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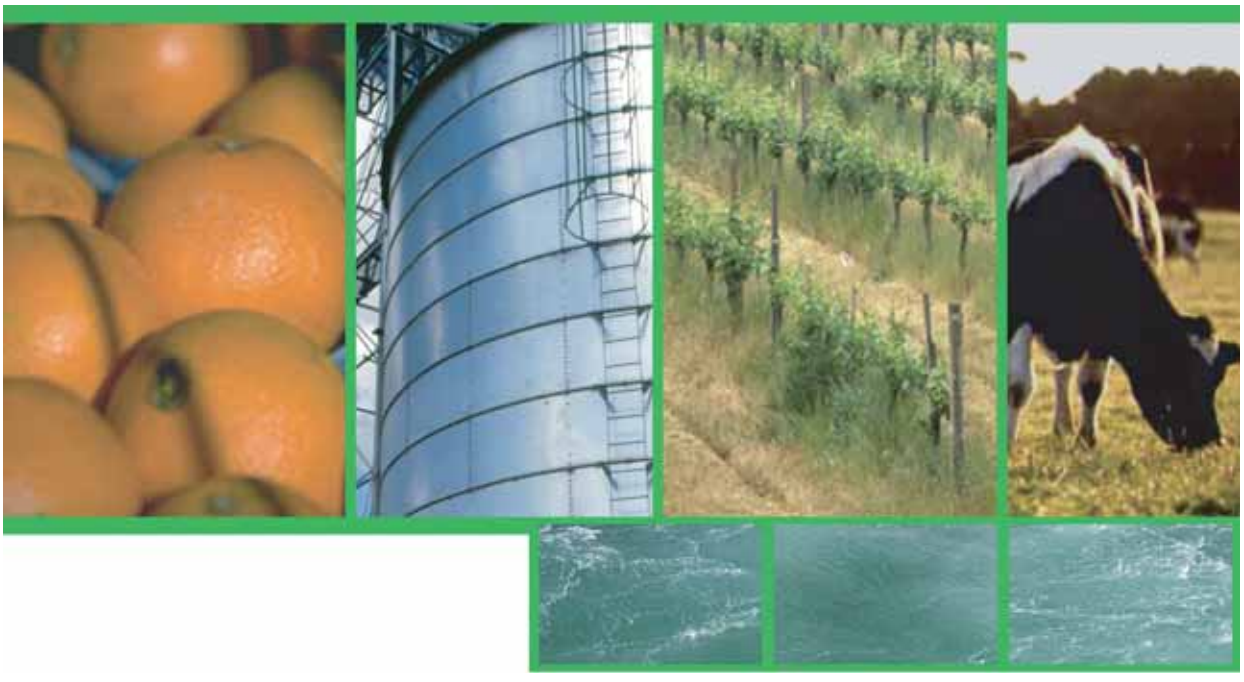
INVESTMENT TRENDS IN THE LOWER MURRAY–DARLING BASIN



Bureau of Transport and Regional Economics

WORKING PAPER 58

INVESTMENT TRENDS IN THE LOWER MURRAY-DARLING BASIN

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FOREWORD

Investment in irrigation-based industry is essential for the long-term prosperity of many Australian communities.

This paper studies the patterns of investment and production across a number of communities in the three States of the Lower Murray-Darling Basin, with a view to identifying the forces driving those patterns. In particular, the project explores the extent to which water entitlements and other factors have influenced on-farm and off-farm investment patterns.

This working paper was researched and written by Geoff Frost, Sharyn Kierce and Matt Balmford under the general direction of Dr Judith Winternitz. Leanne Johnson and Bree Cook assisted with technical advice and comments. Loretta Power from the Department of Transport and Regional Services and Colin Mues from the Australian Bureau of Agricultural and Resource Economics provided additional comments.

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I would also like to thank the Sunraysia Area Consultative Committee (ACC), the Barossa Mid North ACC and the Central Murray ACC and Executive Officers Anne Mansell, Greer Wilkinson, Gerard Herrick and their staff. These people put their regional expertise and contacts at our disposal and organised the field trips. The ability of the team to talk to the right people within regions allowed the research team to quickly come to grips with local issues and attitudes.

Tony Slatyer
Executive Director
Bureau of Transport and Regional Economics
Canberra
October 2003

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… AT A GLANCE

This report examines economic conditions and investment in irrigated agriculture and manufacturing in the horticultural regions of the South Australian Riverland and NSW and Victorian Sunraysia, and the largely broadacre rice and dairy regions of NSW and Victorian Central Murray. Key points from the analysis are:

- Agriculture and manufacturing are the core industries directly employing 35 per cent of the workforce in the regions—they and their employees form the customer base for other regional (predominantly service) industries.
- The most important manufacturing industry in all regions is food and beverage processing, which is reliant on the irrigated agricultural base.
- In the past, water reliability has shaped investment patterns, water tenure is now also an issue for investors.
- High investment in regions is associated with reliable water supplies.
- Investment (per megalitre of water) in irrigated agriculture is up to 7 times larger in regions with highly reliable water supplies.
- Investment (per megalitre of water) in manufacturing is up to 29 times greater in regions with highly reliable water supplies.
- The key factors influencing investment in the areas studied by BTRE are: water reliability and tenure of water entitlements; the ability to trade water; development histories and government policies; community and culture; and use constraints attached to land title.
- Uncertainty is the major inhibitor of investment—future investment is reliant on better water reliability and tenure.
- Government interventions such as 'the Cap', Water Sharing Plans and 'The Living Murray' proposal have brought home to irrigators the historical lack of legal security over future supplies and therefore have reduced confidence in the integrity of their water entitlements.
- Continued uncertainty about water entitlements in the irrigation industry would lead to lower levels of future investment, particularly in horticulture and dairy, where water use is more efficient, investment is higher and lead times longer.
- Improvements to reliability and tenure of entitlements that reduce the uncertainty of long-term water supplies should improve confidence, investment and long-term development of regional economies and communities.

EXECUTIVE SUMMARY

Investment is a key component in the economic health of regions—in particular, in developing and sustaining the industries that support regional economies. This report examines the general economic conditions and investment patterns in irrigated agriculture and associated manufacturing in five regions across three states: the Riverland in South Australia and the New South Wales (NSW) and Victorian sections of Sunraysia and the Central Murray region. The purpose is to determine differences in investment within and between these regions and establish the key factors shaping investment magnitude, type and distribution. As all the regions have irrigated agriculture as their primary economic focus, the project also looks at the role of current and past water administration.

The report methodology includes field interviews with a range of business, farming and development interests from within each region, coupled with analysis of available data sources. The analysis draws heavily on the Australian Bureau of Statistics (ABS) Agricultural Census 1997 & 2001, the ABS 1996 & 2001 Census of Population and Housing, Australian Taxation Office data and a range of other regional data sources. These have been used to deduce indicators of regional economic activity, including income and production as well as levels of capital stock in irrigated agriculture and manufacturing industries.

Capital stock is used in this study as a means of estimating investment, a flow parameter that we are unable to measure directly at a regional level. We have, however, been able to estimate capital stock, which is the accumulated value of investment over time less depreciation. To value capital stock in irrigated agriculture, we used locally accepted replacement values on a per hectare basis to build snapshots for 1997 and 2001. We then compared those values to provide an indication of investment flows over that period. Capital stock in manufacturing has been determined by using census industry employment numbers to derive regional estimates of non-current assets in manufacturing industry sectors from ABS survey data. The basis for these valuations is largely historical cost estimates. Again, trends in investment can be tracked using the differences between 1996–97 and 2000–01 estimates.

