrigators through a system of sluice gates and levees that provide for gravity fed flood irrigation when the river is at an appropriate level. Until recently, river levels have been maintained at this level, assisted by the end-of-system barrages in Lake Alexandrina,

⁴¹ Photo of pumping of water from Lake Alexandrina to Lake Albert (JSA March 2010).

⁴² Site visit March 2010.

⁴³ CSIRO (2008) *Water Availability in the Murray, Summary Sheet from the CSIRO MDB Sustainable Yields Project*, p.1.

⁴⁴ CSIRO (2008) *Water Availability in the Murray, Summary Sheet from the CSIRO MDB Sustainable Yields Project*, p.2.

⁴⁵ NWC *op cit*,

⁴⁶ Around 5,000 ha of River flood plain was reclaimed along an 80 km length of the Murray River from Mannum to Wellington from the late 1800s to 1915 including the installation of an extensive levee system with mechanisms to allow water into the fields and back to the River after irrigation (Workshop with SA MDB NRM Board staff, March 2010).

described earlier. Water efficiencies supported by the State Government saw the introduction of a range of measures to ‘modernise’ irrigated dairy and improve water quality and efficiency completed by 2004/05, although the impact of the drought since 2006 has meant much of these works have been effectively rendered useless.⁴⁷

Several irrigation trusts are also active in the case study area as are a number of private irrigators, with pump and pipe systems delivering water to fruit, vegetables, grapes, and feed and other crops grown in the more elevated land above the river flats. Capital works to achieve water efficiency in these sectors was undertaken earlier than for the dairy industry, with modernisation schemes rolled out in SA since the 1980s, funded by government and industry. The Central Irrigation Trust (CIT), the largest trust in SA covering around 50% of irrigation areas,⁴⁸ has taken over management of the irrigation network for Mypolonga, a horticultural area within Murray Bridge LGA discussed in detail later. The CIT has also been assisting the Woodlane Irrigation Trust following the loss of its pumping system during a riverbank collapse by allowing it to connect to the CIT system while a new pump was being constructed.⁴⁹

A view was regularly expressed during consultations that modernisation over the past few decades means that ‘most water efficiencies that can be gained have been gained.’⁵⁰ As such, there was a strongly held view among most interviewed that there is likely to be limited value in participating in programs like the Private Infrastructure Investment Program (PIIP SA).

Other Federal Government programs under *Water for the Future* such as Restoring the Balance (the ‘buyback’) and the Small Block Exit Package are reported to be more popular among irrigators, particularly given the extreme stress many are facing. Similar to other areas in the Southern Basin, irrigators in the Lower Murray had close to 100% allocations throughout much of the drought, unlike those in the less regulated river systems of the Northern Basin, where full allocations have not been experienced by many for a decade. However, seriously low levels in upstream storages⁵¹ combined with the lowest flows on record led to the first major cuts in water allocations experienced – down to 60% in 2006/07, 32% in 2007/08 and 18% in 2008/09 for the River Murray PWC.⁵²

Low water levels below Lock 1 meant that many irrigators could not access even their reduced water allocation without significant augmentation of infrastructure. This has added an extra level of cost for irrigators in this part of the system, and been a ‘tipping point’ for some when considered in the context of increased debt from buying in water or feed to supplement low

⁴⁷ Interview with CIT and Regional NRM officers.

⁴⁸ The CIT has been expanding its management services to a larger number of trusts, and now operates 10 individual trusts (see for example NWC *op cit*, p.108).

⁴⁹ The new pump is being largely funded by the SA government in exchange for achieving additional water efficiencies., with industry contributions.

⁵⁰ Interview with CIT and Regional NRM officers.

⁵¹ In April 2009, Hume was at around 4% of capacity, and Dartmouth and Lake Victoria at around 20% (see Figure 4.3.2 in NWC *op cit*, p.112).

⁵² (National Water Commission (NWC) *Australian Water Markets Report 2008-2009* National Water Commission (NWC) (2009) *Australian Water Markets Report 2008-2009; 2007-2008; 2006-07*.

allocations and more recent fluctuations in commodities prices, and led even the more efficient operators to apply to sell their water under the buyback, or seek to exit irrigation by taking a package. However, there have been limitations to the extent to which irrigators in the Murray Bridge case study area have been able to benefit from such programs, as discussed later in more detail.

Progressive deregulation of the water market in SA since the early 2000s has also assisted some to ride out the recent water crisis. It has provided some with the means to buy in water to supplement allocations; to sell water entitlements permanently or for a defined period to buy in feed or seasonal water; to change production mix; or to exit the industry entirely. However, as discussed later, this has also not been without its social and economic costs to producers and to communities.

A number of more recent reforms have made the open trade in water within SA and between states even easier. Together with the unprecedented reduction in allocations, fluctuations in commodities prices and other factors, these reforms appear to have contributed to substantially increased market activity in recent times. From 1 July 2009, new legislation⁵³ enabled the unbundling of existing water licences into four instruments that separate entitlements,⁵⁴ allocations,⁵⁵ works⁵⁶ and site use.⁵⁷ In particular, this makes it possible to easily transfer the seasonal volume of water (allocation) independent of an ongoing water right (entitlement).⁵⁸ Initially implemented in the River Murray PWC, this will be progressively rolled out in other prescribed areas in SA.⁵⁹ The gazettal of other legislation⁶⁰ means that, since April 2009, Irrigation Trusts are no longer able to restrict permanent trade out of irrigation districts, and are

⁵³ *Natural Resource Management (Water Resources and other matters) Amendment Act 2007 (SA)*

⁵⁴ Water Access Entitlements (or Water Licences) provide for the ongoing right to a specified share of the water resource expressed in unit shares, and provides for an asset that can be sold or transferred permanently or for a limited period (South Australian Department of Water, Land and Biodiversity Conservation (2010) *Unbundling Water Rights – What Does It mean?*)

⁵⁵ Allocations are the actual volume of water able to be extracted in a given year, and may vary from year to year, depending on water availability. It is an asset that can be sold or transferred (South Australian Department of Water, Land and Biodiversity Conservation, *op cit.*)

⁵⁶ A Water Resource Works Approval is a permission to construct, operate and maintain works (such as a pump, metre, well or dam) to extract water at a particular location in a particular way. This permission is not transferable to another location (South Australian Department of Water, Land and Biodiversity Conservation, *op cit.*)

⁵⁷ A Site Use Approval is a permission to use the water at a particular location in a particular way, and is also not transferable to another location.

⁵⁸ Water entitlements can be traded permanently or for a defined period under a lease arrangement, in full or in part.

⁵⁹ SA uses a system of 'prescribed management areas' under the *Natural Resources Management Act 2004 (SA)*. An area is prescribed under the Act when the level of water use in the area indicates that a regulatory control is needed to secure sustainable management and support water-dependent ecosystems. Once a water resource is prescribed, users need to be authorised by a licence (or other approval) to extract water (see for example National Water Commission (NWC) (2009) *Australian Water Markets Report 2008-2009*, p.108).

⁶⁰ *Irrigation Act 2009 (SA)*; and *Renmark Irrigation Trust Act 2009 (SA)* introduce these requirements at the request of members and in accordance with the *Water Act 2007 (Cth)*.

required to facilitate such trade at the request of members'. Exit fees will generally apply for sale of water out of the network.⁶¹

There was a significant increase in water market activity in 2008/09, which corresponded with the lowest allocations on record (2% in July 2008 rising to 18% in early 2009).⁶² Importantly, the volume of permanent water traded in 2008/09 was three times that traded in 2007/08, though the number of trades increased by around one-quarter. South Australia was by far a net importer of water (around 336 GJ net in 2008/09),⁶³ with the most active water market in the River Murray PWC, and 98% of water imported from NSW.⁶⁴ The imperative to buy in water to keep permanent plantings alive and to maintain dairy herds and pasture built up over generations is evident in these trading figures.

3.2.5. Overview of Land Use & Water Use in Murray Bridge LGA

Around 117,000 ha of land were under cultivation in **Murray Bridge case study area** in the 2005/06 growing season. Cereals,⁶⁵ oilseeds and other broad acre crops and grazing (including irrigated dairy) were the dominant land uses. Horticulture and grapes was a smaller but significant use, as shown in the following table.

Table 3.1: Agricultural Land Uses, Murray Bridge

Agricultural Use	# Hectares	% of Agricultural Use Hectares
Vegetables	692	0.59%
Fruit	314	0.27%
Grapes	85	0.07%
Grazing	72,553	62.07%
Cereal, oilseeds, other broadacre	43,249	37%
Rice	0	0
Cotton	0	0

Source: ABS (2006) and JSA (2009)

Around 36 GJ of water was used for irrigated crops and pasture in the Murray Bridge case study area in 2005/06. Of this 85% was used for irrigated grazing, with 75% of agricultural employment in this sector. This shows the importance of dairy to the local area, and indicates the

⁶¹ The Commonwealth has capped termination fees since 1 September 2009 for the 2009/10 water year (see for example NWC *op cit*, p.110).

⁶² See Table 4.3.7 in NWC *op cit*, p.119.

⁶³ Interestingly, whilst around 340 GJ was traded into the Murray River PWC from other states, only 3.6 GJ was traded out (Table 4.3.11 in NWC *op cit*, pgs.121-122).

⁶⁴ NWC, *op cit*.

⁶⁵ Includes cereals, feed, oilseeds and other broadacre crops

job losses that would be expected with major reductions in dairying. Vegetables were the next largest user of water, with fruit, other crops and grapes also irrigated uses in the LGA.

Table 3.2: Irrigated Water Use and Employment in Murray Bridge LGA 2005/06

Employment & Water Use	2005/06	% Ag Employment
Employment in Vegetables	141	8.7%
Irrigation water use	3.0 Gl	
Employment in Fruit	23	1.4%
Irrigation water use	1.7 Gl	
Employment in Grapes	13	0.8%
Irrigation water use	0.2 Gl	
Employment in Grazing	1207	75.3%
Irrigation water use	30.0 Gl	
Employment in Cereals (incl. feed, oilseeds, etc)	44	2.7%
Irrigation water use	1.2 Gl	
Employment (Balance Agriculture)	174	10.9%
Total Agricultural Employment	1603	100%
Total Irrigation Water Use	36.1	
Total Employment	7,970	

Source: ABS (2006) and JSA (2009)

It is noted that the case study area is also at the heart of a larger regional area of **Murraylands**,⁶⁶ for which Murray Bridge acts as the main regional service centre. It is also important to understand the likely social and economic impacts of changes in water availability on Murray Bridge case study area in its regional context, as there are substantial areas of diverse irrigated agriculture in parts of the Murraylands. Key irrigated water uses are therefore also summarised for the Murraylands region below.

⁶⁶ Murraylands region includes Rural City of Murray Bridge (with the major service centre of Murray Bridge city), Mid Murray, Coorong, Karoonda East Murray and Southern Mallee.

Table 3.3: Irrigated Water Use and Employment in Murraylands Region 2005/06

Irrigated Water Use for:	GI Used 2005/06					Regional Total
	Murray Bridge	Mid Murray	Coorong	Karoonda East Murray	Southern Mallee	
Employment in Grazing	1,206	242	699	91	193	2,430
Irrigated water used by grazing	30.0	9.3	17.3	0.0	0.0	56.6
Employment in Vegetables	141	114	16	32	92	395
Irrigated water used by vegetables	3.0	10.5	0.9	1.4	22.2	38.0
Employment in Cereals (incl. Stock feed)	45	122	174	185	231	758
Irrigated water used by Cereals (incl. Stock feed)	1.2	4.4	27.7	0.0	0.0	33.3
Employment in Fruit	23	65	11	0	11	110
Irrigated water used by Fruit	1.7	6.3	1.1	0.0	0.9	10.0
Employment in Grapes	13	107	0	0	0	120
Irrigated water used by Grapes	0.2	0.0	0.0	0.0	0.0	0.2
Employment (Balance Agriculture)	174	98	158	18	37	484
Total Agricultural Employment	1,603	747	1,058	325	564	4,297
Total Irrigation Water Use	36.1	30.5	46.9	1.4	23.1	138.1
Total Employment	7,102	3,182	2,456	555	1,083	14,378

Source: ABS (2006) and JSA (2009)

Note: ABS employment values for agriculture type have been multiplied by 1.11 to adjust for 'not stated' and 'inadequately described'

Though less significant than in Murray Bridge, the above table again indicates the importance of irrigated dairy to the economy of the Murraylands region in the 2005/06 growing season. Around 40% of irrigation water in the Murraylands was used for irrigated grazing in this year. Almost 28% of water was used to irrigate vegetables, which were especially important in the Southern Mallee and Mid Murray, while around one quarter was used for irrigated 'cereals'⁶⁷

⁶⁷ Includes cereals, feed, oilseeds and other broadacre crops

including stock feed. Just over 7% of water used for irrigation went to fruit, and a much lower amount went to wine and table grapes. The latter was far more heavily concentrated in nearby LGAs including Alexandrina⁶⁸ where almost 7,000 ha was under cultivation for grapes in areas like Langhorne Creek and Currency Creek.⁶⁹ The implications of the regional situation will be examined in more detail when social and economic impacts are discussed later.

3.3. Social and Economic Context

3.3.1. Overview of Murray Bridge Case Study Area

Murray Bridge LGA had a total population of around 18,000 people in 2006, with most people living in the main urban area of Murray Bridge (14,000 residents).⁷⁰ Remaining residents were concentrated in the smaller towns and villages of Mypolonga, Woodlane, Callington, Jervois, Wellington and Woods Point, with the remainder scattered across the sparsely settled hinterland.⁷¹ Murray Bridge also acts as the major regional centre for the **Murraylands Region**, made up of Mid Murray, Coorong, Karoonda East Murray, Southern Mallee and City of Murray Bridge LGAs. The combined population of these five LGAs was around 35,000 people in 2006.⁷²

Prior to European settlement, the Murray Bridge area was inhabited by the Ngarrindjeri people, who were supported for thousands of years by the river, wetland and estuarine environment. The first European to come to the area was Captain Charles Sturt who rowed a whaleboat down the Murrumbidgee in late 1829 and reached the junction with the Murray River in January 1830. He continued down the Murray and passed what is now Murray Bridge in early February, reaching Lake Alexandrina soon after. Murray Bridge was established when a road bridge over the Murray River was completed in 1879, and the original town (called Mobilong) was laid out in 1883. This was followed in 1886 by the Adelaide-Melbourne railway line, which secured the city's importance as a link across the River. Later renamed 'Edwards Crossing', the town gained its existing name when a new railway bridge was constructed across the River in 1924.⁷³

The construction of an expressway in 1979 that linked Murray Bridge to Adelaide also saw the construction of around 900 Housing Trust homes to accommodate the workforce that was to service the expansion of Monarto, a planned growth centre that was never realised as the popularity of more interventionist regional developed policies waned.⁷⁴ Not surprisingly, the population of Murray Bridge township increased markedly around this time, growing by 3,229

⁶⁸ Including Coastal and Strathalbyn areas

⁶⁹ Interviews in Murray Bridge Site Visit March 2010

⁷⁰ ABS 2006 Census

⁷¹ ABS 2006 Census

⁷² ABS 2006 Census

⁷³ <http://www.murraybridge.sa.gov.au>

⁷⁴ Interview, staff of Murraylands Regional Development Board, March 2010

(37%) between 1981 and 1986. Though relatively stable from 1991 to 2001, the city grew by around 700 people from 2001 to 2006. This is likely related to the availability of affordable housing, with median weekly rental of \$220 in Murray Bridge compared with \$380 in Adelaide in 2009,⁷⁵ and of lower skilled entry-level jobs including in the area's large value-adding processing and warehouse / distribution sectors.⁷⁶

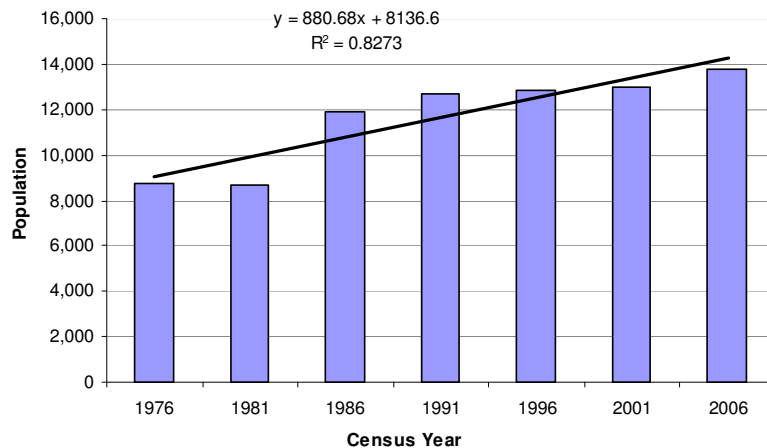
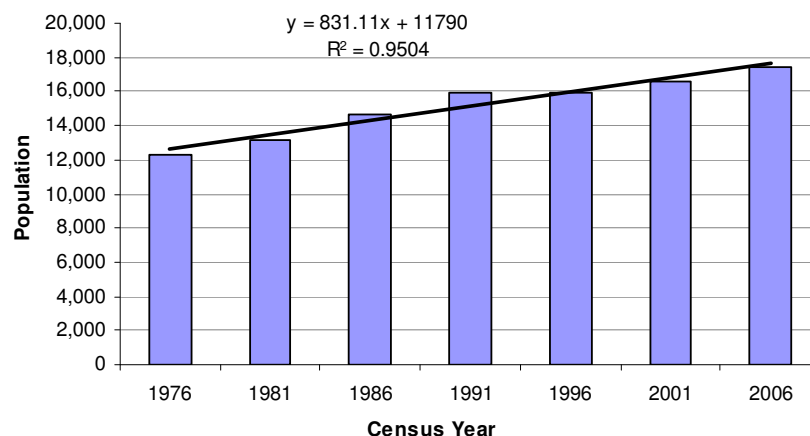


Figure 3.1: Population Change 1976-2006 for Murray Bridge township

Source: ABS Census 1976, 1981, 1986, 1991, 1996, 2001, 2006, by Place of Enumeration

City of Murray Bridge LGA has also been steadily growing over the past thirty years, increasing by 5,092 people (41%) between 1976 and 2006. However, most of this growth has been within Murray Bridge urban centre itself. It is likely that smaller towns and villages in the hinterland have maintained their population or had small growth over the 30-year period including the most recent inter-censal period, given the population differentials shown in the two graphs.



⁷⁵ Taylor-Neuman, L.V.N., and Balasingham, M.R. (2009) *Sustaining Settlement in Murray Bridge South Australia*, Lutheran Community Care, citing Suburbview.com (2009)

⁷⁶ Taylor-Neuman *et al*, *op cit*.

Figure 3.2: Population Change 1976-2006 for Murray Bridge LGA

Source: ABS Census 1976, 1981, 1986, 1991, 1996, 2001, 2006, by Place of Enumeration

Population growth in Murray Bridge LGA between 2001 to 2006 was the highest of any of the eight selected case study areas, and similar to that of Australia during this time (5.4% and 5.8% respectively). It was around 5 times the average growth for the MDB, and very different to the substantial population loss experienced by most of the Northern Basin case studies.⁷⁷

The increasing unaffordability of the Adelaide housing market⁷⁸ combined with good local employment opportunities and a feasible commuting distance to Adelaide, are likely to support continued urban growth in Murray Bridge. Commuting from Adelaide to the substantial entry level jobs in agricultural processing and the warehousing sectors including for recently arrived migrants and refugees is also significant.⁷⁹ More recently, Murray Bridge has been identified as a major regional growth centre by the SA State Government's blueprint for development, *The 30 Year Plan for Greater Adelaide*,⁸⁰ which includes Murray Bridge as one of fourteen 'New Strategic Growth Areas', though this will be subject to further investigation and consultation by the State Government.⁸¹ This could lead to a 70% increase in the population of Murray Bridge and surrounds over the next 30 years if such growth occurs, with commensurate job growth also an aim of the Plan.⁸²

3.3.2. Employment and Industry Profile

Employment has likewise grown significantly over the past three decades in the Rural City of Murray Bridge. The most recent inter-censal increase in jobs of 7.1% was again the largest of any of the eight selected case study areas, and out-stripped local population growth by around 25%. Employment growth was around 6 times the MDB average growth for 2001-06, but lower than the national average (9.7%). This was markedly different to the significant employment *decline* experienced by most case study areas of the Northern Basin for the same period,⁸³ and indicates the extent to which Murray Bridge is cushioned by its regional centre status and proximity to Adelaide, as well as the protection of full water allocations until 2006/07 for its large agriculturally-dependent hinterland.

⁷⁷ See Report 4 of this study (forthcoming) for all comparative demographic data for the 8 case study and benchmark areas referred to in this case study report.

⁷⁸ JSA (2009) *Affordable Housing Mapping and Incentives Project*, City of Perth.

⁷⁹ Taylor-Neuman, L.V.N., and Balasingham, M.R. (2009) *Sustaining Settlement in Murray Bridge South Australia*, Lutheran Community Care

⁸⁰ SA Department of Planning and Local Government (2010), *The 30 Year Plan for Greater Adelaide: A volume of the South Australian Planning Strategy*.

⁸¹ *Ibid*, p.82-85

⁸² Murray Bridge and surrounds is projected to contribute additional accommodation for around 13,400 additional people by 2036 (*ibid*, p.91).

⁸³ See Report 4 of this study (forthcoming) for all comparative demographic data referred to in this case study report.

In 2006, 7,180 people were employed in Murray Bridge case study area. Of these, just over 20% were employed in agriculture, which is lower than the MDB average (29%) but much higher than the national rate (3.5%). Grazing including irrigated dairy and vegetables were the most significant agricultural employers at 15% and 2% of total employment respectively, and Murray Bridge was in the top 10 vegetable growing areas in the MDB.

Compared with the MDB average, a higher than average proportion of the local workforce is employed in health, administration and public administration, financial services, communications, transport, wholesale and manufacturing and utilities, which indicates a more diversified rural economy, though still considerably less diverse than Australia in most sectors apart from public administration, health and retail. A strong value-adding processing sector is evident in the 'manufacturing' figures, as well as in transport, storage and wholesaling sectors, as discussed below.

It is interesting to note that, despite the emphasis on recreational opportunities for visitors and local people in promotional materials,⁸⁴ including to its natural environmental assets to the south, employment in recreation is average and in food and accommodation (typically associated with tourist visitations) is lower than the MDB and national averages.

The following figure shows this employment breakdown in more detail.

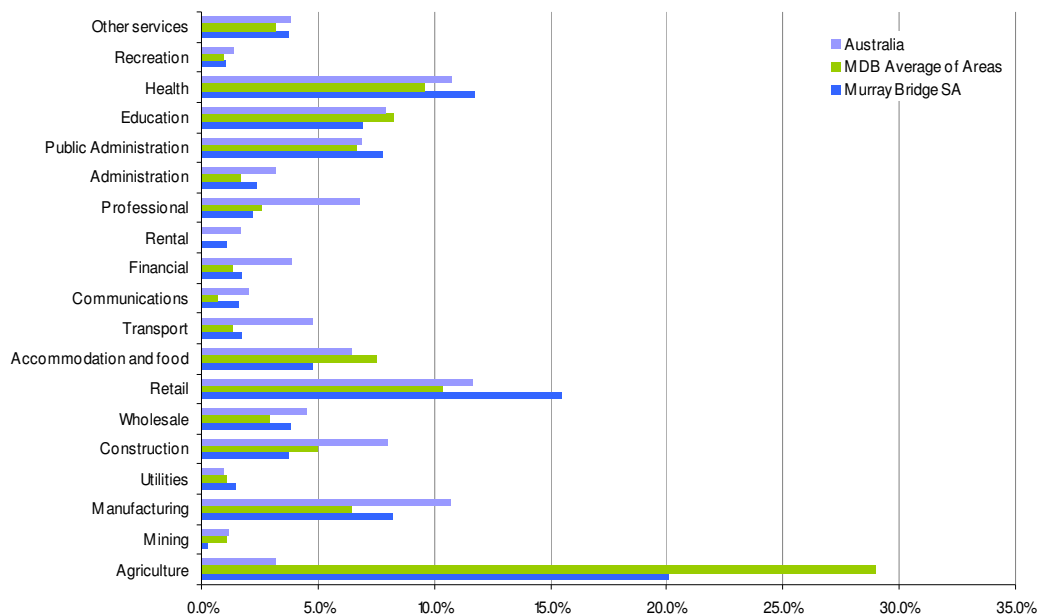


Figure 3.3: Employment Profile, Murray Bridge SA

Source: ABS (2006) Census of Population and Housing, JSA (2009)

⁸⁴ <http://www.murraybridge.sa.gov.au/>

The status of Murray Bridge as the major service centre for the Murraylands region is evident in the town's strong retail, service and value adding manufacturing sectors,⁸⁵ as is its accessibility to Adelaide. It is also near the cross-roads of interstate trade.⁸⁶ Importantly for the assessment of impacts of permanent water reduction, the other four LGAs that make up the Murraylands region had a very high reliance upon agriculture in 2006 including irrigated agriculture, producing significant grain and feed crops, dairy products, livestock, vegetables, fruit, flowers and wine grapes. As shown below, these areas had a very high proportion of their workforce employed in agriculture (42%) compared with the MDB average (29%), with Karoonda East the highest at 69%. Though much of this is likely to be in dryland grazing, the above figures on regional irrigated water use also show a strong irrigation sector in most LGAs. Note that, unlike figures for Murray Bridge reported earlier, the following represents direct employment only and so significantly understates the degree of reliance upon agriculture when related activities like value-adding processing, storage and the like are added.

Table 3.4: Agricultural Employment in Murraylands Region (balance)

Irrigated Water Use for:	Mid Murray	Coorong	Karoonda East Murray	Southern Mallee	Balance Murraylands
Agricultural Employment	520	732	225	383	1860
Total Employment	1843	1453	325	683	4304
% Agricultural Employment	28%	50%	69%	56%	42%
Total Population	8,035	5,670	1,163	2,134	17,002

Source: ABS (2006) and JSA (2009)

The largest single employer in City of Murray Bridge is T&R Pastoral meat processing plant, which sources livestock from a number of Australian states.⁸⁷ Murray Bridge is also a developing hub for warehousing and the distribution of goods including the existing Big W distribution centre, and business growth is also expected to be strong in the short- to medium-term particularly in retail, manufacturing and wholesale/distribution. The expected relocation of a number of larger and smaller enterprises,⁸⁸ and future development of an intermodal road/rail facility at Monarto, is also expected to increase business activity in the area.⁸⁹

Nonetheless, there has been a strong reported downturn in agriculture, value-adding manufacture and related transport and storage industries in the last few years, and projections for growth related to reduced water allocations and access have been seriously affecting certain sub-sectors. Although horticulture is a 'stabilising influence' in some areas of the Murraylands which have

⁸⁵ Taylor-Neuman, L.V.N., and Balasingham, M.R. (2009) *Sustaining Settlement in Murray Bridge South Australia*, Lutheran Community Care

⁸⁶ <http://www.murraybridge.sa.gov.au/>

⁸⁷ Taylor-Neuman *op cit*; and interviews with Murray Bridge Councillors conducted in March and April 2010

⁸⁸ Murraylands Regional Development Board (2009) *Murraylands Growth Update 2009*

⁸⁹ Taylor-Neuman *op cit*; and interviews with Murray Bridge Councillors conducted in March and April 2010

had major setbacks in dairying, the drought and more recent reductions in water availability have reportedly taken a 'heavy toll' on horticultural industries and the industries which service it.⁹⁰ Dairying has been particularly hard hit, and businesses directly related to it including two milk-processing plants are reported to be under threat at the time of writing.⁹¹ As such, 'many businesses and some whole businesses' are reported to be experiencing 'very real setbacks', in particular the value adding manufacturing sector. A number of wholesale and storage organisations which rely upon produce from Murray River irrigators have likewise 'experienced a severe loss of business and some have foundered' in the latter part of the drought.⁹²

Respondents to a recent business growth survey also report that it is more difficult to obtain finance for business expansion, in part due to the Global Financial Crisis. Small business and those which are over-stretched are particularly at risk of contraction.⁹³

The more optimistic forecasts of business growth overall by the Murraylands Regional Development Board appear reasonable,⁹⁴ particularly given the location of Murray Bridge and its linkages to Adelaide. Nonetheless, the case study area remains highly dependent upon agriculture and related industries, and its surrounding region particularly so. The need to continue to diversify and attract major new industries including those not related to agriculture remains a future challenge for the area, particularly if water is removed permanently from the area under the forthcoming Basin Plan or Federal policy initiatives.

3.3.3. Indicators of Community Wellbeing and Resilience

Overview

Murray Bridge is the most disadvantaged of the case study areas in relation to many of the selected indicators of wellbeing. This could make it particularly vulnerable to changes in its agricultural base and related economic and social flow-ons. Importantly, certain groups and smaller local communities are likely to disproportionately experience the impacts of changes to water availability, and have already done so during the drought and more recent changes to water allocations, as discussed in below. Its significant socio-economic disadvantage is also a relevant consideration in this regard.

However, other factors indicate that Murray Bridge is likely to be more resilient in the face of changes to water allocations. These include its relative degree of urbanisation (including size and proximity to the capital city), and relative economic diversity. It is the least remote of the eight case study areas, and less remote than the MDB average (a remoteness index of '1' compared

⁹⁰ Murraylands Regional Development Board (2009) *Murraylands Growth Update 2009*

⁹¹ Interviews with Murray Bridge Councillors conducted in March and April 2010

⁹² Murraylands Regional Development Board (2009) *Murraylands Growth Update 2009*

⁹³ Murraylands Regional Development Board (2009) *Murraylands Growth Update 2009*

⁹⁴ Interview and workshops March and April 2010

with '1.8' for the Basin). Its continued population and employment growth over the last census period and the fact that it is targeted for growth under the State Government's strategic planning framework⁹⁵ also indicate that it is likely to be relatively resilient.

Nonetheless, the area also performs poorly against a number of key indicators of resilience including the skills base of its labour force, very low index of educational and occupational resources, high unemployment and low level of labour force participation. These indicate the presence of more vulnerable populations, and a more at risk demography overall, so that the area cannot necessarily be complacent about its future wellbeing, despite the fact that housing and employment growth is projected. It has not yet achieved the critical mass found to be important in the previous stage of this study to make it independent of the fortunes of its agricultural base and related industries,⁹⁶ and remains somewhat vulnerable in this regard.

Indicators of Wellbeing and Resilience

Unlike other more disadvantaged case study areas in the Northern Basin, Murray Bridge has a relatively low level of Aboriginal residents (around 4% compared with 29% for Bourke, 19% for Moree Plains and 15% for Balonne SLAs), and was slightly lower than the MDB average (around 5%). The proportion of Aboriginal people in a community is generally strongly related to indicators of disadvantage or less favourable indicators of community wellbeing.⁹⁷ It is understood that such indicators in Murray Bridge are related to the high level of social housing, the presence of a prison including family visitation and post-release settlement, the concentration of semi- and low-skilled jobs in the large abattoirs, meat, poultry and milk processing operations, and the waves of more disadvantaged migrants who have settled in the area including recent refugees and humanitarian visas. The relatively low cost of purchase and rental accommodation in close proximity to Adelaide are also likely to be a significant attractor for less well off groups.⁹⁸

Murray Bridge has the lowest SEIFA Index of Disadvantage of any of the case study areas (900 compared with 1000 for Australia), the lowest labour force participation rate among those aged 15+ years (56% compared with 60% for the MDB and nationally, and 70% for Balonne Shire). It has by far the lowest median household income (\$670 compared with \$1030 for Australia and \$780 for the MDB). As would be expected from the economic base of the area, skill levels are low, with only 26% of local residents holding some form of post-secondary qualifications compared with around 40% nationally, which was again the lowest rate of any of the eight case study areas.⁹⁹ The SEIFA Index of Education and Occupation for Murray Bridge was extremely

⁹⁵ SA Department of Planning and Local Government (2010), *The 30 Year Plan for Greater Adelaide: A volume of the South Australian Planning Strategy*.