IRRIGATION AND THE MURRAY RIVER

Agricultural producers reliant on the Murray River in South Australia, New South Wales and Victoria face differing arrangements for obtaining water for irrigation purposes. Some key differences are the location and volume of water licences and entitlements awarded, historical legislation and conventions in entitlement and allocation, and inconsistency between states in recent reform approaches. These differing arrangements have impacted on the type of agricultural output produced. Permanent water trading has increasingly altered the geographic distribution of water entitlements within and, to a lesser extent, between states. Temporary trading, usually on an annual basis, is more common and has allowed flexibility in short-term redistribution of supplies.

In South Australia, there is (almost) 100 per cent reliability of supply, with water-use efficiency actively promoted in the face of a fixed volumetric cap. In NSW, High Security water has 97 per cent reliability of full allocation, but General Security allocation varies widely depending on the resource supply (full allocation available in 7 out of 10 years on average). General Security users need to be opportunistic, but can mitigate some of the risk of low allocations through a carryover system. In Victoria, reliability is good (96-98 per cent) for allocation of base Water Right/licence entitlement, although entitlement is generally less per hectare than in NSW and many broadacre producers depend on less reliable Sales Water.

SUNRAYSIA AND THE RIVERLAND

The Sunraysia and Riverland regional economies are growing very strongly—at rates exceeding the national average. This growth is based on high investment in irrigated horticulture and associated manufacturing. The wine grape, fresh citrus export and almond industries have been particularly buoyant. Value of production in agriculture increased by 55 per cent between 1997 and 2001 to $663 million in Sunraysia and by 79 per cent to $682 million in the Riverland.

Estimated capital stock in irrigated agriculture increased substantially in both regions between 1997 and 2001—in combined Sunraysia by 37 per cent to $765 million and in the Riverland by 50 per cent to $778 million (see Table ES.1). Manufacturing capital stock in Sunraysia rose by 49 per cent to $431 million and by 62 per cent in the Riverland to $384 million. In Sunraysia, manufacturing capital is focussed heavily in Mildura, whilst in the Riverland, investment is more evenly spread between the five population centres.

The biggest positive influence on investment in these regions has been the rapid development in response to agricultural market opportunities. It has been facilitated by deregulation of the water market, the confidence of agricultural investors in the reliability of water supplies (SA and NSW High Security, and

Water Right/diversion licences in Victoria), the use of forward contracts by processors and the confidence of local investors in their own region. The largest single negative factor impacting on investment has been the lack of available freehold land in NSW Sunraysia. This has diverted agricultural, manufacturing and private housing investment away from Wentworth Shire.

CENTRAL MURRAY

Population, economic activity and investment are heavily skewed to the Victorian side of the Central Murray (see Table ES.1). There is over four times the number of people, holding over four times as many jobs and earning over four times the gross taxable income of the NSW Central Murray. The value of Victorian Central Murray's agriculture is far larger than in NSW ($1522 million compared to $649 million) and the growth rates are higher (37 per cent compared to 28 per cent). This is despite the Victorian Central Murray being physically smaller and using about 10 per cent less water than its NSW counterpart.

The key industries in irrigated agriculture are pasture, dairy and fruit in Victorian Central Murray and rice, other cereals and grazing in NSW Central Murray. Victorian Central Murray farmers have almost twice the capital stock invested as their NSW counterparts and there is over eight times the manufacturing capital stock in Victoria as NSW.

Estimates of capital stock in Central Murray increased by 23.5 per cent in NSW and only 10 per cent in Victoria (in nominal terms, by $190 million and $166 million) for irrigated agriculture, but in manufacturing capital stock by 47 per cent and 77 per cent respectively (by $56 million and $650 million).

Our fieldwork revealed that the primary factor impacting on investment is uncertainty over water reliability and tenure. The high value permanent investment in dairy and horticulture has been attracted to the security that the Victorian system is perceived to offer and the downstream industries have followed.

In NSW, a number of factors have contributed to some recent success in attracting investment. These include improvements in the water carryover provisions and the larger lot sizes and cheaper land prices. However, in both states agricultural investment is under pressure from concerns over water tenure and reliability.

TRENDS, SIMILARITIES AND CONTRASTS IN INVESTMENT AND GROWTH PATTERNS

Manufacturing in all regions is heavily reliant on irrigated agriculture, either directly processing produce or providing inputs to it. Food and beverage processing of irrigated agricultural products is the largest component in all regions. For Central Murray, this is fruit and dairy processing; for Sunraysia and Riverland, wine and juice processing.

High investment levels are found within those areas where there are highly secure, reliable water supplies. Investment per megalitre of water in irrigated agriculture is far higher in Sunraysia and Riverland (around $3000 per megalitre compared to less than $1000 a megalitre in Central Murray). Manufacturing investment is also far higher ($1397 per megalitre in Riverland and $1703 per megalitre in Sunraysia compared to $674 a megalitre in Victorian Central Murray and only $71 a megalitre in NSW Central Murray).

Those regions where investment in irrigated agriculture is highest (Sunraysia, the Riverland and some parts of Victorian Central Murray) are also the regions with:

- the best performing overall economies (highest populations, the highest real gross taxable incomes and growth rates and the most people employed in almost every sector of the economy); and
- the highest productivity (the highest value of agricultural production with lower overall water use; high and growing manufacturing investment, greater production and investment per megalitre of water used).

This pattern strongly links investment in irrigation industries to the overall well being of the communities they support. This association of strong economies and strong communities was confirmed in our fieldwork discussions. The Riverland and Sunraysia communities are strong, outwardly looking communities ready to face difficulties and grasp opportunity. This is also true for much of Victorian Central Murray. By contrast, communities in NSW Central Murray tend to be more subdued and struggling with changing economic circumstances.

TABLE ES. 1 SUMMARY OF PERFORMANCE BY REGION

	NSW Central Murray	*Vic Central Murray*	*NSW Sunraysia*	*Vic Sunraysia*	*Riverland*
Population (persons, 2001)	31 220	132 591	7 078	49 283	33 546
Population growth 1991–2001 (persons)	500	6 232	-184	5 175	436
Area (km^2)	26 187	22 652	26 273	22 082	20 952
Irrigated area 2001 (km^2)	3 394	3 774	93	244	337
Real gross taxable income ($M, 1999–2000 in 01–02 $)	399.3	1757.3	80.6	621.5	457.2
Unemployment Rate (01–02)	3.9%	5.5%	9.0%	7.7%	6.7%
Agricultural/mining employment (persons, 2001)	3 877	10 747	904	3 677	4 168
Manufacturing employment (persons, 2001)	936	7 396	223	1 911	1 734
Infrastructure employment (persons, 2001)	1 361	5 970	310	2 288	1 269
Services employment (persons, 2001)	6 350	28 585	1 385	11 607	7 029
Total employment (persons, 2001)	12 524	52 698	2 822	19 483	14 200
Irrigation water use (ML, 2001)	2 455 603	2 217 828	70 619	182 796	274 785
Irrigation water use per person (ML/person, 2001)	78.7	16.7	10.0	3.7	8.2
Agricultural value of production ($M, 2001)	648.85	1522.45	138.29	524.92	682.36
Change in agricultural value of production ($M, 1996–2001)	142.32	410.54	37.08	197.29	301.96
Agricultural capital stock ($M, 2001)	999	1 818	200	565	778
Agricultural capital stock per water used ($/ML, 2001)	407	820	2833	3092	2831
Change in agricultural capital stock ($M, 1997–2001)	190	166	69	136	261
Manufacturing capital stock ($M, 2001)	174	1 495	47	384	384
Manufacturing capital stock per water used ($/ML, 2001)	71	674	671	2102	1397
Change in manufacturing capital stock ($M, 1997–2001)	56	650	29	184	147

Source Various—see Chapters 2, 3, 4 and 5.