⁹⁶ JSA (2010) *Report 3: Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Irrigated Agriculture and Socio-Economic Indicators*,

⁹⁷ JSA (2010) *Report 3: Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Irrigated Agriculture and Socio-Economic Indicators*.

⁹⁸ Interviews conducted during site visit {date}; see also Taylor-Neuman *et al*, *op cit*.

⁹⁹ See Report 4 of this study (forthcoming) for all comparative demographic data for the 8 case study and benchmark areas referred to in this case study report.

low (876 compared with 1000 for Australia and 953 for the MDB), and was again by far the lowest of the case study areas. Youth unemployment at 13.5% was also the highest of the selected case study areas apart from Bourke, and much higher than the national and MDB averages (both around 10%). General unemployment was also high (6.6%) and second only to Bourke among selected case studies, although lower than the national average of 7.3%. Labour force participation among those 65+ was low (7.2% compared with 15.4% for the MDB and 8.4% nationally)¹⁰⁰ though this may also be due to access to a younger labour force and was lower than average compared with the MDB.

Murray Bridge also had the highest proportion of disability support pensioners of any case study area (at around 10% of the population and almost double the national average), and the highest proportion of those with a profound or severe disability. This may be partly related to the relatively high median age (39 years compared with 37 for Australia, though lower than the Basin average of 40 years). The level of chronic ill health was also slightly higher than the MDB and national average, though not as high as case study areas in the Northern Basin.¹⁰¹

More positively, the school participation rate of those aged 16 years was higher than many case study areas (as low as 51% for Moree Plains in the Northern Basin), and was only slightly lower than the MDB and national average (70% for Murray Bridge compared with 71% and 75% respectively). This may be due to the higher than average level of youth unemployment which may encourage more young people to stay at school despite opportunities for entry level jobs in the local economy; or to the reported value of schooling among the City's migrant and refugee populations.¹⁰²

In terms of other indicators related to social capital, there was a relatively stable population during the inter-censal period, with 19% changing address from outside the SLA compared with 24% for Australia and the 23% for the MDB. This indicates that in-migration has not been particularly high, and at least some of the increase in inter-censal population is likely to be related to natural increase (childbearing). Volunteering was much higher than the national average (26% compared with 18% for Australia), but quite low for a regional area (29% for the MDB average of areas).¹⁰³

Moreover, this is a highly disadvantaged resident population with indicators that show a high level of vulnerability to change in the economic base, including in agriculture and related entry-level jobs in value-adding agriculture, storage, packing, and transport/distribution. This is supported by anecdotal information provided during fieldwork within the case study area. Other studies also highlight the vulnerability of the migrant and refugee populations that have

¹⁰⁰ See Report 4 of this study (forthcoming) for all comparative demographic data for the 8 case study and benchmark areas referred to in this case study report.

¹⁰¹ See Report 4 of this study (forthcoming) for all comparative demographic data for the 8 case study and benchmark areas referred to in this case study report.

¹⁰² See Report 4 of this study (forthcoming) for all comparative demographic data for the 8 case study and benchmark areas referred to in this case study report.

¹⁰³ See Report 4 of this study (forthcoming) for all comparative demographic data for the 8 case study and benchmark areas referred to in this case study report.

increasingly made their home in the area to gain access to affordable housing and entry-level employment, and of the commuter population from these groups who travel to Murray Bridge for such employment each day.¹⁰⁴ Recent research among such disadvantaged groups also indicates that the community of Murray Bridge is strongly welcoming and supportive of migrants and refugees who live or work in the area,¹⁰⁵ so that less tangible aspects of community wellbeing and resilience are likely to be positively experienced in Murray Bridge.

¹⁰⁴ See for example Taylor-Neuman *op cit*; and interviews discussed below.

¹⁰⁵ See for example Taylor-Neuman *op cit*.

4. Potential Impacts of the Long-Term or Permanent Reductions in Water

4.1. Modelling and Quantification of Impacts

The impact on the Murray Bridge case study area from permanent reductions in the availability of irrigation water that may occur through reductions in SDLs under the forthcoming *Basin Plan* and trade of permanent water out of area (whether open market or government ‘buyback’) has been modelled using data from Research Strategies 1 and 2 of this study.¹⁰⁶

The extent to which additional reductions in entitlements or allocations may occur under the Basin Plan is at the time of writing unknown. As such, we have modelled 10%, 25% and 50% cuts in irrigation water from that used in 2006. The results of that modelling in relation to the likely impact on employment, population and other key indicators of wellbeing and resilience are summarised here, and detailed in the table below.

The effects of cuts to irrigation water on Murray Bridge are significant, but lesser in scale when compared to the effects on other case study areas. This is because irrigated agriculture forms a relatively small proportion of agricultural industries in Murray Bridge. In addition, the area has a relatively small Aboriginal population with a labour force participation rate similar to the non-Indigenous community. That said, the effects are probably understated, as Murray Bridge has a relatively high rate of jobs value-adding processing, transportation, storage and distribution and warehousing related to agricultural production, and is servicing a wider regional economy that is highly agriculturally dependent (42% average for Murraylands in direct agricultural employment, and likely as many in flow-ons to other industry sectors). As noted above, recent studies indicate that these jobs have already been adversely affected by the drought, with significant impact projected into the future.

The primary effect of reductions in the availability of irrigation water in the Murray Bridge SLA is projected to be a loss of employment, with a 2.5% loss (201 jobs) predicted from a 50% reduction in irrigated water use based on 2006 data, including direct and indirect employment in agriculture and multipliers. Given the fact that irrigated agriculture is anecdotally stated to have higher multipliers than the average for agriculture, and the likelihood that some agricultural jobs have not been identified in our analysis, this is again almost certainly an underestimate. It is also noted that, though small in quantum, employment loss in a highly disadvantaged economy like Murray Bridge can have significant social impacts.

¹⁰⁶ JSA (2010) Report 1: Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Scoping Paper, JSA (2010) Report 2: Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Understanding Agricultural Employment, and JSA (2010) Report 3: Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Irrigated Agriculture and Socio-Economic Indicators.

Subsequent population loss is estimated at 3.2% (560 people). However, Murray Bridge also acts as the major regional centre for the six LGAs in the **Murraylands Region**. Around 40% of the region's workforce was employed in agricultural including diverse irrigated agriculture in 2006, with some LGAs having up to 70% of their employment in agriculture. Results of modelling a 10%, 25% and 50% reduction in water across the Murraylands Region are displayed in the table below.

Table 4.1: Predicted job and population losses in the Murraylands due to water reduction

Water Reduction		10%	25%	50%
Job Loss:	No.	200	500	1,000
	%	1.4%	3.5%	7%
Population Loss:	No.	560	1,500	2,800
	%	1.6%	4%	8%

Source: JSA calculations based on ABS 2005/06 Agricultural Census

There may also be flow-one to City of Murray Bridge from regional job and population loss, and Murray Bridge is likely to suffer additional jobs and population loss associated with loss of agricultural production in surrounding towns and rural areas. This will in part depend on the extent to which people leaving smaller LGAs in the hinterland settle in Murray Bridge compared with another major centre outside the Region such as Adelaide or Mt Barker.

Socio-economic indicators of wellbeing and resilience are expected to remain largely unchanged as a result of reductions in availability of water for irrigation in Murray Bridge. However, the severely disadvantaged socio-economic profile of its existing community has already been noted. It appears to be an area highly vulnerable to changes that would lessen the employment and service opportunities for local residents.

Impacts on regional indicators are likely to be more significant, including an accelerated aging of the population and increased disadvantage arising from a more residualised population due to the remoteness of these areas and their population size. Areas like Karoonda East Murray, Southern Mallee and Coorong LGAs and smaller towns within these area are likely to be highly vulnerable to any changes in the agricultural base. This includes changes to groundwater extraction that may also occur under the Basin Plan (for example, in the Southern Mallee where vegetable growing has been relocated from Murray Bridge due to problems accessing water due to low river levels – see fieldwork information below).

The following table shows these projections for Murray Bridge case study area in more detail.

Table 4.2: Murray Bridge Projected Changes in Employment and Population with 10%, 25% and 50% Reductions in Irrigation Water

Indicator	Base case	Predicted indicators for 2006 for reduction in irrigation water			Notes
	2006	10% reduction	25% reduction	50% reduction	
Irrigation water use (Gl)	36.1	32.5	27.1	18.1	
Employment (total) ⁽¹⁾	7970	7928	7868	7769	
% decrease in employment		0.5%	1.3%	2.5%	
Employment (Vegetables) ⁽²⁾	141	136	128	116	
Irrigation water use (Gl)	3.0	2.7	2.3	1.5	
Employment (Fruit) ⁽²⁾	23	20	16	8	
Irrigation water use (Gl)	1.7	1.5	1.3	0.9	
Employment (Grapes) ⁽²⁾	13	13	12	11	
Irrigation water use (Gl)	0.2	0.2	0.2	0.1	
Employment (Grazing) ⁽²⁾	1207	1194	1175	1144	Assumed next best use
Irrigation water use (Gl)	30.0	27.0	22.5	15.0	
Employment (Cereal) ⁽²⁾	44	44	44	44	Likely to reduce but estimates are unreliable
Irrigation water use (Gl)	1.2	1.1	0.9	0.6	
Employment (Balance Agriculture)	174	174	174	174	
Employment (Total Agriculture)	1603	1581	1550	1497	
Population ⁽³⁾	17678	17561	17394	17115	Remains above 10,000 threshold
estimated % decrease in population		0.7%	1.6%	3.2%	
Indigenous population ⁽⁴⁾	4.2%	4.2%	4.2%	4.2%	
Number of indigenous people	742	739	735	727	
Dependent variables:					
SEIFA disadvantage	900	900	900	900	

Indicator	Base case	Predicted indicators for 2006 for reduction in irrigation water			Notes
	2006	10% reduction	25% reduction	50% reduction	
SEIFA Economic Resources	928	928	928	928	
Premature death	295.6	295.7	295.8	295.9	
LFP 15+	55.6%	55.6%	55.5%	55.5%	
Median Household income	\$ 672	\$ 672	\$ 672	\$ 672	
Disability support pensioners	9.7%	9.7%	9.7%	9.7%	
Profound or severe disability	5.2%	5.2%	5.2%	5.2%	
Chronic ill health	209.6	209.6	209.6	209.5	
LFP 65+	7.2%	7.2%	7.2%	7.3%	
Median Age	39	39.0	39.0	39.0	
Skills Base	25.9%	25.9%	25.9%	25.9%	
Education participation	70.3%	70.2%	70.1%	69.9%	
SEIFA Education and Occupation	876	876	876	875	
Polarisation	0.84	0.84	0.84	0.84	
Youth unemployment	13.5%	13.5%	13.6%	13.7%	
Unemployment	6.6%	6.6%	6.6%	6.6%	
Change of SLA five years ago	19.3%	19.3%	19.3%	19.4%	
Voluntary work	25.5%	25.5%	25.5%	25.5%	
Assault (Non domestic violence)	643	643	642	640	2006 value estimated
Assault (Domestic violence)	433	433	433	433	2006 value estimated
Property Crime	4107	4103	4096	4085	2006 value estimated

(1) Includes factor of 1.11 to account for census under reporting, and allows loss of 0.9 jobs for each lost agricultural job

(2) Estimates using data from Table 3.1 of report two and using regression analysis data to account for dryland production, factor of 1.11 included)

(3) Assumed one job per household, 2.8 people per household, unemployed households leave the area

(4) In 2006, the indigenous LFP rate was 51%, compared to 59% for the non-Indigenous population.

Note: JSA has assumed that job losses will have a lesser effect on indigenous populations, leading to an increased proportion of indigenous people in the population, at the rate of the loss of one indigenous person for each 1.2 non-Indigenous persons.

4.2. Field Work: Understanding Likely Impacts Through Responses to the Recent Drought and Other Stressors

4.2.1. Overview

Compared to a ‘long term’ or permanent reduction in water availability that may occur as a result of government policy and climate change, the recent drought represents a relatively short- or medium-term impact. Given its duration and severity, in many ways it represents a ‘real time simulation’ of what may happen if water for consumptive or productive uses is removed permanently from production, and how communities may experience the impacts and respond.

It also sheds some light on the way in which government policy and progressive deregulation of the water market is already affecting communities, the ‘winners and losers’ that may be created, and the way in which water policy is experienced and responded to in communities facing significant stress.

Moreover, an understanding of how farms, agricultural industries and the local community have responded to the ‘short to medium term’ stressor of the drought is necessary to better predict the likely impacts of ‘long term’ stressors like more permanent reductions in water availability in the context of other important issues facing communities.

The following case study firstly focuses on the Rural City of Murray Bridge in the context of the wider social, economic and environmental impacts being experienced in the area below Lock 1. It illustrates the responses of key stakeholders, including government, farmers and communities, to the drought and other stressors facing this area.¹⁰⁷ The case study then focuses on a specific area within the Murray Bridge LGA, Mypolonga, a small agricultural community to the north of Murray Bridge urban centre that has been particularly affected by reductions in water allocations and access in the last few years, and the responses of this community to what is arguably unprecedented ‘stress’.

Each of these areas – Murray Bridge in the context of the area below Lock 1 and the small community of Mypolonga – provide a different lense through which to understand the likely impacts of and responses to more permanent reductions in water availability that may occur under the Basin Plan or climate change.

¹⁰⁷ A wide range of staff and elected or appointed representatives of the following agencies and groups were interviewed and/or attended workshops City of Murray Bridge Council; Central Irrigation Trust; Murraylands Drought and Rural Support Centre; South Australian Murray-Darling Basin Natural Resources Management Board; Drought advisor to the Premier of South Australia; Price Merrett Consulting; Murray Futures Project; Wellington Local Action Planning Committee; SA Murray Irrigation; Lower Murray Irrigators; Individual irrigators and industry groups; Interested members of the community who attended workshops and report back sessions. Individual attributions for comments have not generally been provided as a number of participants made their comments confidentially.

4.2.2. The Area Below Lock 1

The area below Lock 1 has been particularly hard hit by a combination of very low water allocations since 2006/07¹⁰⁸ on top of a decade long drought. The 2008/09 growing season was particularly bad, starting at 2% allocations in July 2008 and reaching 18% by April 2009.¹⁰⁹ The area has experienced what some interviewees describe as a ‘triple whammy’ since 2006 – very low allocations, an initial very high cost of leasing water for permanent plantings and pasture,¹¹⁰ and a more recent decline in commodities prices.¹¹¹ Historically low river and lake levels led to significant additional costs for irrigators as they extended infrastructure to reach water sources, at least until they could no longer afford to do so or purchased in feed.¹¹²

Whilst some areas in the upstream states of NSW and Victoria report that ‘twenty years of adjustment happened in just 3 years’, the situation is more complex in South Australia. Significant infrastructure upgrades to achieve water efficiency were completed by the late 1990s including ‘pump and pipe’ systems throughout most of Lower Murray provided through joint government-industry funding.¹¹³ System loss is now reported to be as low as 1-2%.¹¹⁴ ‘Rehabilitation’ of the dairy swamps and industry modernisation occurred somewhat later, with upgrading of 100-year-old infrastructure on the reclaimed dairy swamps along 80kms of river frontage from Mannum to Wellington completed by the mid-2000s.¹¹⁵ Undertaken principally to stem increasing eutrophication of the river system and Lower Lakes, this involved laser levelling land and metering to increase efficiency of water use, and limiting discharge of irrigation water to the river, with costs again shared between government and farmers.¹¹⁶

During this time, there was reported to be significant structural adjustment.¹¹⁷ Fruit, grape, vegetable and irrigated crop growers who were less efficient or were not prepared to go through the infrastructure ‘modernisation’ process due to age or other factors often exited the industry, with sale of blocks leading to increased farm consolidation during this time.¹¹⁸ Likewise, those wanting or needing to exit the dairy industry chose not to participate in the ‘rehabilitation’ process, and a process of farm consolidation also occurred.¹¹⁹ The opportunity to exit farming was also made easier by the progressive deregulation of the water market including early

¹⁰⁸ 60% in 2006/07, 32% in 2007/08 and 18% in 2008/09

¹⁰⁹ National Water Commission (NWC) *Australian Water Markets Report 2008-2009* National Water Commission (NWC) (2009) *Australian Water Markets Report 2008-2009; 2007-2008; 2006-07*.

¹¹⁰ Initially reported to be up to \$1200 /MI (Interview, Staff of CIT, 18 March 2010)

¹¹¹ Particularly for grapes, but also citrus and dairy products (Interview, Staff of CIT, 18 March 2010)

¹¹² Interviews with irrigators, Field Visit March 2010

¹¹³ Interview, Staff of CIT, 18 March 2010.

¹¹⁴ Various interviews, March 2010

¹¹⁵ Various interviews, March 2010

¹¹⁶ Various interviews, March 2010

¹¹⁷ Various interviews, March 2010

¹¹⁸ Various interviews, March 2010

¹¹⁹ Various interviews, March 2010

‘unbundling’ of water rights in the early 2000s, with SA Water offering to purchase water including for the environment and Adelaide’s potable use.¹²⁰ A typical comment heard in interviews in this areas noted that, ‘There’s been quite a shakeout of less viable farmers over the past few decades, and a lot of restructuring down here by the time the worse of the drought hit [in 2006]. What we’re often seeing now is good operators leaving the business. It’s good that they’ve got the opportunity [with the buyback and water trade], but really many have no option. The last 2 years have just been too much’. Other stakeholders noted that, ‘The people we should be helping to stay are being encouraged to leave. We’re hitting them at a very vulnerable time – we’re saying ‘We’ve got no confidence in you’.

This sentiment was echoed strongly by a staff member of the SA Murray Darling Basin Natural Resource Management Board, who has worked collaboratively with local producers and communities over many years to improve on-farm water efficiency and practices, and environmental health. It reflects what the researcher heard repeatedly during consultations in this area.

What we’re losing now [through the Small Block Exit package and ‘buyback’] are the good operators. We’re losing the knowledge base of some of the best operators when we buy them out and make them rip out the infrastructure they’ve just put in and say, ‘The land can’t be used for 5 years¹²¹ and exit them from the industry – possibly for good.’ We’re going to face a leadership vacuum in these communities, and it will be all the harder when the drought breaks and the River is up again.

Commenting on the proposition that Federal programs are assisting with necessary restructuring of inefficient enterprises, the NRM officer commented,

The Board has been criticised by some for actively promoting the Commonwealth Government’s irrigation infrastructure programs, as many believe it is an investment in less efficient enterprises and the early adopters that have already invested in efficiency measures are being disadvantaged. We know we are starting from a very efficient base in this region and the opportunities will be limited but we don’t set the guidelines. We don’t expect to see huge uptake of the PIIP¹⁶ as significant off-farm irrigation modernisation has already occurred in SA. Sure we support seeing more funding directed to help people stay instead of encouraging them to leave but we must work within the guidelines provided to us.

A farmer I’ve worked with for years [in land management] - a really good operator - just bulldozed his whole block, his whole life. His dad handed the block to him, now it’s all gone. Broken his heart. Told his son to go and get a job away. It does seem a little ironic that he has to pull out a drip system that the government paid him \$20,000 to put in 6 months ago? Maybe they could just lock off the water

¹²⁰ Interview, Staff of CIT, 18 March 2010

¹²¹ Requirements under the requirements of the Small Block Exit Package include that irrigation infrastructure must be removed, and the land not used for irrigated agriculture for 5 years, and that the water entitlement must be sold to the Federal Government Water Holder.

meter. In the meantime, many of our districts are turning into dustbowls, over-run with vermin, thistles, sandflies and foxes – it's an example of how an area benefits from good management – and what happens when it becomes unmanaged.' ¹²²

Another stakeholder commented,

We're seeing a lot of good businesses in the Lower Murray going now – the ones who modernised early, kept their block immaculate, always delivered the best produce – getting no help, paying a fortune for their water, borrowing to buy in feed. But this last year or two, many of them just couldn't do it any longer. They took the [Federal] money but they were saying at the same time, 'Why won't someone help me to stay?



The requirement to decommission and remove all irrigation infrastructure and ensure that the property is not used for agriculture for 5 years was raised frequently in other areas where the Small Block Exit package has been more prevalent (see for example the Mildura case study).

A further concern of the NRM Board was that collaborative programs developed over some years with local communities to improve environmental outcomes and water use will be

in jeopardy through reduced program funding.. As an NRM Officer noted,

Appropriate responses to land and water management are many and varied – the one-size fits-all approach is rarely successful. Our irrigated *Land and Water Management Plans* have been developed in partnership with the local community to address local issues, which is essential to gain real outcomes. We've seen real improvements generated by investment provided through the NAP program but this program concluded in June 2008. Funding priorities have subsequently changed dramatically and we've lost 80% of our program funding and much of our previous momentum and community support.

Our bottom up, partnership approach is now being compromised. We can't engage the community if we've got nothing tangible to offer them and they want to see on-ground action and not more planning. While these difficult times make us reflect and explore other ways of delivering the program more efficiently it is the loss of

¹²² Workshop with staff and consultants of the SA Murray Darling Basin Natural Resource Management Board, 18 March 2010

the previously strong community engagement networks that is most concerning. It's a reactive response rather than a proactive one.¹²³

Staff of the Central Irrigation Trust (CIT) also expressed strong concerns about the impacts they are seeing in irrigation districts throughout the SA River Murray PWC.¹²⁴ Originally licensed to extract 155 GL of water after the amalgamation of 10 providers, it now administers 120 GL due to sale of water by individual irrigators under Federal Government programs in the past 18 months – a loss of around 23% from their system. CIT staff report that most water sold has come out vineyards, which have been affected by commodity price fluctuations, and some from citrus. Together with restricted allocations, problems accessing water and the cost of leasing water,¹²⁵ this has had a big impact on industry and communities.

Even the most efficient producers were hurting. Water prices reached \$1200 a ML in 2006/07 before settling to a more realistic price, but lot of people panicked. They weren't used to dealing on the open market. Then commodities prices took a dive and that exacerbated the situation.

With the unbundling [since 1 July 2010],¹²⁶ a common strategy has been to retire debt through selling permanent water and buying in seasonal water. But some say they're out for good or they've turned off the water to permanent plantings. But if they still own the land and delivery rights they can come back in when the price is right. Properties are cheaper with no water, and there's more buy ups of neighbours' properties – it's a good time to buy - so we'll see more consolidation.

It's more of a problem if you've taken the Exit Package, though 50% of those we talk to intend to come back in after the 5-year moratorium is up. 'Apply for delivery rights, lease some water, grow some vegies', that's the way a lot are talking. Others are undecided.

Highlighting the difference between short-term responses and more long-term impacts with the permanent removal of water and productive land, he commented,

Australian agriculture is very resilient and adaptable – years ago they were growing apricots, then grapes, and later vegies. A lot of what's been dried out could come back into production, but we still need the water. Nothing happens without it. Now there's less water in the system overall [with the 'buyback' and Exit Packages], so you'd expect more permanent impacts, though they can still purchase in water from other areas or states.

¹²³ Workshop with staff and consultants of the SA Murray Darling Basin Natural Resource Management Board, 18 March 2010

¹²⁴ The CIT is the largest trust in SA and manages around 50% of SA's irrigation areas.

¹²⁵ Leasing cost of water is reported to have reached \$1200/ML in 2006/07 (Interview, Staff of CIT, 18 March 2010).

¹²⁶ Under the *Natural Resource Management (Water Resources and other matters) Amendment Act 2007 (SA)*, Water Access Entitlements (or Water Licences) provide for the ongoing right to a specified share of the water resource expressed in unit shares, and provides for an asset that can be sold or transferred permanently or for a limited period (South Australian Department of Water, Land and Biodiversity Conservation (2010) *Unbundling Water Rights – What Does It mean?*)

It's a different matter altogether if SDLs [under the *Basin Plan*] remove water permanently and there's less water for everyone in the long-term. Open trade could help but when water is traded out of the area, then one community is sustained at the expense of another. Overall, it depends on how much water is traded and from where, but there are practical limits to trade across the Basin. But when water goes out of the system for good, production is reduced permanently – there's less to trade.

CIT staff felt that parts of the region have been affected in different ways, due to irrigation efficiency and previous farm consolidation. Some areas had been badly affected by cuts to water and take up of Federal programs, with likely flow ons throughout the region including the regional centre.

Since 2006/07 we've lost about 85% of dairy, 20-30% of fruit production. Some areas have lost 50% of vegies, and others have had 75% of grapes go out of production.

In towns like Barmera [where the CIT head office is located and which is close to the irrigation districts of Loxton and Kingston] heaps of shops have closed, tourism is down, all the clubs are losing members, the whole place is hurting. In Waikerie, ten shops have closed, warehousing and transport businesses are really struggling, the school is losing teachers. House prices are at rock bottom - people are getting \$165,000 for a home worth \$280,000 2 years ago. Prices were going up – it's only an hour and a half from Adelaide. Now there are 67 homes on the market and you can't sell them.¹²⁷



Later, in the main street of Barmera, a lovely town with undulating relief and a view of Lake Bonney around 100 kms above Lock 1, more than one in three shops were closed. Tourism was also badly affected and caravan parks on the lakeshore were not booked out at Easter 'for the first time in memory', though locals noted that, 'You can see there's still plenty of water in the Lake. The media talking things up all the time is really not helping us.' A spare parts and machinery

repair business reflected the view of other businesses interviewed in the town. They noted that most of obvious signs of economic downturn had occurred in the past 2 years.

People around here are blaming the farmers for taking the Exit Package, but you can't blame them. The last 2 years have been really bad. You should go to the backblocks and see how many are left. It wouldn't be so bad if you could keep using the land, but they're not allowed to, and the water's gone so that's that.

¹²⁷ A search of several real estate database confirmed what the CIT representative had reported

It's really sad that a lot of guys are leaving with nothing when they pay their debts. The younger people are leaving to go and work in the mines. Once they would have come back to take over their father's property, but now it's different. There's nothing to come back to. In a few years we'll start to see the effects of this – everyone in the town getting older and no one to run things. I don't understand why they couldn't keep using the land for something. It just seems wrong for the whole community.

Though smaller satellite centres that are highly agriculturally dependent are particularly hard hit, it is evident that medium sized service centres like Waikerie and Barmera are also experiencing a significant contraction in higher-level services. The process of urbanisation occurring in many rural areas is likely to be accelerated through opportunities presented by out of area trade or administrative reductions in water. Such a process may be effectively instigated in towns not otherwise 'declining'. The extent to which this is 'inevitable', provides a 'positive exit' for farmers, or opportunistically 'hits a grower when he's down' – all of which are comments from stakeholders - essentially depends on who you are and the vantage point from which you view such changes. An overwhelming feeling among those interviewed throughout the region was that there was limited assistance available for those wanting to stay and no assistance with 'community restructuring' that was being actively facilitated by recent public policy.

The next day, in the City of Murray Bridge, other impacts were raised by civic and community leaders. Though Murray Bridge is forecast to grow over the next 30 years as part of Adelaide's growth strategy,¹²⁸ the Council was far from complacent about the future of the area. They noted the impacts on the houseboat, recreation and tourism industries in this part of the River, as well as the likely closure of one if not both milk processing plants due to the loss of most irrigated dairy in the past few years, and the problems facing other businesses from the recent agricultural downturn in Murray Bridge area and surrounding LGAs that are heavily dependent on agriculture. The Council was also thinking about the impact of future urban development and 'If all the water goes for domestic [use], what will happen to agriculture?' Social issues were a major concern of civic leaders.

If this is your first time here, you probably can't imagine what it was like before the [river] flats dried out – so lush and green it hurt your eyes. Now it's dry and brown all along the flats. We've had to let most of the parklands go, and people can't keep their gardens. It's so demoralising for people who have lived here for a long time, and it will certainly affect visitors and those who might be thinking of moving here. We're seeing more social problems, and I can't say for sure but the depressing look of the whole area has got to be affecting people. For these towns, it's all about perceptions.

¹²⁸ SA Department of Planning and Local Government (2010), *The 30 Year Plan for Greater Adelaide: A volume of the South Australian Planning Strategy*

Like studies on Murray Bridge that find it is a very positive place for refugee and humanitarian migrants to settle compared with metropolitan areas,¹²⁹ the Mayor was positive about the social cohesion of his community.

It's still a good place to live. We're actively welcoming of people who are different. We had a suicide of an Afghani man here a few years, ago and we all banded together to make sure that never happens again. We've got really good community leaders in the Aboriginal community, too. It certainly has a much more disadvantaged profile, but the people here are good people. Again, it's more about perception than reality.

I think one of the biggest concerns is the people we're losing now – some of the farmers and community leaders who put a lot of time into running things. They're the ones who are going or thinking of going – a lot have leased out their water and are waiting to see what happens when the water comes back. So we hope we don't lose them for good. There are very disadvantaged groups here, and we need to keep strong leadership.

It's really bad in some of the other dairying areas too, like the Narrung Peninsular. They've lost most of their dairying [due to low Lake levels].

As another Councillor commented,

The Lakes are on life support. Some of the communities are on life support. There really are few winners below Lock 1.

Like the Murraylands Regional Development Board, Council also talked about the likely resilience of the city due to future residential and economic development and potential industry relocation. Nonetheless, they were concerned about specific industries that were being seriously affected through reduced water allocations and access, and the possible flow on effects from more permanent loss of irrigated agriculture in the Murraylands region.



Council's concern for the future of its smaller communities was evident in the composition of the large group the Mayor had assembled to attended the workshop. Among these were irrigators and peak bodies, as well as a group of farmers for the small rural town of Mypolonga, 17 kms to the north of Murray Bridge city centre.

¹²⁹ Taylor-Neuman, L.V.N., and Balasingham, M.R. (2009) *Sustaining Settlement in Murray Bridge South Australia*, Lutheran Community Care

4.2.3. The Town of Mypolonga

The statistics on Mypolonga tell a story of a small community with a high level of community engagement and a stable population in recent years. There was little change in from the 680 or so residents who live there in 2001 in the 2006 Census count,¹³⁰ and it has twice the national rate of participation in voluntary activities.¹³¹ In 2006, it had a relatively young population,¹³² but was less advantaged than the national average in terms of educational and occupation,¹³³ skills,¹³⁴ broad socio-economic status,¹³⁵ income¹³⁶ and youth unemployment.¹³⁷ It is also somewhat more disadvantaged than the MDB average across a range of socio-economic indicators.¹³⁸ Moreover, the area has been changing over the past decade or so through a combination of urban development, dairy and horticulture ‘modernisation’ and farm consolidation,¹³⁹ and most recently the effects of the prolonged drought.

The description of a community worker, interviewed just before our visit to the community paints perhaps a more lasting picture. In her words,

It was just the most beautiful place – the river makes an oasis in the middle of the drylands. If you could have seen it [before the drought]. The most beautiful fruit and vegetables. Olive trees and orchards sitting above the green dairy flats.

But now, to chop the trees down and burn them in piles in the fields. The women come in to talk to me. The thing they talk about is the smell of smoke all the time over the valley. And the vandalism of turning the water off and destroying what’s taken 80 or 100 years to build up. Men at the abattoirs saying, ‘Why are they sending 2 or 3 year old heifers here to be slaughtered, milk dripping from their udders?’ Saying, ‘I can’t do this. It’s the most terrible waste – a tragedy’.

¹³⁰ Mypolonga and the adjacent Woodlane area has a resident population of 682 in 2001 and 669 in 2006 (ABS Census 2001 and 2006).

¹³¹ 34% compared with 17.9% (ABS Census 2006).

¹³² Median age 35 years compared with 37 years for Australia (ABS Census 2006).

¹³³ SEIFA Index of Education and Occupation of 908 compared with 1000 for Australia (ABS Census 2006).

¹³⁴ 32% had some form of post-secondary qualification compared with around 40% for Australia (ABS 2006 Census)

¹³⁵ A score of 908 on the SEIFA Index of Educational and Occupational Resources compared with 1000 for Australia (ABS 2006 Census).