FACTORS IMPACTING ON INVESTMENT

Water reliability and tenure

Investors in Central Murray are clear that reliability and tenure of supply is the most important factor in determining the location of industry. The relatively high investment dairy and horticulture industries are heavily concentrated on the Victorian side, whilst NSW, which largely operates on General Security water, is characterised by opportunistic annual cropping and grazing with relatively low fixed costs and investment. The evidence in Sunraysia and the Riverland is more equivocal, but our analysis suggests that water reliability and security of water entitlement tenure are already shaping investment and in fact may be the most important factors of all.

The high investment industries are concentrated in regions of high water supply reliability (Victoria, South Australia or NSW Sunraysia). This has been the key factor underpinning overall investment patterns.

Introduction of water trading

The ability to permanently purchase water from other regions has led to the establishment of new developments in the Riverland, Victorian Sunraysia and western Central Murray. This has been at the expense of broadacre irrigation in Victorian Central Murray in particular. Temporary trading has allowed users to opportunistically access additional supplies. In both cases, the existence of temporary trading has given irrigators greater strategic control of a major productive input and led to increased investment and returns.

Development history and government policies

The momentum built up by historic investment patterns is a key factor in all regions. In the NSW Central Murray, the effects of the establishment of irrigation systems and the lack of drainage that effectively excluded the establishment of horticulture continue to be felt long after the policy changed. Similarly, the historical development of dairying in the Victorian Central Murray has created an institutional legacy that supports continued investment. Of course existing institutions and infrastructure can also support new market trends. For example, the history of vines and fruit in Sunraysia and the Riverland have assisted the recent expansion of these industries in response to market signals.

Investment is also hindered by the sheer complexity of the different state water supply arrangements, which are overlayed with Basin-wide and national policies and priorities. Information on the administrative differences,

uncertainties and accepted practices in the various systems is not readily available, although recent Murray-Darling Basin Commission (MDBC) publications are beginning to remedy this situation. Alongside water supply arrangements, there is a similarly complex array of drainage arrangements that vary from area to area. Separate administrative systems address salinity and other water quality issues. Investors obviously face a huge task in properly informing their decisions.

Community and culture

In all regions, the question to locals 'Why do you invest in this region?' is almost unanimously met with the simple answer 'because we live here'. This response reflects an amalgam of local and state loyalties, community, family and cultural ties and presumably self-interest in promoting the region in which they live. 'Sticking to what you know' is an important risk-minimising strategy.

Land use constraints attached to land title

An important issue in NSW Sunraysia is the combination of restrictions on land use and crops able to be grown under Western Lands Lease title and the risk of native title claims. This has, until very recently effectively precluded increased development in irrigated agriculture. Recent court decisions will aid resolution of this issue, but ongoing problems with conversion of Western Lands Lease to freehold may continue to delay development.

Other factors

Other factors influencing investment include:

- physical factors (water infrastructure, other infrastructure, soils and climate, location, serendipity, land prices and availability of larger lot sizes);
- human factors (labour availability, local knowledge, social capital, demographics, the presence of urban and lifestyle investors);
- industry and commercial factors (agglomeration effects, contracts and guarantees, marketing structures, processors' sourcing strategies); and
- general economic conditions and context (overall market conditions, access to finance, government charges and intervention strategies).

THE IMPORTANCE OF UNCERTAINTY

Investment is reliant on the expected magnitude of returns to the investor, the timing of costs and returns and the risks to them and the capital itself. Most investment is the result of decisions made on the basis of explicit or implicit

analyses of costs and benefits by investors and lenders. Uncertainties in these calculations create difficulty and demand higher returns in compensation—the more uncertain the outcome, the higher the return on capital needs to be and the longer the timeframe, the more uncertain the predictions.

Uncertainty is the underlying determinant of investment in irrigated agriculture, on which the communities in all the regions visited depend. Investors in irrigation focus heavily on risk. In all regions uncertainty pervades the thinking of investors and shapes the amount and distribution of their investments. Risk management focuses on servicing markets for irrigation products and securing water supply. There are a number of strategies adopted including: forward sales contracts; securing freehold land title; holding water entitlements excess to immediate needs; investing close to home; preference for highly reliable water supplies; and minimising capital invested where water reliability is less certain.

Investment and growth with continuing uncertainty

The drought placed pressure on supplies to all Central Murray producers in 2002–03 and the low levels of the major storages threaten an even worse result in 2003–04. Producers, however, generally regard water shortages due to drought as a natural risk to be managed, with few lasting implications for the long-term outlook or investment decisions.

Of more concern for producers is sovereign risk, with concerns surrounding the ability of the various supply systems to meet their long-term requirements in the face of increasing demands for water for other (particularly environmental) uses. Speculation over the long term worth of water entitlements in the context of the push for more water to be used for the environment looms as the largest issue likely to impact investment in the long term.

In NSW, the effective reduction due to 'the Cap' has reduced confidence and caused some to question the security of tenure of their water entitlement. South Australian producers appeared more confident that their entitlements were secure under the Murray-Darling Basin Agreement. However, the recent 35 per cent decrease in the announced allocation for 2003–04 may have shaken that confidence. In Victoria, producers are aware of pressure on the Victorian Government for competition reforms in the water industry and fear that they will be adversely affected.

Irrigators in all states argue that the lack of certainty associated with current systems is already having a dampening effect on their investment and will continue to impact into the future. The possibility of up to 1500 gigalitres being withdrawn from irrigation uses under the Living Murray Initiative figures highly in the forward planning of many irrigators. Others are more concerned

that this initiative is just one more step in an ongoing process that continuously reduces their water use. They argue that they will be asked to make even more cuts under the Living Murray Initiative with no guarantee that they can count on the new lower levels into the future.

If cuts in water use are made, the short- to medium-term water use reductions will impact on dairy, and pasture-based regions of the Central Murray rather than in existing horticultural regions. This reflects the high gross margins in horticulture. If interstate trading is freely available, the rice and pasture-based NSW Central Murray may also be affected.

The long-term impact on investment will be more widely spread across industries. Long-term investment calculations are based on overall profitability (including allowances for risk), not gross margins. Additionally, if there is an expectation of continuing cuts into the future, the greater uncertainty will result in lower levels of investment. The impact of this will be much larger in the horticultural and dairy industries, where investment is higher and lead times longer. Conversely, low investment broadacre cropping and grazing enterprises typical of the NSW Central Murray will be favoured. Unfortunately, these are the industries that are least able to sustain regional economies and communities and are the least efficient users of water.

IMPLICATIONS

The findings of this report, particularly the importance of security of tenure and reliability of supply to investment indicate the potential benefits of strengthening certainty in water entitlements, and improving the trading system for these entitlements.

This would reduce uncertainty surrounding the key input of water in its own right and therefore add to investment. It would also allow the expansion of water trading across state boundaries, enabling industry to build on the efficiencies gained through the introduction of intrastate trading in the 1990s.

Our fieldwork indicates that longer-term investment decisions are already being adversely influenced by the uncertainties of the current water debate.

CHAPTER 1 INTRODUCTION

REPORT OUTLINE

This introductory chapter provides some information on the project background, policy context, objectives, approach, data sources and method. Chapter 2 describes the regions under investigation, the Murray River system, and outlines the current state of play with respect to the administration and supply of water, including water property rights, allocation histories, the Murray-Darling Basin Commission (MDBC) and the Council of Australian Governments (COAG) water reform process. Chapter 3 describes case study results for the Sunraysia and Riverland areas by examining the economic performance, observed investment patterns and factors impacting on investment. Chapter 4 does the same for the Central Murray region. Chapter 5 contains regional comparisons of performance and investment across the Sunraysia, Riverland and Central Murray regions. Chapter 6 concludes by summarising the key factors influencing investment.

BACKGROUND

Investment is a key component in the economic health of regions—in particular, in developing and sustaining industries providing employment and underpinning regional economies. The reasons for the geographic distribution of investment are not well understood in Australia. It has been suggested that it is influenced positively by factors such as existing community and industry regional infrastructure, social and human capital, availability of suppliers and markets, government institutions and programmes. It is also contended that land tenure and native title claims, lack of clarity in rights to use water and other natural resources, limited networks, negative perceptions, poor communication and lack of regional entrepreneurs may be factors that inhibit regional investment.

Obtaining good information on geographic investment patterns is difficult and identifying and substantiating underlying causes even more so. It may also be difficult to generalise as to the reasons behind investment decisions as they may vary across locations. We have taken a specific focus on investment in irrigated agriculture in the primary region for such activity—the lower Murray-Darling

Basin (MDB). As this region has irrigated agriculture as its primary economic focus, the project includes an examination of the role of current and past water administration and property rights.

Irrigated agriculture in Australia has undergone considerable change and investment over the last decade. For example, the area of irrigated agricultural land in Australia has increased by 26 per cent in the last 20 years (NLWRA 2001b)[1]. Investment and development in irrigation areas will depend on a variety of factors, one of the most important being the dependability of water supply.

About two-thirds of Australia's agricultural production from irrigation is derived from the MDB. The Basin extends from north of Roma in Queensland to Goolwa in South Australia, including half of Victoria and three quarters of New South Wales. Over two million people live in the MDB, and another million people outside the Basin are heavily dependent on its water. The value of irrigated crops in the Basin is about $3 billion per annum, with significant levels of that production for export. The food processing sector, is heavily dependent on primary production from these irrigation areas (MDBC 1999a).

The total area of crops and pastures irrigated in the MDB is 1 472 241 hectares. This is 71.1 per cent of the total area of irrigated crops and pastures in Australia (2 069 344 hectares). Some 70 per cent of all water used in Australia is used by irrigation in the MDB. The Basin generates about 40 per cent of the national income derived from agriculture and grazing. It supports one quarter of the nation's cattle herd, half of the sheep flock, half of the cropland and almost three-quarters of its irrigated land.

Given the importance and recent growth of irrigated agriculture and the investment associated with this expansion, a number of areas of the lower MDB were selected by the BTRE for study. The irrigated agriculture industry has a large number of participants and potential investors so that there is less potential for a few big investors to overly influence outcomes. This study of investment along the Murray River in the lower MDB, aims to determine if investment patterns differ between regions and states and tries to identify any underlying factors driving these differences.

Figure 1.1 illustrates irrigated areas of Australia in 1997 and, in particular, the significance of the MDB. Within the Basin, the importance of irrigated agriculture in the Sunraysia, Riverland and Central Murray regions along the Murray River is evident. In Sunraysia and Riverland, horticulture is the main irrigation activity, whereas the Central Murray region is more concentrated on dairy and cereals interspersed with significant areas of horticulture.

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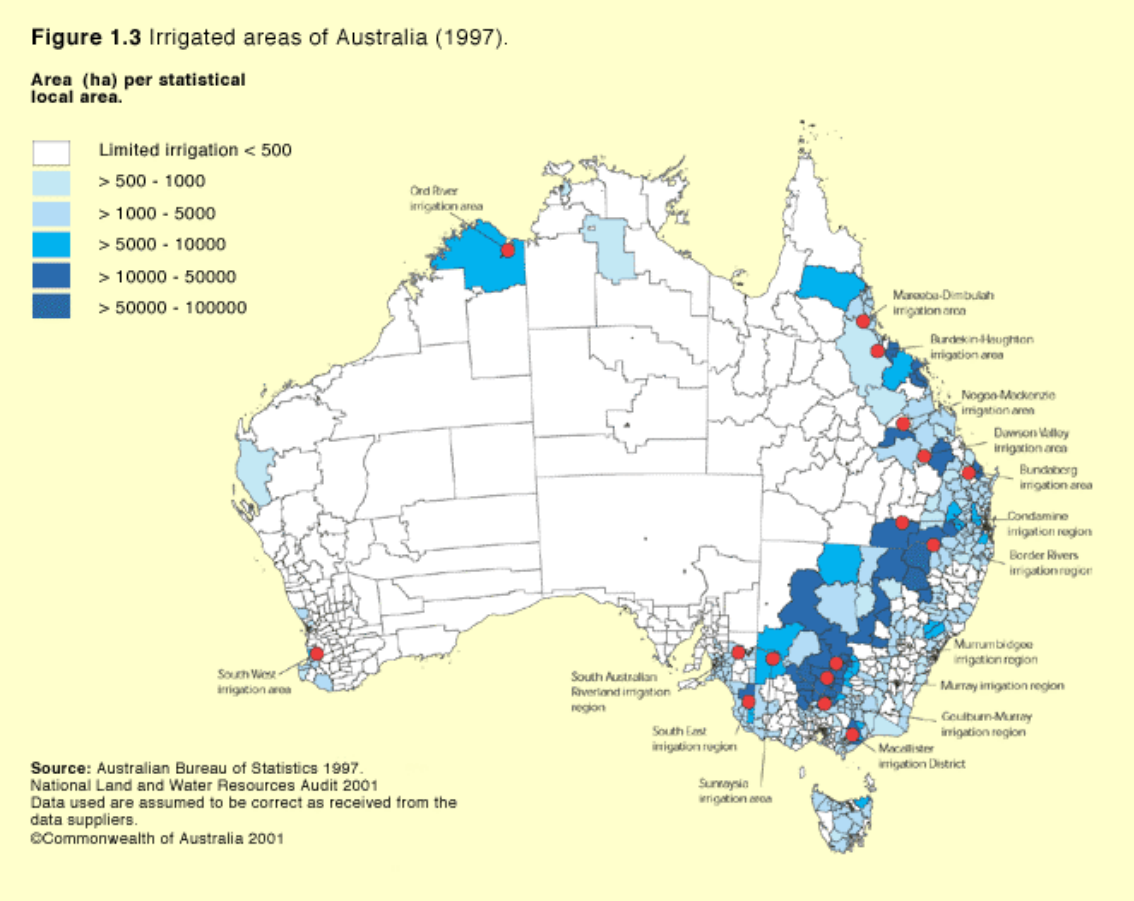
[1] The following paragraphs draw heavily on the Murray-Darling Basin Commission (MDBC) website that can be found at http://www.mdbc.gov.au.