¹³⁶ \$830 compared with \$1,025 median household income nationally (ABS 206 Census)

¹³⁷ At 15%, youth unemployment was 5 percentage points higher than the NDB average of areas, and doubled between 2001 and 2006 (ABS Census 2001, 2006).

¹³⁸ ABS 2006 Census

¹³⁹ Direct employment in agriculture declined by around 50% between 2001 and 2006 (from 40% to 20%), though this does not include the significant level of employment in value-adding processing and other related activities, nor the flow ons to other sectors. There is evidence that the newer arrivals in the release area at Woodlane are employed in professional, administrative and service sector jobs due to the increased in such jobs inter-censally, likely as commuters to Adelaide, Mt Barker, Murray Bridge and other centres (ABS 206 Census).

I've seen suicides in the last few years, and other things you'd never see. The wives come in and say they're worried about their husbands. They just go out and sit on their tractor all day like they've done all their lives, but now there's no purpose. Others have found them just in time – with a hose connected up to the inside of the car. If they don't come in by 7 or 8 at night they get worried and go looking for them. More heart attacks, family fights. You can't say for sure that it's directly related, but they're under so much stress. A lot of people have shut down. They're not going to functions. Some haven't left the house in 18 months. Why can't they help the poor buggers who have been there for generations?

It's really hard to see what's happening to the town, too. The school was in danger of shutting down but now they're bussing kids out from Murray Bridge – it's got a really good name. It's affecting the sporting clubs – they're now providing incentives for kids from other areas to come and play here, buying their uniforms, things like that. And it's affecting churches and Mypolonga Traders – they're hanging in for the moment.

They call this 'adjustment', but most of the inefficient ones left years ago. That's why the ones left haven't been eligible for the [Federal] packages. Almost no-one in Mypolonga was able to get the EC¹⁴⁰ because they are 'too viable', and I think only one or two got the [Small Block] Exit Package. They're worth too much. But borrowing to buy in water or feed in the last few years has tipped the balance for some. Others have decided to sell their water [entitlements] and are leasing water in, but some haven't been able to. With permanent plantings it's a hard decision – it takes years to re-establish your trees. Dairy herds that have taken decades of breeding are being slaughtered. Some have said they just don't have the heart to come back [into farming], but there are others buying up a lot of blocks. We'll see what happens when the water comes back.

At the Council workshop we met Mike,¹⁴¹ a third generation Mypolonga fruit grower. He showed us around his town for a day with obvious pride - the oval that they are keeping green with purchased water to keep the sporting teams going, the Mypolonga Traders, a community institution where produce has been sorted and packed and farm equipment sold for 80 years, the school where children were being brought in from Murray Bridge to keep it going 'until the water comes back'.

He took us to the dry hills on the outskirts of the town areas where the still living grapes, stone fruit, citrus and olive groves perch on the contours above the river flats, and below it all the brown channel of the River Murray - a scene, as we had been told, that would not look out of place on a post card from Umbria.

¹⁴⁰ Exceptional Circumstances

¹⁴¹ Not his real name.



Other scenes were less bucolic. Dying trees where the water had been turned off some time ago. Grapes unpicked dying on the vines. Massive piles of trees in fields waiting to be burnt. Fields a patchwork of thriving and dying groves.

Down on the River, Mike showed us where the Woodlane irrigation pump had been destroyed when the River bank collapsed due to low water levels.

We changed from stone fruit to citrus and then to grapes a few years ago. You change as the market changes. Bought more land, planted Chardonnay, Shiraz, Grenache. Had a contract with Orlando. They were good times. But 2009, commodities prices were very bad and projected to be bad for 3 years. On top of the water problems and the debt, I would have been working for nothing and I can't do it at my age. My son was doing the books, and he saw what was coming. He left before I had to say anything.

Mike, like other growers, is making decisions about water based on water price and availability, commodities prices, opportunities provided by policy, and other social, economic and personal factors.

I tried to sell my water to the Commonwealth, a bit of an ambit claim. A protest, if you like. Then I tried to sell to SA water, but they were offering less than what it was said to be worth. Then I leased it to CIT [through their brokerage scheme] so SA Water didn't want to buy it. I'll have another go in Round 2 [of the 'buyback'] – really I don't know if I want to sell my [permanent] water, but I might end up losing more [under the forthcoming Basin Plan]. They said that Penny Wong might just be able to take your water and not give you anything, so maybe I should try to sell now. I don't know what to do, it's all so uncertain.

But it breaks your heart to turn the water off. I'm a third generation farmer. My father still lives on the property in the house he was born in 50 meters up the hill from me. I'm ashamed I've let him down. He's 93 and he's passionate about farming, passionate about the River. It's been his whole life. How can I just rip out everything he's worked for and his father before him? I know it's not good business, but I'm watering 3 rows of citrus and some stone fruit just to keep some greenery around dad. It would be an amazing thing not to be able to go out and pick fresh fruit off a tree.

Mike took me to the home of John,¹⁴² another third generation farmer and one of the larger growers in the area with 20 ha under cultivation for stone fruit, citrus and wine grapes. His two sons are ‘away at uni’, but one ‘might come back and make it fourth generation’. He provided the perspective of someone committed to staying in production.

I’ve got no intention of going. I can get by for quite a few years with the existing infrastructure and plantings. These were all soldier settlements blocks in the 1920s - 6 to 20 acres. There’s been a lot of consolidation over the years, and we’ve mostly modernised, that’s why we can’t meet the target of the PIIP.¹⁴³

There’s no reason why things can’t come back into production here. We’ve got a magnificent irrigation system [provided through CIT] as long as we’ve got the water and commodities prices pick up. Most of what’s gone recently could come back or we can grow something else. That’s what people have always done here.

In many ways, Mypolonga is at a crossroads. Its proximity to Murray Bridge and its rural amenity is making it popular among people wanting a rural lifestyle within commuting distance to major service centres. Rural residential subdivision has been occurring in the area and smaller lots with a pleasant aspect near the River at Woodlane have been constructed over the past 10 years.



The extent to which Council will encourage or enable further subdivision into smaller lots is at this stage unknown. As is the case in many such communities, planning authorities grapple with issues of urban and rural sustainability including the need to provide sufficient housing for growing population balanced against the loss or fragmentation of prime agricultural land and need to ensure housing is provided close to services and transport through consolidation in larger urban centres rather than in more outlying

areas.¹⁴⁴ As John commented,

Mike may not agree – I know he’s keen to subdivide some of his land if he can - but I’d rather see land come back into production. It’s better for the community to have people living here committed to the local area rather than becoming a dormitory suburb, better for agricultural production, better for us all. To some extent, it will depend on the SDLs [under the *Basin Plan*] and Council’s position

¹⁴² Not his real name

¹⁴³ Private Irrigators Infrastructure Program (PIIP) is providing \$110.0 million to SA irrigators to upgrade infrastructure in exchange for water efficiencies under WFTF

¹⁴⁴

[on strategic planning for future development]. We're not sure about either of those things.

We then dropped in on Brian,¹⁴⁵ a former shearer and a dairy farmer for the past 30 years. He owns the last dairy currently operating in Mypolonga. The property supports a milking herd of around 600 head, with related enterprises in lucerne and heifers around 100 kms away. The river flats near Mypolonga and adjoining Woodlane once supported around 30 dairies. Modernisation in the late 1990s and early 2000s saw the number of dairies fall to 9, with those that remained largely consolidating herds of less than 200 to around 400. Most of the remaining dairies have gone out of operation in the last 3 years.

They just cut us loose below Lock 1. Just left us for dead. I've never seen it like this – never though it could dry out. There's been no support. Some areas [for example, grapes in Langhorne Creek] are getting water piped in largely paid for by government. We've got nothing.

I'm buying in feed now. I did try to irrigate last year but I used 12 Ml [of water] to the hectare instead of the usual 0.5 Ml – the cracks are so deep you just can't water it. So I lease out my water and buy in feed.

I've bought up eight other dairies along the river swamps. I could run 1500 head. There's no reason this land can't come back into production when the water situation improves and the market picks up. Dairy isn't finished here, but it is going to be difficult [with the degree of land subsidence]. We'll see what happens.

Brian runs a modern rotary dairy constructed in 2000 with 'half of the cost from dairy modernisation money.' Despite the hard work and early mornings, he has no intention of leaving dairying.

My son and grandson are in the business with me. You'll have to carry me out in a box. I'm not going anywhere.



A visit to the Mypolonga Traders shed some light on CSIRO predictions that ground water use in the Murray SYR is likely to treble in the next 30 years with decreased access to surface water. The manager of the store showed us around the large packing and distribution shed with onions of all colours and types piled high on wooden pallets ready for transportation to Woolworths and other stores throughout Australia. As he explained,

Onion production is down 50% in the area because of low allocations and low river levels. Other vegies are way down as

¹⁴⁵ Not his real name

well. Citrus would probably be at 25% of average production. Some are keeping the trees alive but not giving them enough water enough for fruiting. Onion growers have moved down to the Southern Mallee til things improve. They're putting in pivots and irrigating off groundwater. They'd much rather be here – there's a cost socially and economically. They miss their kids sporting events. Families are disrupted. The cost of trucking [the onions] back here [for packing and distribution] is high and they had to put in bores and pivots [for groundwater irrigation]. But there's a good market with Woolies buying as much as they can grow. Hopefully it's only temporary and they can come back when the water comes back. It's a different story for citrus growers. They can't just shift their operations, and prices have been down as well.

He also explained the difference that the 'look' of produce can make can make to a producer's profitability.

It might sound silly, and they're really the same product, but those perfect white onions are the farmer's profit –the difference between being able to pay some of your debts and just hang in. In today's market, people expect their vegies without blemish and pay top dollar, and we do our best to produce it. Sometimes it's the difference between life and death for a grower.

As far as their business is concerned, things are hard but they are surviving.

Business is probably down about 50% locally, but probably only 15% net when you consider we're doing a lot more transport from places like the Southern Mallee. We've also been promoting ourselves to the drylands [for transport and packing] and we're picking up business there. We're going wider and its working for now, but obviously the growers would rather be back here.



Mike took us to his cousin's place where the vines were still producing in abundance. We stopped now and again so Mike could pick different types of grapes for us to taste.

With pride Mike, explained the difference in the top quality grapes he'd been growing, Grenache, Merlot and the now unfashionable Chardonnay.

Back at his own property, many of the fields were obviously dying. But some vines were refusing to die, though the water had been turned off 8 months ago.

Orlando bought out my contract. But some of these grapes are hardy – they’re the drought resistant variety. If they last through the winter, I might give them some water. Maybe we’ll grow something else. We’ll see.

At the end of the day, Mike took us to visit his father. The sorrow was clear in the man who had relied on the River for his livelihood all his life, and the confusion about why ‘the city has turned against the farmers’. He asked a number of times during our discussion, ‘What’s happened to the River?’ and when the water [flowing down the lower Darling at that time from floods in the north] was coming? Before we left he said,

Tell Mike to give you some dried fruit before you go. Take it back to the city and give it to people. Tell them what fruit used to taste like...before we bought it all in from overseas.

Back at Mike’s home, talking to his wife who works as a teacher in Murray Bridge in one of the region’s most disadvantaged schools, Mike brought in a massive bag of dried apricots and peaches. Maybe it was the setting, or knowing where they had come from, but they did taste like nothing this writer had eaten before.

Appendix 9: Comparative Socio-Economic Indicators for Case Study Communities



Report 4: Exploring the relationship between community resilience & irrigated agriculture in the Murray Darling Basin: Social and economic impacts of reduced irrigation water

July 2010

This report has been prepared for



Cotton Catchment Communities CRC

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1 SEIFA Disadvantage

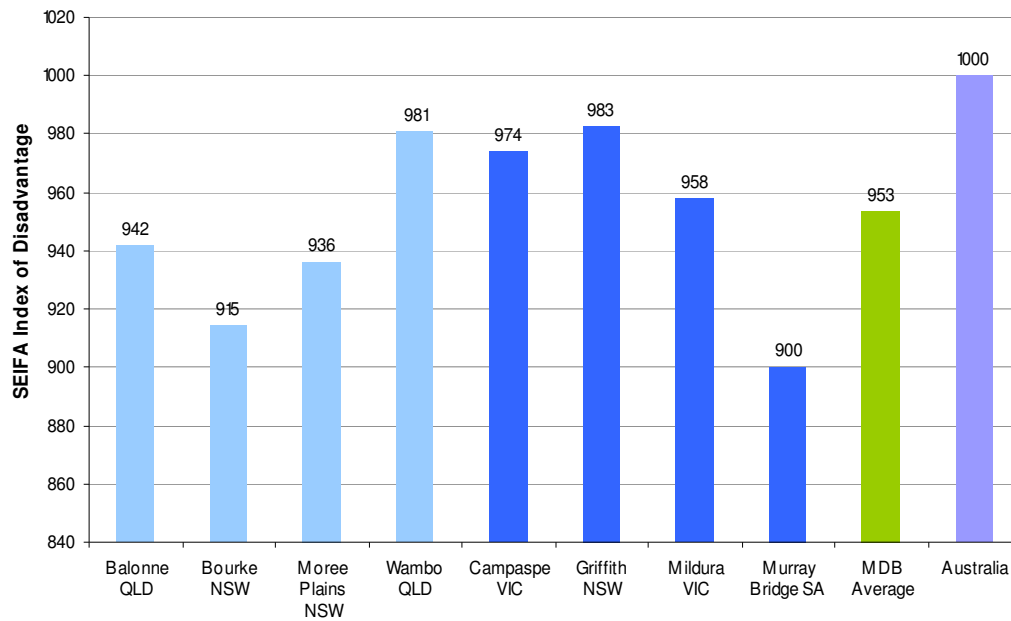


Figure 1: Socio-Economic Index for Areas (SEIFA) Index of Relative Disadvantage

Source: ABS (2006) Census of Population and Housing, JSA (2009)

2 Premature Death

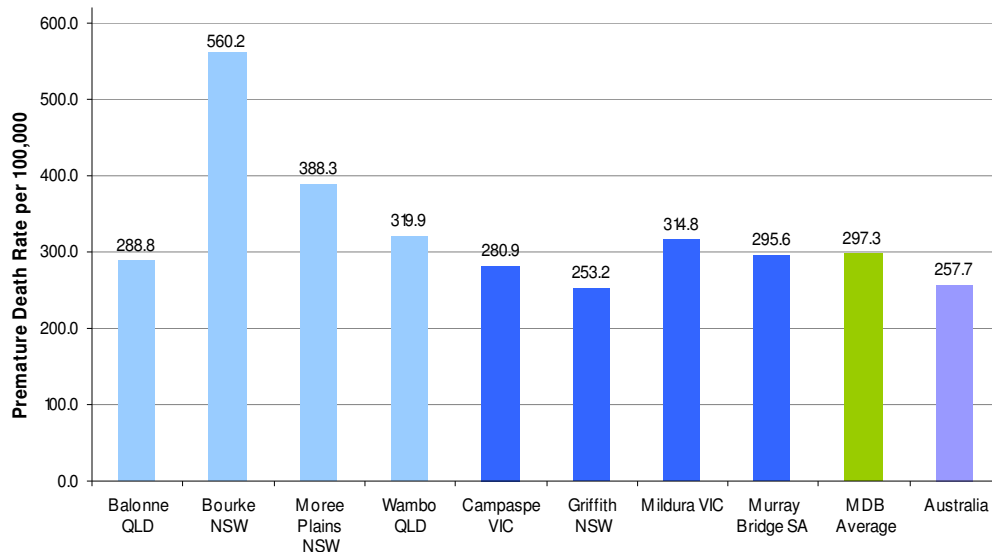


Figure 2: Premature Death Average Annual Rate per 100,000 people

Source: PHIDU (2008), JSA (2009)

3 Labour Force Participation 15+

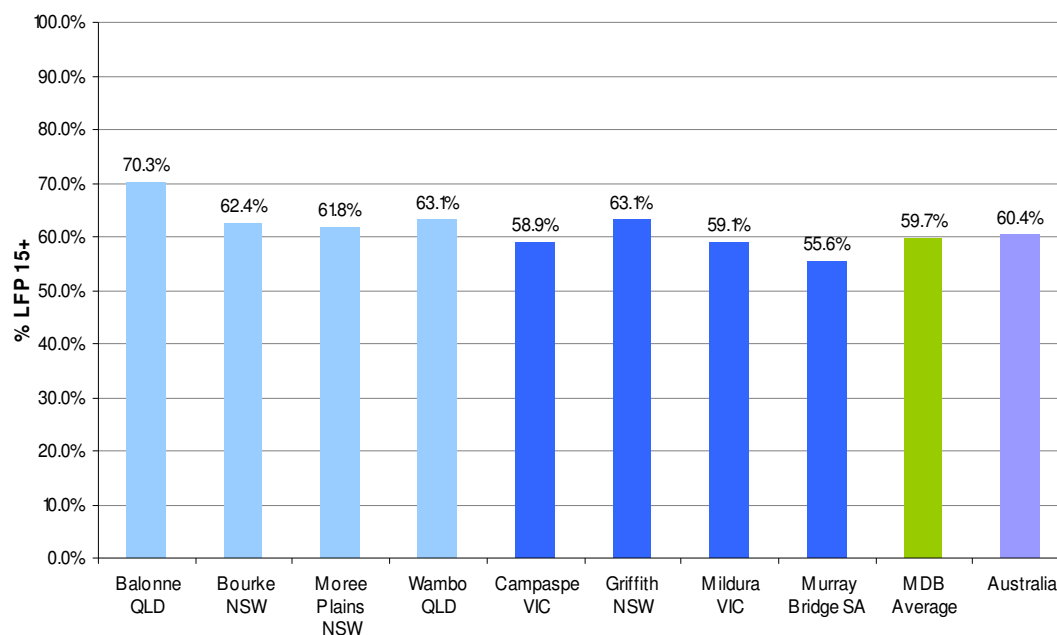


Figure 3: Labour Force Participation Rate (15+yr)

Source: ABS (2006) Census of Population and Housing, JSA (2009)

4 Median Household Income

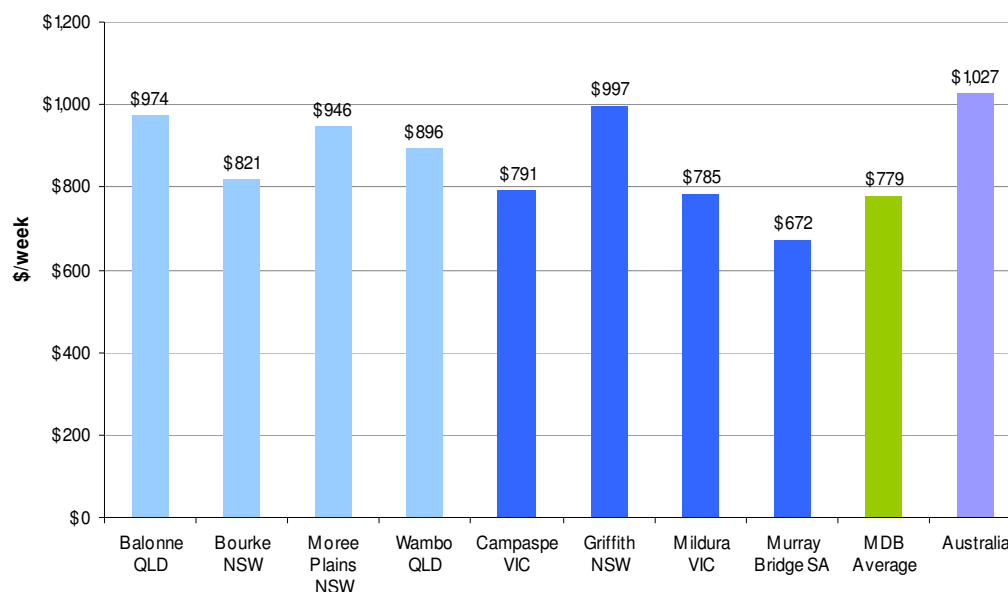


Figure 4: Median Household Income (\$ per week)

Source: ABS (2006) Census of Population and Housing, JSA (2009)

5 Disability Support Pensioners

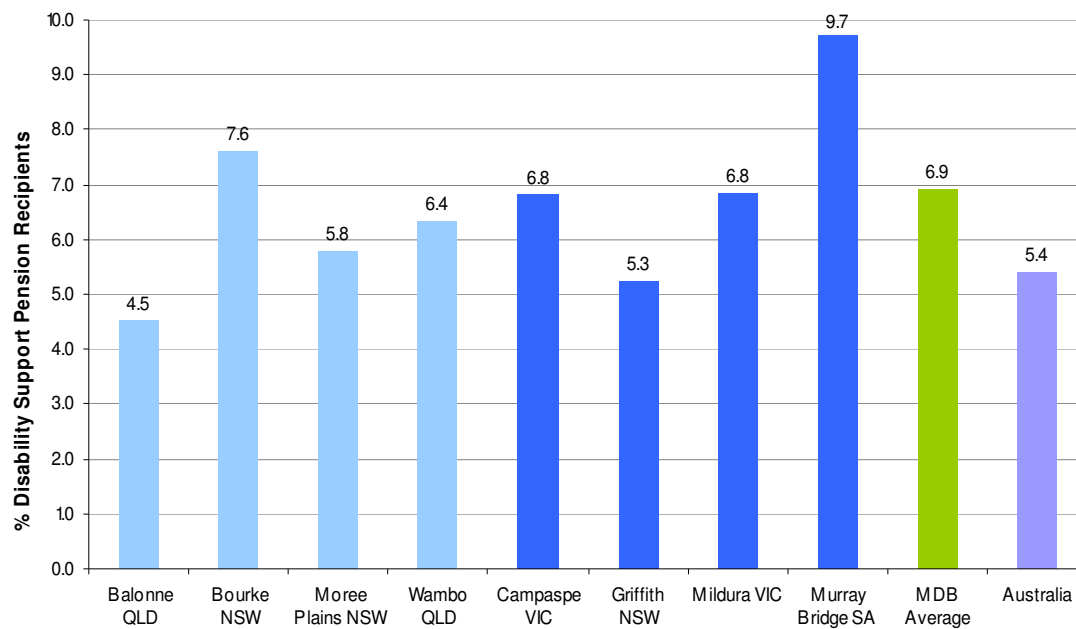


Figure 5: % of 16-64yr old females and 16-62yr old males in receipt of disability support pension

Source: PHIDU (2008), JSA (2009)

6 Profound or Severe Disability

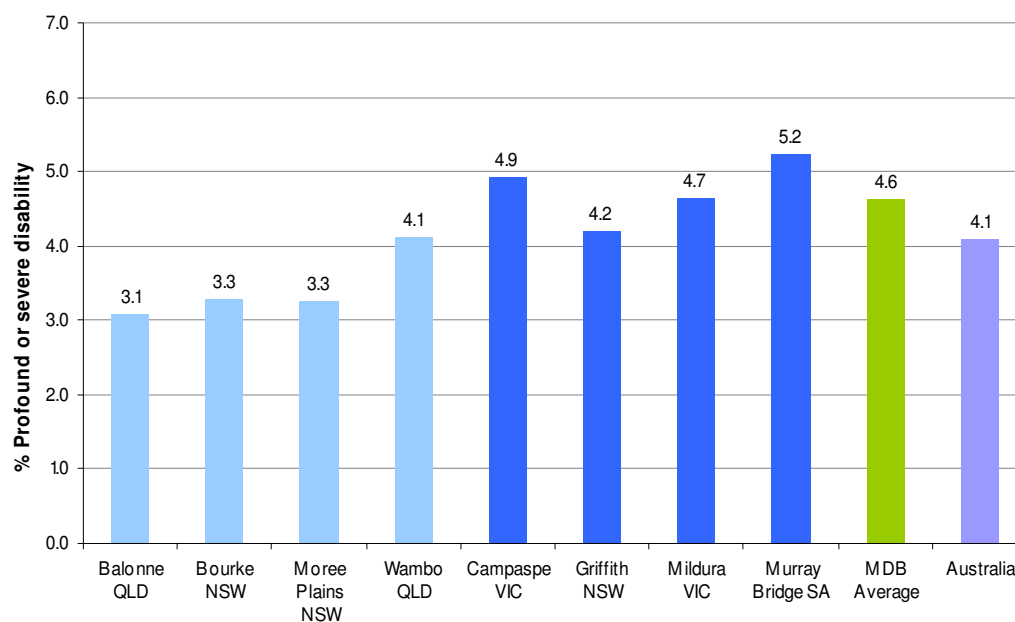


Figure 6: % Population with a profound or severe disability

Source: PHIDU (2008), JSA (2009)

7 Chronic Ill Health

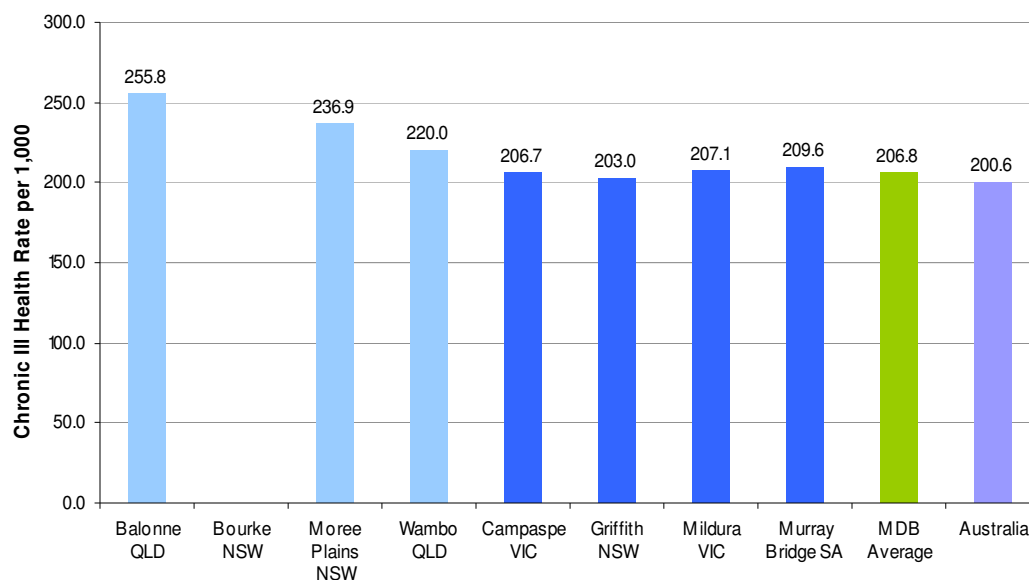


Figure 7: Chronic Ill Health Rate per 1,000 people

Source: PHIDU (2008), JSA (2009)

8 Employment Change 2001-2006

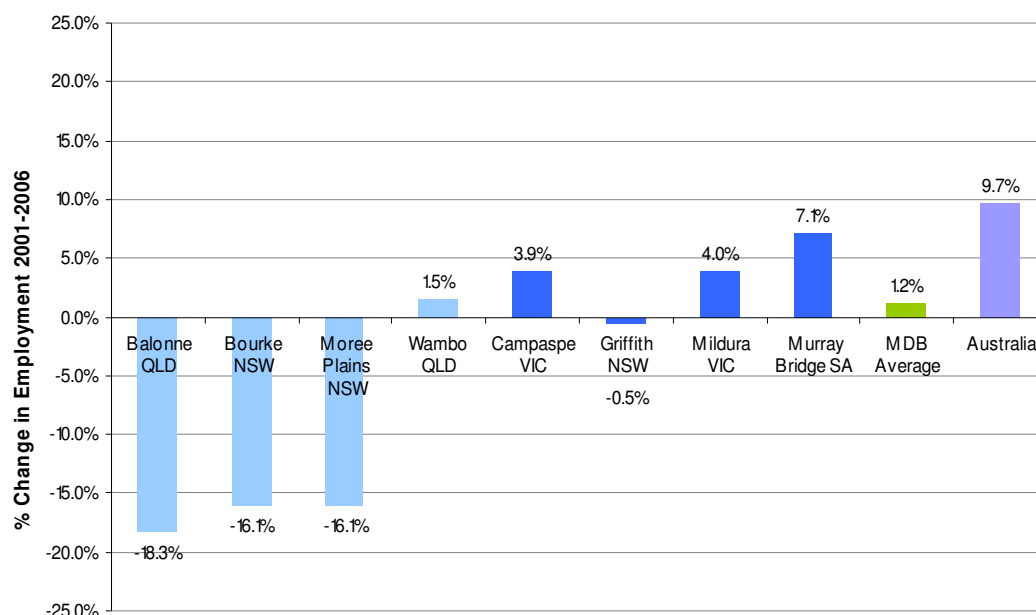


Figure 8: % Change in Employment 2001-2006

Source: ABS (2006) Census of Population and Housing, JSA (2009)

9 Labour Force Participation 65+

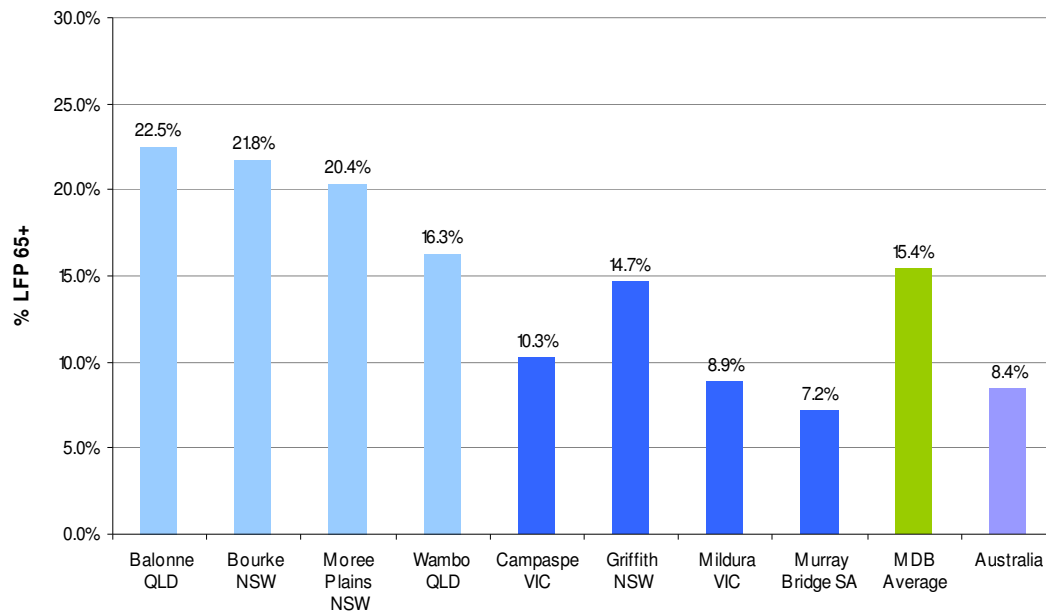


Figure 9: Labour Force Participation Rate Age 65+

Source: ABS (2006) Census of Population and Housing, JSA (2009)