FIGURE 1. 1 IRRIGATED AREAS OF AUSTRALIA



Source http://www.mdbc.gov.au.

POLICY CONTEXT

This research will inform Government policy in two key areas: regional development policy in general and more specifically natural resource management policy. The last ten years have seen significant and ongoing changes in the way Australia manages its natural resources—the focus of this change has been the move towards sustainability, in particular, environmental sustainability. Sustainable use of natural resources is a cornerstone of economic activity in many of Australia's regions (directly and through flow-on effects), in particular agricultural and tourism activity. The ongoing changes in natural resource management are impacting on the way many regional businesses operate, and this flows through to the broader regional community. This research assists governments to consider the impact of policies together with the needs and abilities of regional communities in adjusting to new natural resource management regimes.

Reports that on-farm irrigation investment and the value of related production activities are relatively lower on the New South Wales side of the Murray River border region compared to Victoria form the background to this research. One

of the aims of this study is to trace this spatial investment pattern and the reasons for it. One major reason may be the existence of less secure or unreliable water property rights in New South Wales (Anderson 2003, p. 25). In an environment of relative scarcity and competing water demands, it is important to understand the potential role and efficacy of water property rights and related water trading systems in promoting efficient water use and economic development.

Objective

Within this context, the study will assist in the further development of the water policy reform process and regional development policy more generally by addressing the important question:

> *Do significant differences exist with respect to investment and production activities between the relevant States of the Lower Murray-Darling Basin, and if so, what are the key factors driving these differences? To what extent do water property rights influence investment patterns?*

The project explores the extent to which water property rights and other factors, have influenced on-farm and off-farm investment patterns in the Lower Murray-Darling Basin.

APPROACH AND METHOD

The nature of the research question and the anecdotal evidence meant that a case study approach was most appropriate. Preliminary evidence suggested the Sunraysia (NSW and Victoria) and Riverland (South Australia) areas as good potential case studies. However, further investigation revealed that there were some unique local characteristics of those regions which led the project team to broaden the area of research to include the NSW and Victorian Central Murray region further upstream.

As a result, this research focuses on two broad case study regions which essentially cover the Murray River border area from approximately downstream of the Barmah Choke to the Riverland region in South Australia. These case studies explore the possible links between on-farm and related investment patterns and the factors underlying these patterns (including the types of water property regimes that exist).

Information sources

The high dependence of the chosen regions on irrigated agriculture necessitates a strong focus on these industries. However, an understanding of the overall

regional investment picture is also important, so off-farm investment and investment in other industries are also examined.

Information and data on these current investment patterns is scarce, particularly at the small area level. As a result, a number of proxy or indicative data are used to provide an insight into investment patterns. Four primary information sources are used throughout this paper:

- Industry of employment data (place of enumeration) from the Australian Bureau of Statistics (ABS) 2001 *Census of Population and Housing*. This data measures employment by industry using the Australian and New Zealand Standard Industrial Classification (ANZSIC). Various levels of industry detail are used to examine statistical local areas (SLAs) within the case study regions.
- 2001 ABS *Agricultural Census* data. The latest data applies to the year ended 30 June 2001 and provides key information on physical production and trends over time, including area sown, area irrigated and value of production by major crop types by SLA. There is a specific irrigation component to the survey, which allows for comparisons of irrigation in 1997 and 2001.
- Qualitative and quantitative information gathered during field trip interviews with key stakeholders. Insights gained from local observation are critical to ensure accurate interpretation of data.
- Literature review—a range of background studies on water property right regimes, water trading and irrigated agricultural production are used to identify the broad parameters of water property regimes and existing levels of economic activity.

Method

In order to undertake the study as efficiently as possible, the main method employed was rapid rural appraisal[2] of relevant information and analysis based on well-targeted fieldwork and official agricultural and other financial data.

Fieldwork

Interviews and fieldwork in the study regions formed an integral component of this research. The project team was fortunate in having access to the Area

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[2] Rapid rural appraisal refers to a range of investigation procedures that rely primarily on expert observation coupled with semi-structured interviewing of stakeholders and officials for the cost-effective collection of data in a short time period. See Montreal Process Working Group (1998) http://www.mpci.org/other/portland/rra_e.html.

Consultative Committee (ACC) network[3] (which is administered by the Department of Transport and Regional Services). The three ACCs covering the study region were instrumental in facilitating this process—they are the Barossa Riverland Mid North ACC, Sunraysia ACC and Central Murray ACC. Through the ACC network, the team were able to successfully identify the relevant key stakeholders and face-to-face interviews with these people allowed the team to get a grasp of the current situation in the regions very quickly. The ACCs assistance in organising these consultations and in providing an introduction to the people involved proved an extremely valuable resource.

Participants for the fieldwork interviews were chosen with the aim of attempting to cover a broad cross-section of relevant stakeholders. However, the short timeframes limited the number of people that could be involved. Key stakeholders interviewed during the project included: ACC Executive Officers and nominated ACC members, regional industry associations, tourism bodies, regional development agencies, Australian Bankers Association, banks and other lenders, local councils, irrigation scheme managers, industry experts, Australian Property Institute, land and water valuers, and farmers (irrigators).

The questions asked during the fieldwork covered the following areas:

- economic activity and investment levels;
- irrigation arrangements and status of water property regimes and local regulations;
- factors influencing investment decisions;
- elements of risk and uncertainty from a financial lending and business investment perspective;
- on-farm information regarding major crop types, industry trends, water use, on-farm investment requirements etc; and
- demand and price levels for irrigable land and water entitlements.

Investment and capital stock

'Investment' is not an easy concept to define or measure. Whilst the common understanding of the term is capital spent in order to gain long term returns, there are differences in the interpretation of what is regarded as investment in an economic sense compared to the financial context. Economics defines investment as the act of incurring an immediate cost in the expectation of future rewards (Dixit & Pindyck 1994, p. 3). Investment can be easily confused with costs of production. This is especially so where investment is in capital goods that are themselves used up in the production process. In addition, financial

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[3] ACCs are non-profit, community-based organisations funded under the Regional Assistance Programme, an Australian Government Initiative. There are 56 ACCs across Australia serving rural, regional, remote and metropolitan communities.

definitions of investment will include allowances for capital gains and losses and include 'investment' in land and financial products that would not be included in economic definitions of capital investment.

Most investment is the result of decisions made on the basis of explicit or implicit analyses of costs and benefits by investors and lenders. As such it includes consideration of the returns on capital, the timing of costs and returns and the associated risks. Traditional economic theory sees investment decisions as determined by using a net present value rule—invest if the benefits sufficiently outweigh the costs. Return on capital is the key driver of investment but the interplay of other factors such as time and uncertainty also underpin any investment decision.

More recent approaches to investment stress the irreversibility of most investment decisions and the ongoing uncertainty of the economic environment in which those decisions are made as key explanatory factors. Dixit & Pindyck (1994) suggest a theory of irreversible investment under uncertainty. They identify three key characteristics of investment: partial or complete irreversibility; uncertainty over future rewards; and choice of timing of investment (Dixit & Pindyck 1994, p. 3). These characteristics interact to determine the optimal decisions of investors. They suggest that decisions to invest are highly sensitive to uncertainty and as a result that there is an option value attached to investment which can lead investors to delay investment and wait for better information (Dixit & Pindyck 1994, p. 6).

Economics typically distinguishes between stocks and flows. Investment is a flow concept—an action and its effects that take place within a given period of time. Investment is inherently volatile and can be strongly influenced by perceived uncertainty and risks (EPAC 1986, p. 14). Stocks refer to positions at a given point in time. Capital stock is generally thought of as accumulated investment measured at a particular point in time. There are no definitive measures of capital stock. Estimates are based on cumulated investment and (depending on valuation method) assumptions about average depreciation rates (EPAC 1986, p. 6).

In the light of these complications and the consequent lack of consistent definition and data we have avoided using the term 'investment' in anything but the general sense. However, in order to gain an insight into the flows of capital investment, we have developed estimates of the capital stock used in specific industries in 1997 and 2001. Existing capital stock is a fundamental determinant of employment and economic growth. As a result, we have chosen capital stock as the key indicator to provide an insight into the result of investment in the regions being studied. A brief description of the methodology follows and a more detailed account is contained in Appendix I.

To value capital stock in irrigated agriculture, we used locally accepted replacement values on a per hectare basis to build snapshots for 1997 and 2001. We then compared those values to provide an indication of investment flows over that period. Capital stock in manufacturing has been determined by using census industry employment numbers to derive regional estimates of non-current assets in manufacturing industry sectors from ABS survey data. The basis for these valuations is largely historical cost estimates. Again, trends in investment can be tracked using the differences between 1996–97 and 2000–01 estimates.

The data limitations mean that these different methodologies are used to calculate estimates of capital stock in irrigated agriculture and manufacturing and the estimates are based on different valuation methods. As a result, we have chosen not to add the two figures.

These estimates provide a snapshot guide to the long-term assets used in that industry at that time. Differences between the 1997 and 2001 estimates indicate the direction and extent of trends in investment over the period. However, given the imprecise nature of the definitions and the limitations of the estimation methodology (see Appendix I), neither the estimates of the total stock, nor the changes over time should be taken as precise estimates of actual investment dollars. Rather, they should be used to indicate direction and general magnitude. Small differences and changes are unlikely to be significant.

The figures in this report predominantly relate to 2001 (and earlier). This period has been chosen because it allows the use of the most recent data from the 2001 Census of Population and Housing and the 2001 Agricultural Census. This timing also has the advantage of avoiding distortions due to the current drought and therefore is more typical of longer-term trends.

Estimates of capital stock associated with agriculture and manufacturing do not cover the entire capital for a region. They do not, for example, cover service industries, government investment or investment in private housing. The value of the investment associated with these services is not available. As such, the estimates presented here are underestimates or partial indicators of total investment. However, irrigated agriculture and manufacturing are the core industries exporting from the regions under study and therefore are the most important in terms of determining underlying economic performance. It is expected that for the most part, regional service industries will expand to essentially meet the demand created by the workers in these core industries. Our fieldwork did not reveal any region where this assumption was not valid. The obvious additional exporting industry is tourism. Unfortunately, tourism is similar in character to other services and it was not possible to distil capital stock associated with the tourism industry from that in general accommodation, catering, transport and entertainment. Information on these sectors is therefore limited to the employment data and a brief qualitative description.

CHAPTER 2 IRRIGATION AND THE MURRAY RIVER

Irrigated agriculture and horticulture are integral industries in the study regions of Sunraysia, the Riverland and the Central Murray. Water for irrigation is sourced mainly from the Murray River system. In understanding the competitive and structural pressures surrounding industries facilitated through irrigation (either directly or through downstream processing) and the factors affecting investment in these industries, it is important to understand both the historical and contemporary environment surrounding irrigation water. This chapter aims to briefly describe the history of irrigation in the regions and the physical environment affecting irrigation. It then discusses the legislative and operational structure surrounding water entitlements and allocations in the three states under investigation (South Australia, Victoria and New South Wales), including water trading.

HISTORY OF USE AND DEVELOPMENT

Development on the Murray

The first diversions from the River Murray for irrigation were in the 1880s. Irrigation, for European settlers, was protection against the dryness and variability of the inland Australian climate.

A number of irrigation settlements were founded by the South Australian and Victorian Governments in the late 19th century, including Renmark and Mildura. There was active colonial government support for irrigation as a tool to encourage increased settlement of inland areas, and as such small property sizes were common in these initial government-driven areas (MDBC 2003a).

Soldier settlement schemes established after both World War I (such as Berri, Cadell and Waikerie in South Australia) and World War II (such as Cooltong and Loxton in South Australia and Robinvale in Victoria) encouraged further irrigation development, often again with small farm sizes.

Irrigation schemes were established at many other locations in South Australia, New South Wales and Victoria through the first half of the 20th century, as irrigation moved further upstream, and inland along irrigation channels. More

effective irrigation infrastructure was established to accommodate the demands of increased irrigation, such as storage reservoirs. Private diverters, directly pumping water from rivers and groundwater, have been the source of most of the expansion of irrigation areas since the 1960s.

In addition to water for irrigation, the Murray River has been an important aspect of the regions under investigation, historically, for industry and transport, and more recently, for tourism. From the 1850s, paddle steamers carried goods to and wool and wheat from Murray settlements, until faster and more efficient forms of transport such as railways superseded them. Recent research has indicated tourism is both a significant and growing component of the regional economy, mostly based around the Murray River (MDBC 2003b).

Figure 2.1 charts the progress of the Murray River and associated rivers through the study area.

FIGURE 2. 1 MAP OF MURRAY RIVER AREA

Source http://www.mdbc.gov.au/river_murray/river_murray_system/images/RMS_ht2.gif, accessed 15 July 2003.

History and role of the Murray-Darling Basin Commission

The Murray-Darling Basin Initiative is a partnership between the states that cover the Murray-Darling Basin and the Commonwealth. The goal of the Murray-Darling Basin Initiative is 'to promote and co-ordinate effective planning and management for the equitable, efficient and sustainable use of the water, land and other environmental resources of the Murray-Darling Basin'. It was established under the Murray-Darling Basin Agreement, initially signed by the Commonwealth, New South Wales, Victoria, and South Australia in 1987, and revised in 1992. Queensland became a signatory in 1996, with the Australian Capital Territory added in 1998 (MDBC 2003c).

The Murray-Darling Basin Ministerial Council (MDBMC) is the Initiative's decision-making forum (consisting of the relevant Ministers in each of the partner states and territories). The Murray-Darling Basin Commission is the executive arm of the Ministerial Council, which advises the Council and implements its decisions (MDBC 2003c).

The Initiative had its beginnings in the River Murray Water Agreement of 1915 between the Commonwealth, New South Wales, Victoria and South Australia that established the River Murray Commission, and facilitated the construction of various storages, weirs and locks along the Murray. This regulation aimed to give greater control and consistency to the flow of water to the three riparian states for productive consumptive purposes. Over time, the River Murray Commission acquired other water management objectives, including water quality and environmental considerations, leading to the Murray-Darling Basin Agreement in 1987 (MDBC 2003d).