10 Median Age

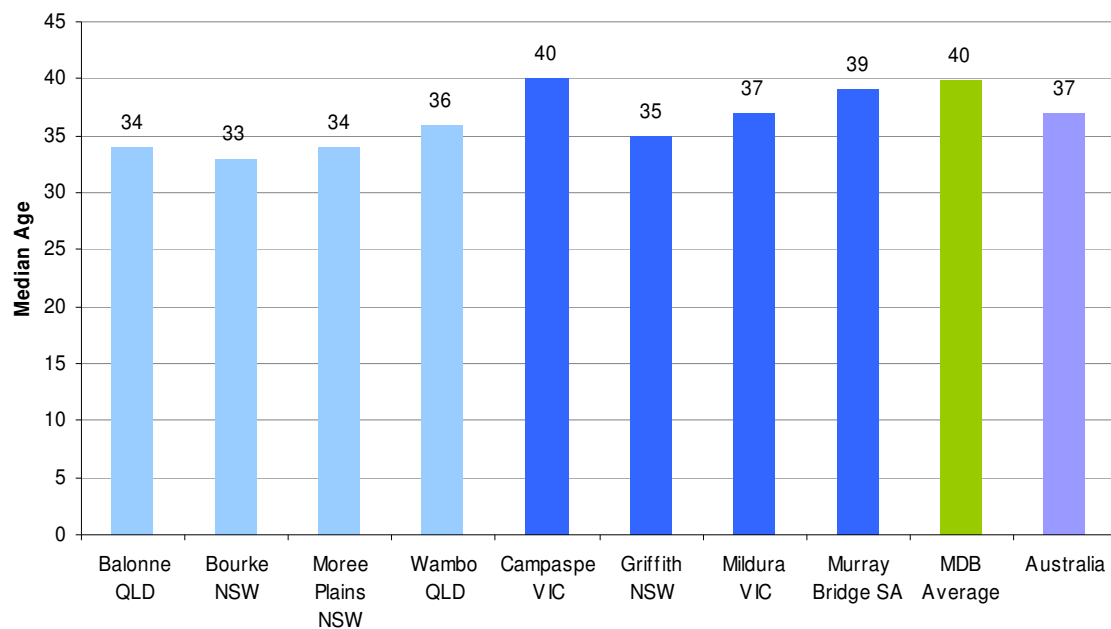


Figure 10: Median Age

Source: ABS (2006) Census of Population and Housing, JSA (2009)

11 Skills Base

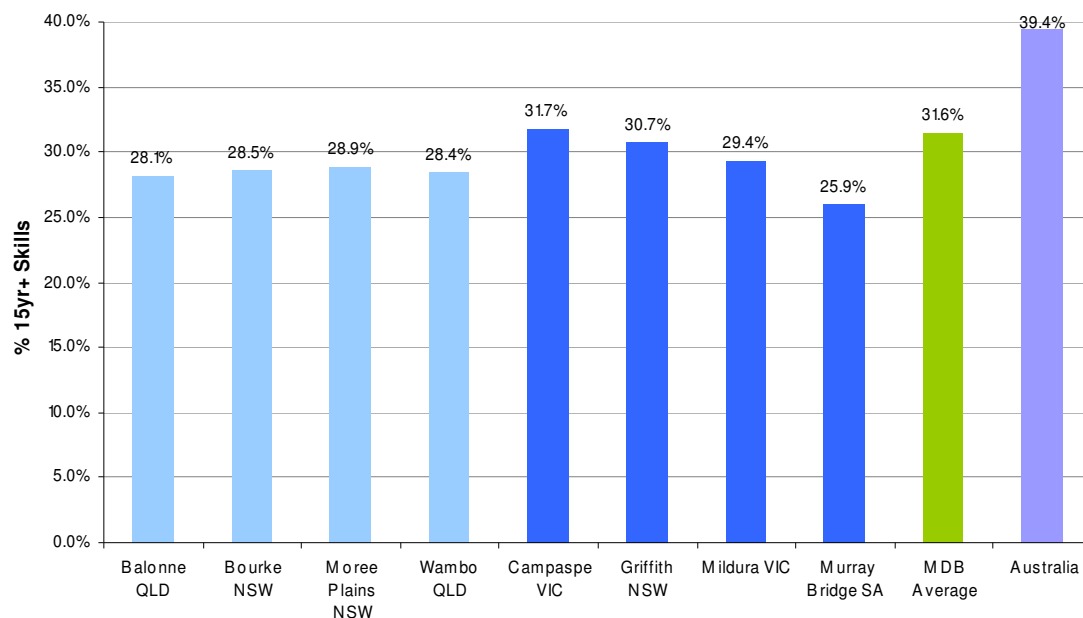


Figure 11: % Population 15+yr with Trade or Better Qualifications

Source: ABS (2006) Census of Population and Housing, JSA (2009)

12 Participation in Secondary Education at Age 16

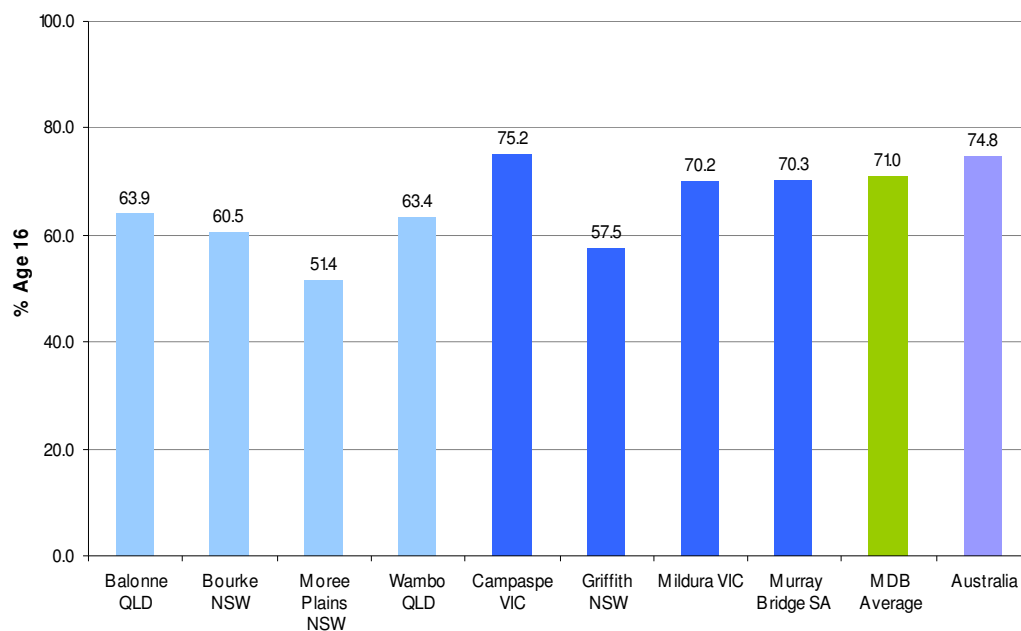


Figure 12: Secondary Education Participation Rate at Age 16

Source: PHIDU (2008), JSA (2009)

13 SEIFA Education and Occupation

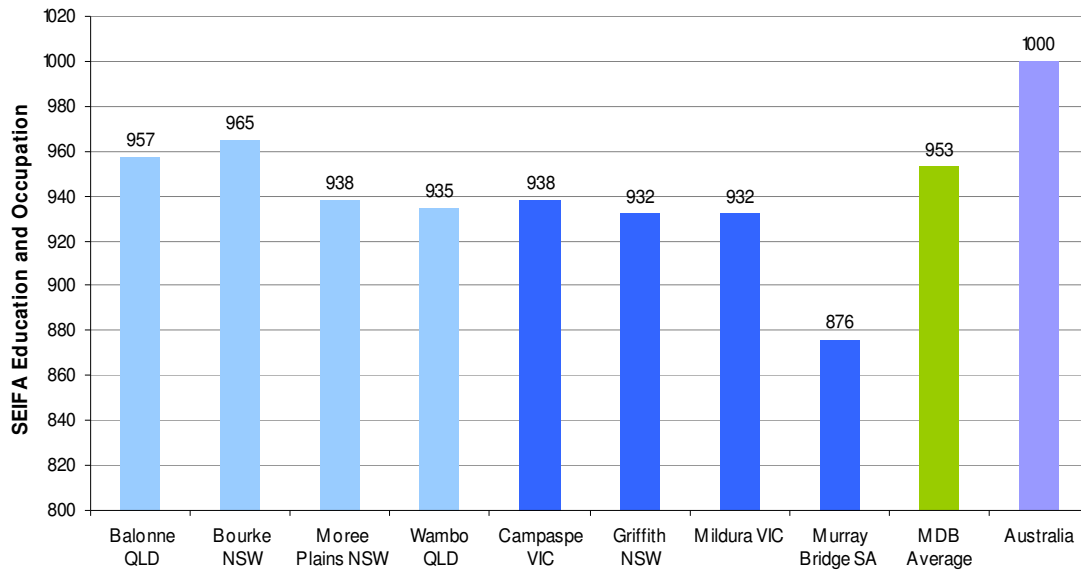


Figure 13: SEIFA Index of Education and Occupation

Source: ABS (2006) Census of Population and Housing, JSA (2009)

14 Polarisation (GINI co-efficient)

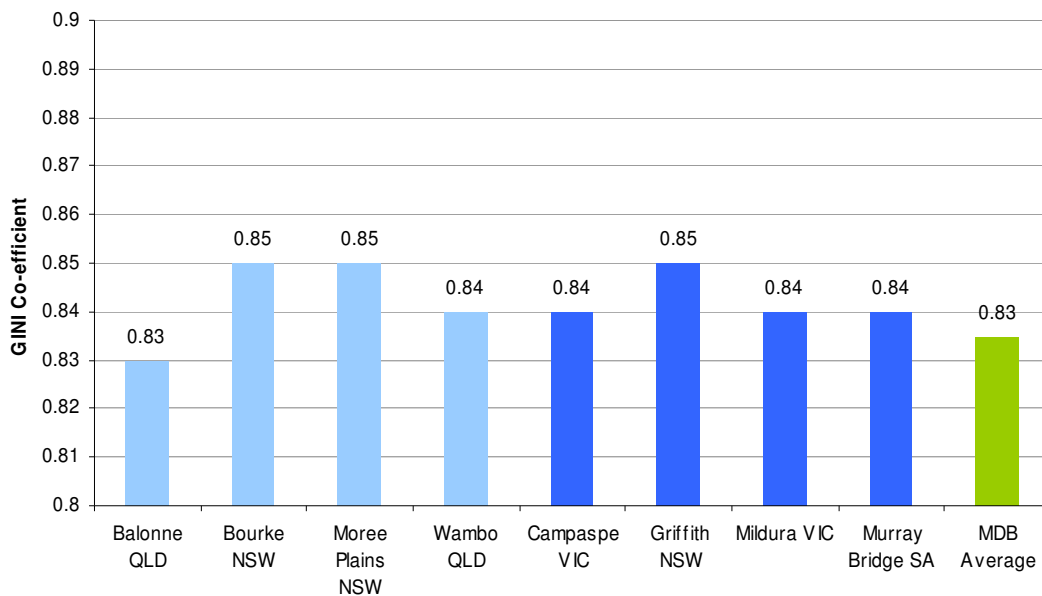


Figure 14: Polarisation (GINI co-efficient)

Source: JSA (2009)

15 Youth Unemployment

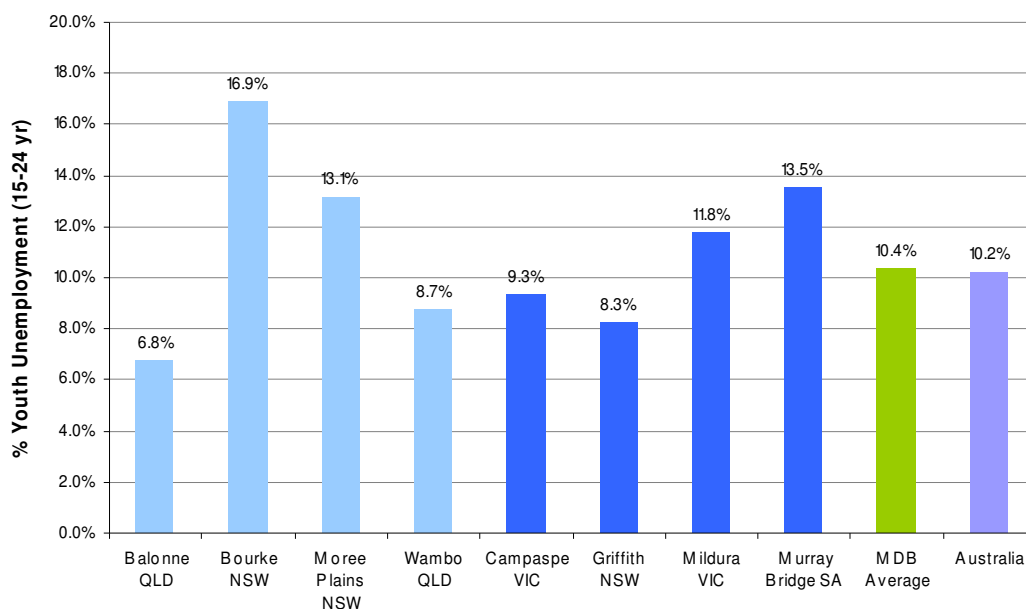


Figure 15: Youth Unemployment Rate (15-24 yrs)

Source: ABS (2006) Census of Population and Housing, JSA (2009)

16 Unemployment

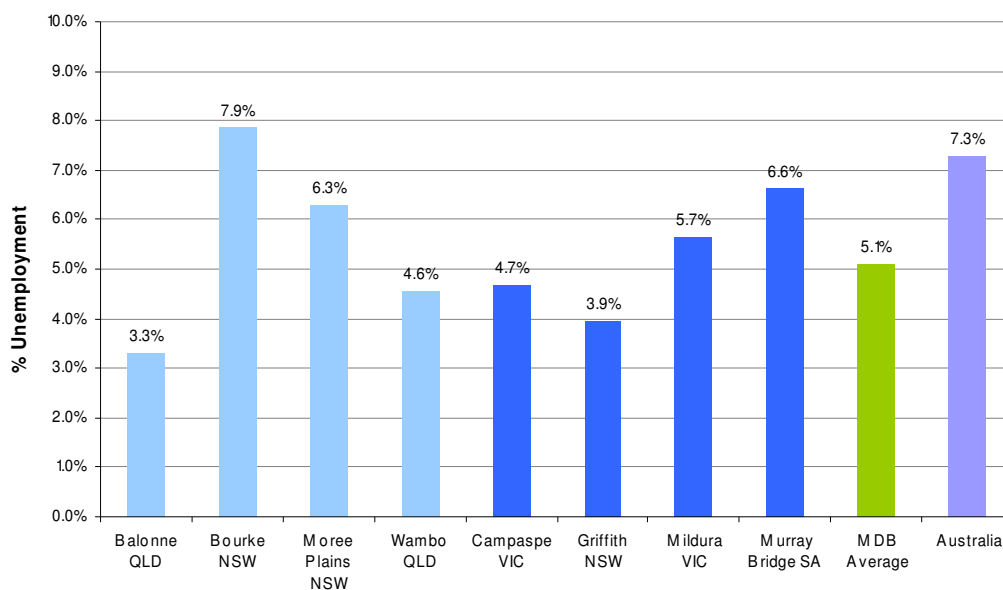


Figure 16: Unemployment Rate

Source: ABS (2006) Census of Population and Housing, JSA (2009)

17 Change of SLA 5 Years Ago

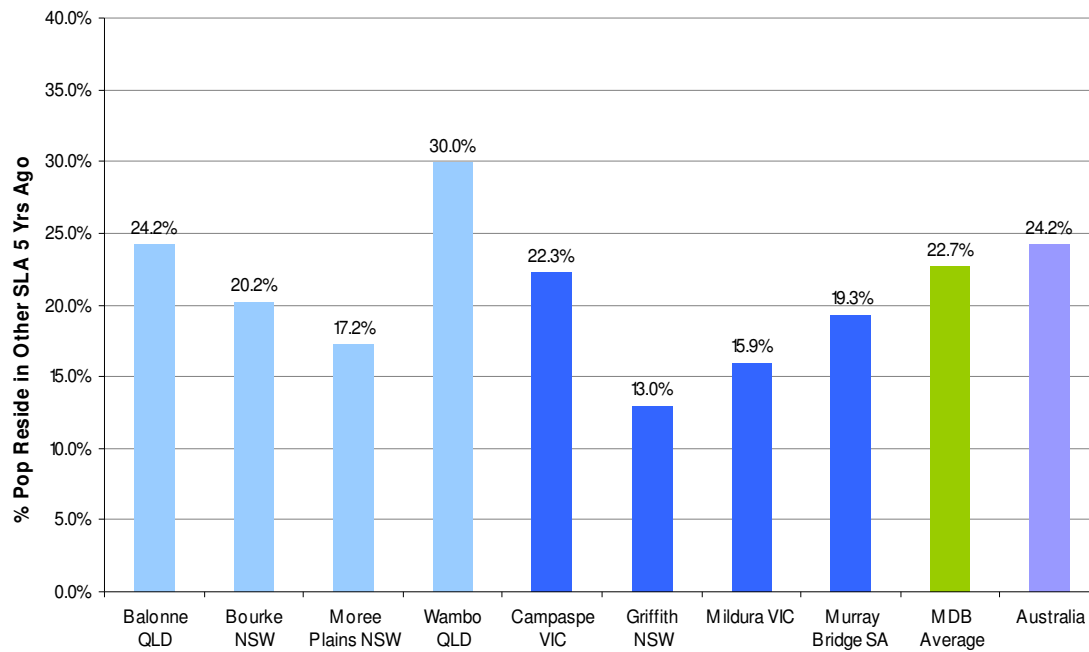


Figure 17: % of Resident Population that Lived in a Different SLA 5 Years Ago

Source: ABS (2006) Census of Population and Housing, JSA (2009)