Diversions from the Murray-Darling Basin have grown from approximately 2000 gigalitres (GL)[4] a year in 1920, to over 11 000 GL a year today (MDBC 2003e). The rate of growth in water use was fastest between approximately 1955 and 1975, with diversions increasing at an annual rate of about 250 GL a year. Most of this growth was in New South Wales (MDBC 2000). Today, New South Wales, Victoria and South Australia collectively extract 95 per cent of the water diverted in the Murray-Darling Basin, and over 90 per cent of diverted water is used for irrigation (MDBC 2003a).

Regulated River Murray supply system

The 'River Murray system' is defined according the Murray-Darling Basin Commission (MDBC 2003f) to be:

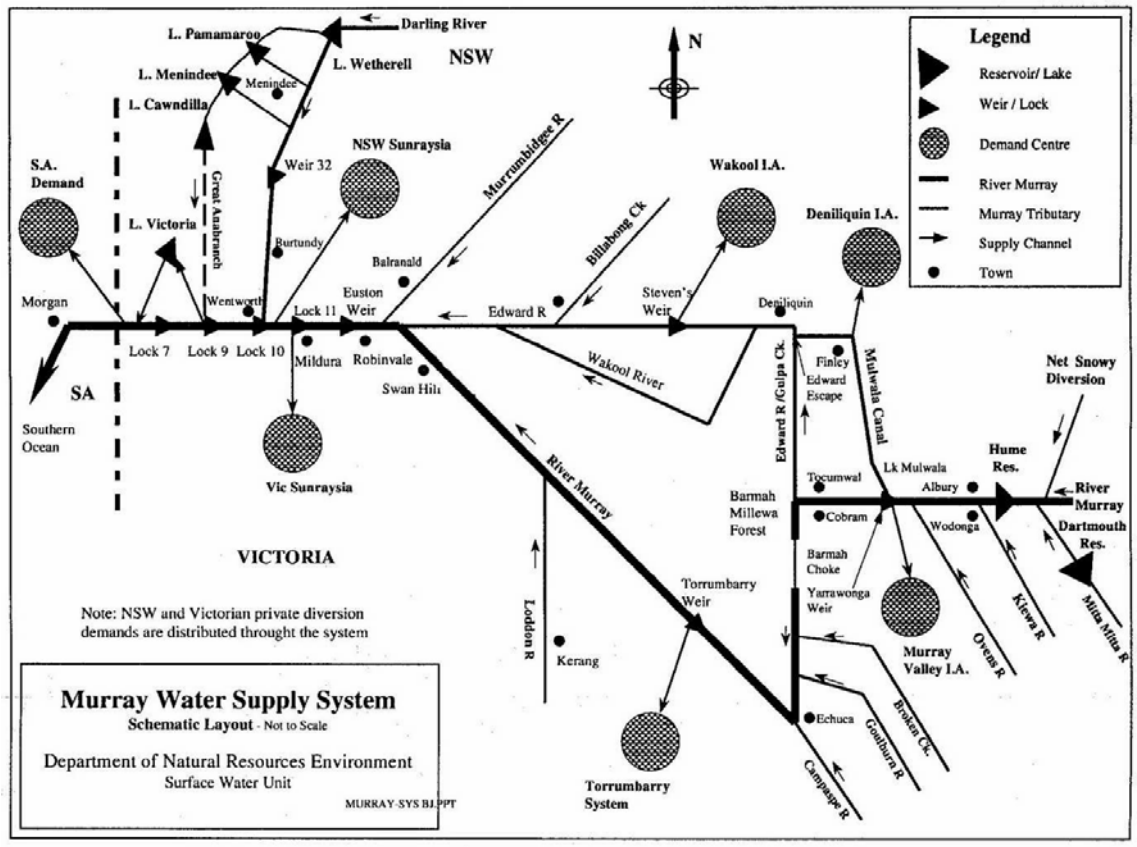
- the main course of the River Murray and all its effluents and anabranches;

[4] A gigalitre (GL) is defined as one thousand megalitres (ML). A megalitre is one million litres (L).

- tributaries entering the River Murray upstream of Albury;
- the Darling River downstream of the Menindee Lake storage;
- Commission works—Dartmouth Dam, Hume Dam, Yarrawonga Weir. Lake Victoria storage, weirs and locks along the River Murray and lower Murrumbidgee, and the barrages near the mouth of the River Murray; and
- the Menindee Lakes storage, which the NSW Government has leased to the Commission in perpetuity.

The schematic layout of the regulated Murray River supply system as it relates to this study (from the Barmah Choke upstream through to Morgan downstream) is shown in Figure 2.2. Note the Wakool Irrigation Area and Deniliquin Irrigation Area (as part of the NSW Central Murray) and the Torrumbarry System (as part of the Victorian Central Murray).

FIGURE 2. 2 SCHEMATIC LAYOUT OF MURRAY RIVER SUPPLY SYSTEM



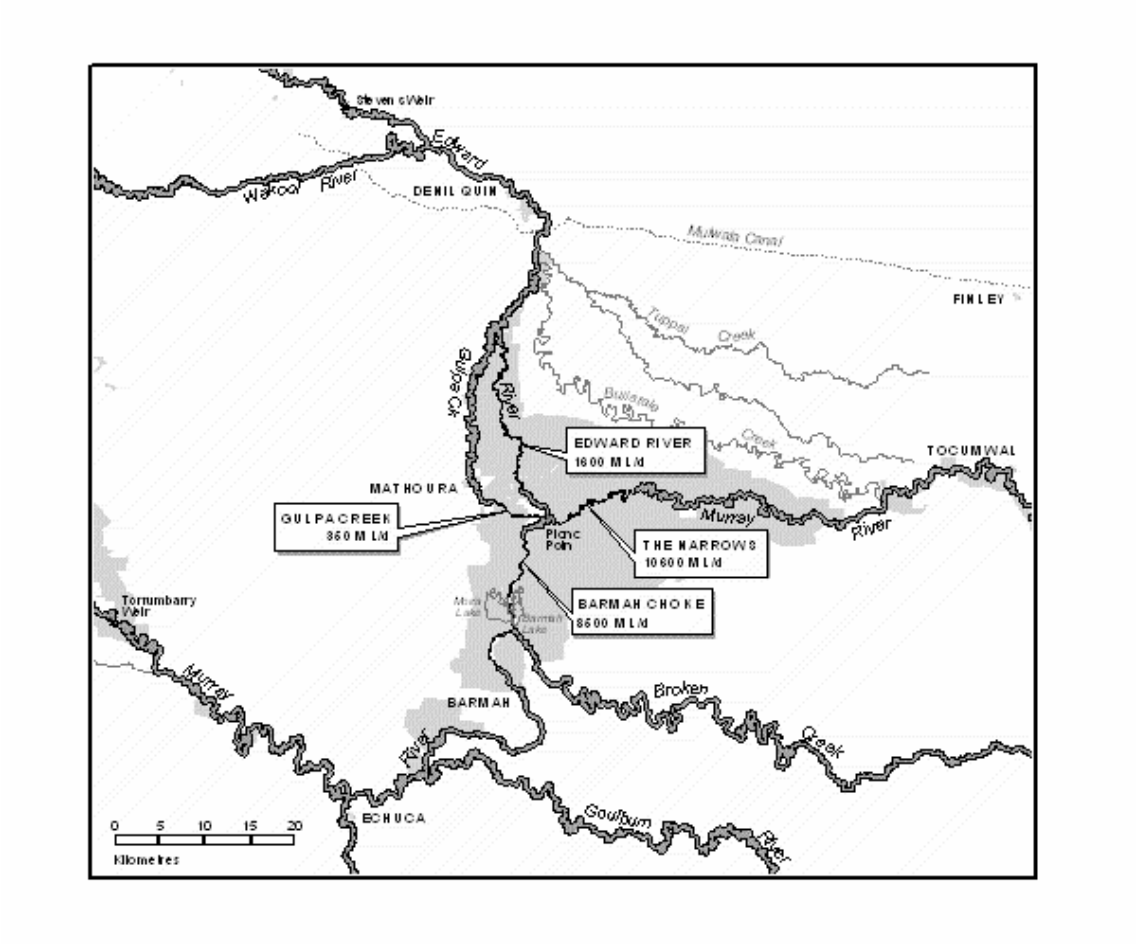
Source SMEC 2001.