18 Voluntary Work

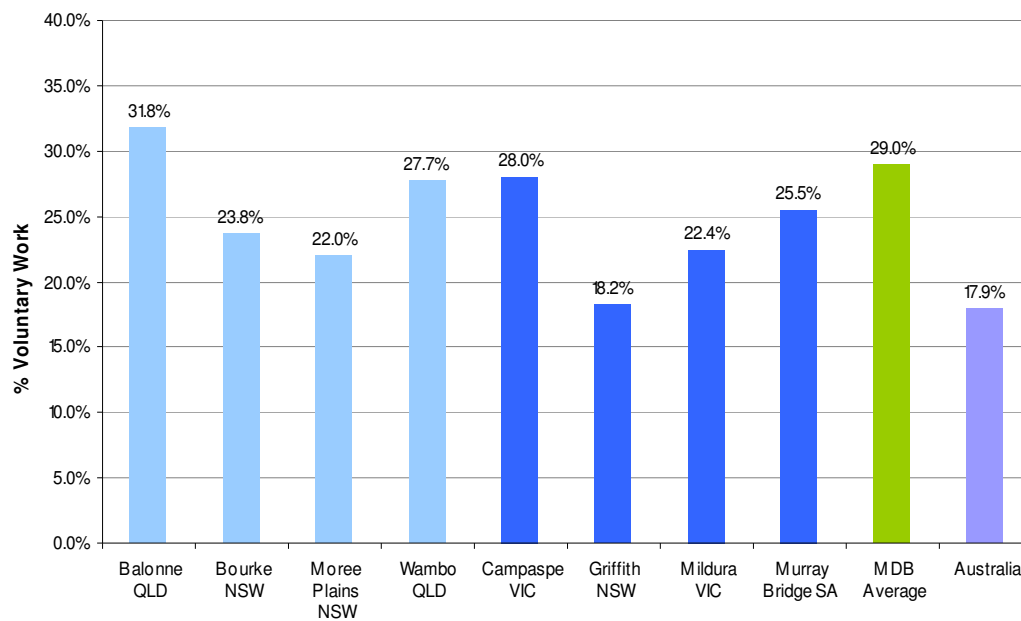


Figure 18: % Population 15+ Engaged in Voluntary Work for an Organisation

Source: ABS (2006) Census of Population and Housing, JSA (2009)

19 Selected Crime Rates (NSW Only)

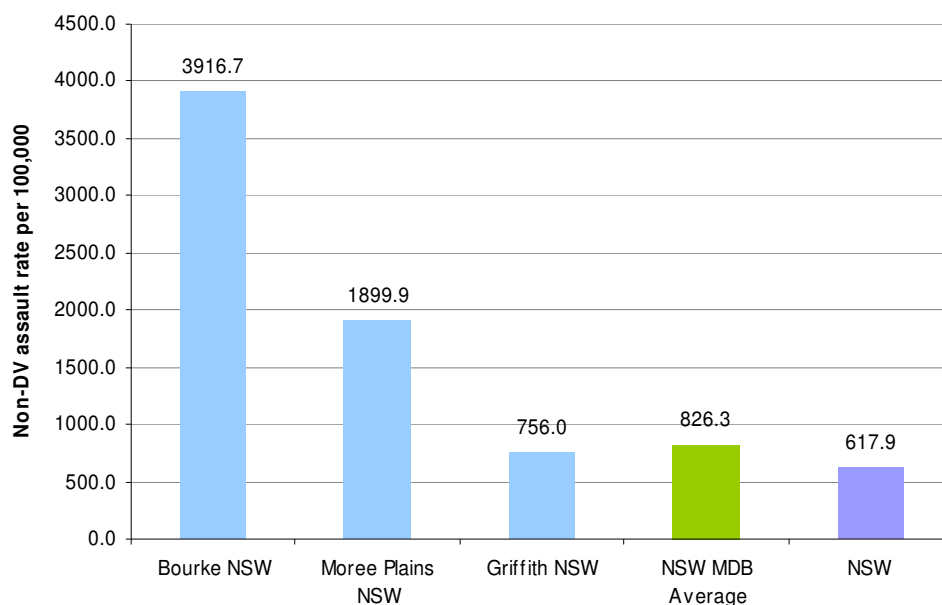


Figure 19: Non-DV related assault rate per 100,000 for 2006

Source: NSW Bureau of Crime Statistics and Research (2008) Recorded Crime Statistics 2003-2008. JSA (2009)

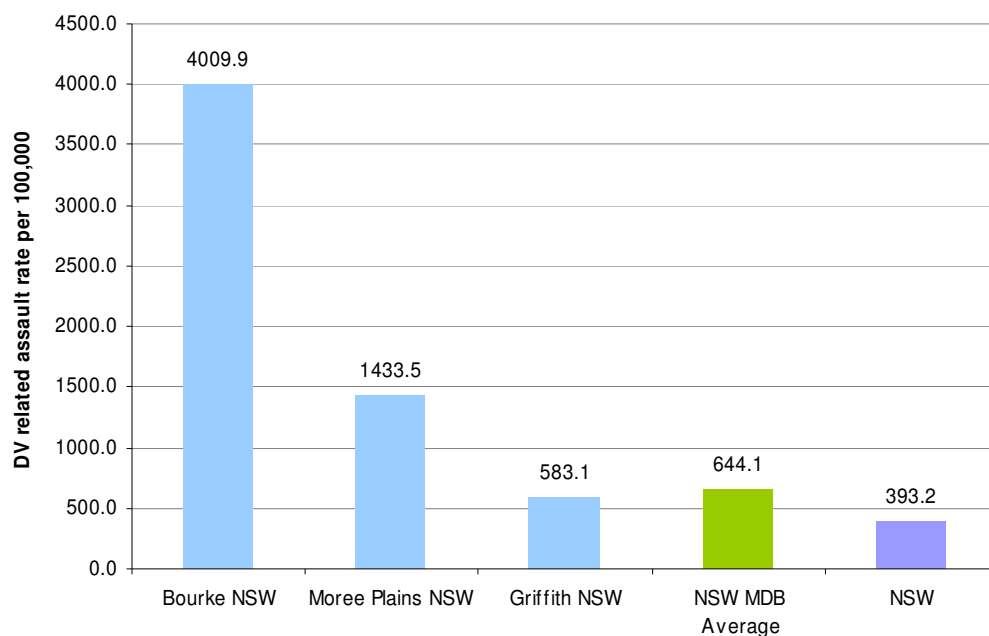


Figure 20: DV related assault rate per 100,000 for 2006

Source: NSW Bureau of Crime Statistics and Research (2008) Recorded Crime Statistics 2003-2008. JSA (2009)

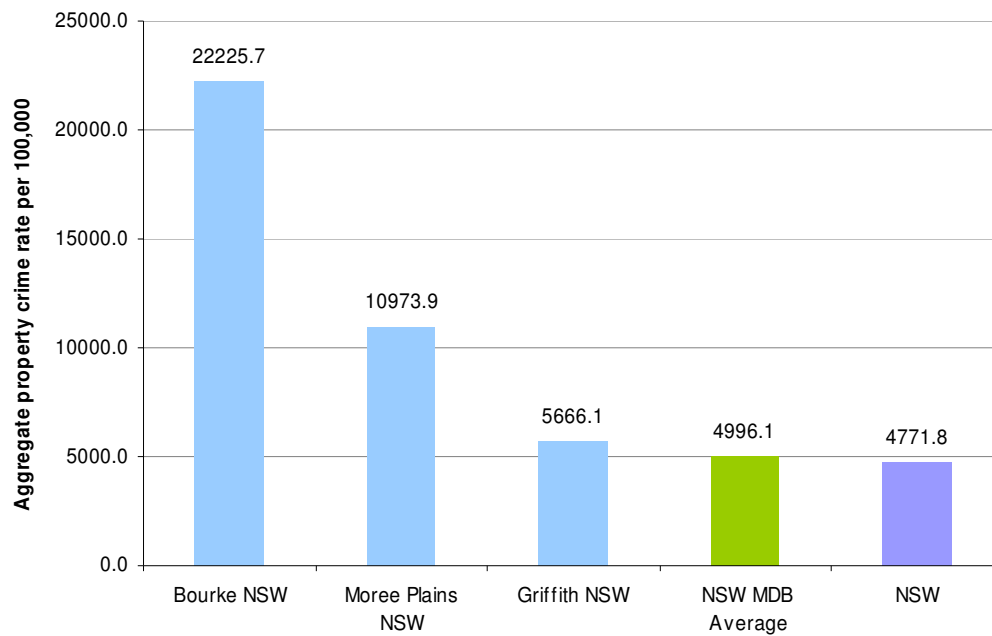


Figure 21: Aggregate property crime rate per 100,000 for 2006

Source: NSW Bureau of Crime Statistics and Research (2008) Recorded Crime Statistics 2003-2008. JSA (2009)

“Aggregate property crime” is a total value of rates per 100,000 for the following:

- Break and enter dwelling
- Break and enter non-dwelling
- Incidents of motor vehicle theft
- Steal from motor vehicle
- Steal from retail store
- Steal from dwelling
- Steal from person
- Malicious damage to property

Appendix 10: Case Study Selection Criteria



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1.5	Indigenous	3
1.6	Top 10 Agricultural Employers in the MDB by Type	3

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Table 1.1:	Case Study Community Criteria	4

1 Case Study Selection Rationale

1.1 States

As policies often vary between different states, we are interested in selecting case study areas in different jurisdictions. The 8 areas selected comprise: 3 NSW, 2 Queensland, 2 Victoria and 1 South Australia. This is also particularly important for comparison between cotton producing areas. Therefore, we have selection 2 cotton case study areas each in NSW and Queensland.

1.2 CSIRO Murray-Darling Basin Sustainable Yields Project Regions

The CSIRO has completed a series of reports through the Sustainable Yields Project which assess the current and future water availability in the Murray-Darling Basin in terms of catchment development, changing groundwater extraction, climate variability and climate change.¹ The project is based on 18 regions or catchments that comprise the MDB.

The case study communities selected include areas across 10 Sustainable Yield Regions, providing a valuable range of diversity for comparison between areas. From north to south, the case study areas fall within the following Sustainable Yield Regions:

- Wambo, QLD: Condamine-Balonne Region
- Balonne, QLD: Condamine-Balonne and Moonie Regions
- Moree Plains, NSW: Gwydir Region
- Bourke, NSW: Barwon-Darling Region
- Griffith, NSW: Murrumbidgee Region
- Mildura, Victoria: Murray Region
- Campaspe, Victoria: Campaspe Regions
- Murray Bridge, South Australia: Murray and Eastern Mt Lofty Ranges Regions

¹ For more information on the CSIRO Murray-Darling Basin Sustainable Yields Project, see <http://www.csiro.au/partnerships/MDBSY.html>

1.3 Population Size

In Report 2, JSA found that a series of ‘step-wise’ population bands provided a ‘good fit’ for the model with regards to the relationship between employment in primary industries (agriculture and mining) and general levels of employment within an area.² These population bands are:

- 1: <5,000 residents
- 2: 5,000-10,000 residents
- 3: 10,000-50,000 residents
- 4: 50,000+ residents

The 8 case study areas selected include 2 areas in Band 1 and 6 areas in Band 3. While most of the areas are in band 3, their sizes are diverse with (for example) Moree Plains at 13,975 residents and Mildura at 49,817 residents.

1.4 Remoteness Average

A ‘remoteness average’ was determined for each of the SLAs in the MDB for Report 2. These values were derived from remoteness data by Collection District (CD) provided by special order from the ABS, based on the Remoteness Structure determined for the 2006 Census as listed in the publication, Statistical Geography: Volume 1 Australian Standard Geographical Classification (ASGC), 2006 (cat. no. 1216.0). For this study, JSA ‘remoteness averages’ are classified as:

- 0 – 0.99 Major Cities
- 1.00 – 1.99 Inner Regional
- 2.00 – 2.99 Outer Regional
- 3.00 – 3.99 Remote
- 4.00 – 4.99 Very Remote

In selecting the 8 case studies, we considered whether an area had a ‘remoteness average’ of less than or greater than 2.5, the mid-point of the scale. 2 areas selected have remoteness averages greater than 2.5, and are more remote. 6 areas are less remote with values less than 2.5. Based on the nature of settlement, areas where cotton is grown are more likely to have higher remoteness values, whilst vegetable and fruit areas appear to be more likely to have lower remoteness values.

² For a detailed explanation see JSA (2009) Report 2: Quantifying the impacts of cotton production on community wellbeing across the MDB.

1.5 Indigenous

Aboriginal populations are young and often with large families compared to the general population. Report 2 found that the two major indicators of disadvantage are Indigenous population and increasing age, which are both associated with remoteness. Remote areas more likely to contain residualised populations with higher levels of aged and Indigenous residents.

We have selected case study communities that provide an opportunity to compare between areas with different Indigenous profiles. In three areas, the resident population is over 10% Indigenous. Interestingly, these are cotton areas. To provide a contrast we have included Wambo, which is a cotton areas with a lower proportion of Indigenous residents at 5%. In general, the northern part of the MDB has a larger Indigenous population (particularly in NSW) when compared to the south.

1.6 Top 10 Agricultural Employers in the MDB by Type

In order to include case study areas from a mix of agricultural use profiles, the MDB SLA areas were sorted by employment in each agricultural type (vegetables, fruit, grapes, grazing, cereals, rice and cotton) with the top 10 areas for each agricultural type recorded. Areas were selected that either had one dominate agricultural employer (eg. top 10 for cotton but no other use), or had multiple prominent agricultural employers (eg. top 10 in vegetables, fruit and grapes). We assume that areas with multiple prominent agricultural employers will have complex ‘trade-offs’ between different uses for water.

- 2 areas were top 10 agricultural employers in one type
- 3 areas were top 10 agricultural employers in two types
- 2 areas were top 10 agricultural employers in three types
- 1 area was a top 10 agricultural employer in four types

The following table provides an overview of the 8 case study areas against the criteria for selection described.

Table 1.1: Case Study Community Criteria

Area	State	CSIRO MDB SYP Catchment Area	Pop Size Band (# residents 2006)	Remoteness <2.5	Remoteness >2.5	Indigenous >10%	Top 10 Veg (emp)	Top 10 Fruit (emp)	Top 10 Grape (emp)	Top 10 Grazing (emp)	Top 10 Cereals, Other (emp)	Top 10 Rice (emp)	Top 10 Cotton (emp)
Moree Plains	NSW	Gwydir	3 (13,975)	✓		✓ (19%)					✓		✓
Balonne	QLD	Condamine-Balonne and Moonie	1 (4,625)		✓	✓ (15%)							✓
Bourke	NSW	Barwon-Darling	1 (3,095)		✓	✓ (29%)							✓
Wambo	QLD	Condamine-Balonne	3 (15,007)	✓		(5%)					✓		✓
Mildura	VIC	Murray	3 (49,817)	✓		(3%)	✓	✓	✓		✓		
Campaspe	VIC	Campaspe, Loddon-Avoca and Goulburn-Broken	3 (36,201)	✓		(2%)	✓	✓		✓			
Griffith	NSW	Murrumbidgee	3 (23,801)	✓		(4%)		✓	✓			✓	
Murray Bridge	SA	Murray and Eastern Mt Lofty Ranges	3 (17,678)	✓		(4%)	✓			✓			