Physical constraints to water supply

The Barmah Choke is the most significant physical constraint in the Murray system. It is a section of the Murray River between Picnic Point and Barmah (see Figure 2.3) where the Murray moves south in order to take over the Goulburn Channel downstream of Echuca.

A narrow channel 8000 years old formed after geophysical disturbances, the Barmah Choke is only able to accommodate flows of 8500 ML a day without flooding into the Barmah-Millewa Forest wetlands. As such, supply of water downstream of the Barmah Choke is limited (MDBC 2003g).

FIGURE 2. 3 BARMAH CHOKE



Source http://www.wentworth.gov.au/minutes/2002/aug/minsaug2002-08.asp, accessed 11 July 2003.

In times of peak demand, water volumes needed to flow through the Barmah Choke can often exceed its 8500 ML a day capacity. Peak demand for water downstream of the Choke is likely to occur: when low rainfall downstream of the Choke corresponds with times of high irrigation demand; when storages downstream of the Choke (notably Menindee Lakes on the Darling system) are

low, leading to the Hume supplying an increased amount of water for South Australian entitlements; and in situations of high irrigation entitlements resulting from high Hume and Dartmouth volumes. Figure 2.2 also shows the Choke in the context of the larger system (MDBC 2003g).

Various ways to overcome the Barmah Choke constraint are used, such as diverting irrigation water around the Choke to the Edward River and back onto the Murray via the Mulwala Canal, and releasing water from the Snowy Scheme to the Murray via the Tumut and Murrumbidgee Rivers. These solutions are also highly constrained by capacity limitations and competing uses (for example, stock and domestic water).

In addition to the Barmah Choke, there are other less significant physical constraints in the Murray system. For example, the limitation of the Murray's channel capacity between Hume and Yarrawonga to 25 000 ML a day, and supplementary flows from regulated tributaries taking a greater proportion of system capacity (MDBC 2003g). Constraints because of physical limitations are an important factor in intrastate and interstate water trading.

SUPPLY AND ADMINISTRATION OF WATER

Two concepts: 'reliability' and 'tenure'

Two components of water entitlements held by irrigators are particularly important to the discussion in this study—reliability and tenure.

Reliability refers to the probability that a water entitlement will be fully available for use, or allocated, in a given season. Governments play a significant role in determining reliability of their water products through their allocation and administration methods (particularly in their approach to High Security and General Security entitlements and the geographic distribution of such entitlements). However, a very significant factor in reliability on a year to year basis is the natural water conditions, such as inflows from rainfall into water storages. The concept of reliability is often confused through synonymic terms such as 'availability' or 'security'.

Tenure refers to the legal and administrative conditions surrounding the water entitlement (setting out aspects such as length of time to hold the entitlement, volume, and transferability through water trading) and the circumstances under which any of these aspects can be altered by governments and/or by irrigation authorities. Unlike reliability of entitlements, which are to some extent determined by natural conditions (natural risk), tenure is entirely determined by the regulatory environment. Risk in this regulatory context is often termed sovereign risk, where a government changes the rules that affect plans or investments that are already in place (Goesch & Hanna 2002).

There are significant differences between historical and contemporary tenure conditions of water products with similar reliability in the three states of the study area, further outlined later in this chapter.

'The Cap'

The main focus of governments through most of last century was to promote increased water consumption from the Murray (for irrigation), as a driver of economic growth for the region and Australia. By the late 1970s, however, over-allocation of water was increasingly identified as a problem, and environmental issues were also gaining momentum. Efficient and effective water allocation, in broader social terms, became a common policy objective. Reforms such as volumetric allocation schemes and temporary and permanent trade of entitlements occurred in the various states of the Murray-Darling Basin, although these were developed and implemented in inconsistent ways (Marsden Jacob Associates 2000).

In June 1995, the Murray-Darling Basin Ministerial Council introduced an interim Cap, made permanent from July 1997, to limit the expansion in the level of water diversion from the Murray-Darling Basin. 'the Cap' was defined in 1996 as 'the volume of water that would have been diverted under 1993–94 levels of development', with only slight changes since then (MDBC 2000).

The Cap is not a set annual limit on diversions, but rather is a long-term average, with yearly levels varying with climatic and hydrologic conditions, given the infrastructure (pumps, dams, area developed for irrigation, etc.) that existed in 1993–94. As such, in some years the level of diversion will be above the average volumetric Cap, and some years below, as would be expected with varying water supply.

The stated aim of 'the Cap' is to not restrict development, but rather create an environment where any water needed for increased development is required to come from water use efficiencies or by purchasing water from existing developments. Whilst some irrigators faced lowered average allocations, the Murray-Darling Basin Commission contends that 'the Cap' has also played a significant role in guaranteeing the reliability of those allocations.

The Cap required significant changes to the system for licences/entitlements and allocations in the States. This was in addition to previous reforms and liberalisation that occurred under National Competition Policy and Council of Australian Governments (COAG) agreements. These changes, along with a description of current supply arrangements and historical allocations/reliability are discussed in the following sections.

South Australia

Legislative controls

The *Water Resources Act 1997* controls access to water in prescribed water resource management areas through licences as specified in water allocation plans. Water licences are not linked to land, and give (potential) users the right to extract an identified volume of water from the River Murray.

Licence tenure is notionally unlimited, however they are subject to access conditions (on time, amount, location and rate of water extraction). Water allocation plans, reviewed every five years, may alter conditions of access to irrigation water.

The current Water Allocation Plan (WAP) for the River Murray was adopted in July 2002, providing the legal policy framework for the allocation, use and transfer of River Murray water in South Australia. It identifies the maximum volume of water that can be allocated per year for various uses (and provides for this volume to be adjusted as a consequence of intra and interstate water trade).

No new water is available for allocation to irrigation uses in South Australia, and as such allocations to a new licence or increased allocation to an existing licence must be through transfer of an existing allocation held elsewhere.

Allocations may be either 'taking' or 'holding'. A taking allocation is approved for use at a specific location, whereas a holding allocation has no approved location for use and water cannot be extracted until a 'taking' allocation is gained.

The *River Murray Bill 2002* was passed by the South Australian Legislative Assembly in April 2003, and is currently in the Legislative Council. The Bill intends to give the South Australian Government clear powers over the way in which the River is used and to control planning, irrigation practices, pollution, and rehabilitation programmes. The Bill will increase the power of the Minister for the River Murray, but does not significantly alter conditions of entitlement.

Water supply system and approach to water allocations

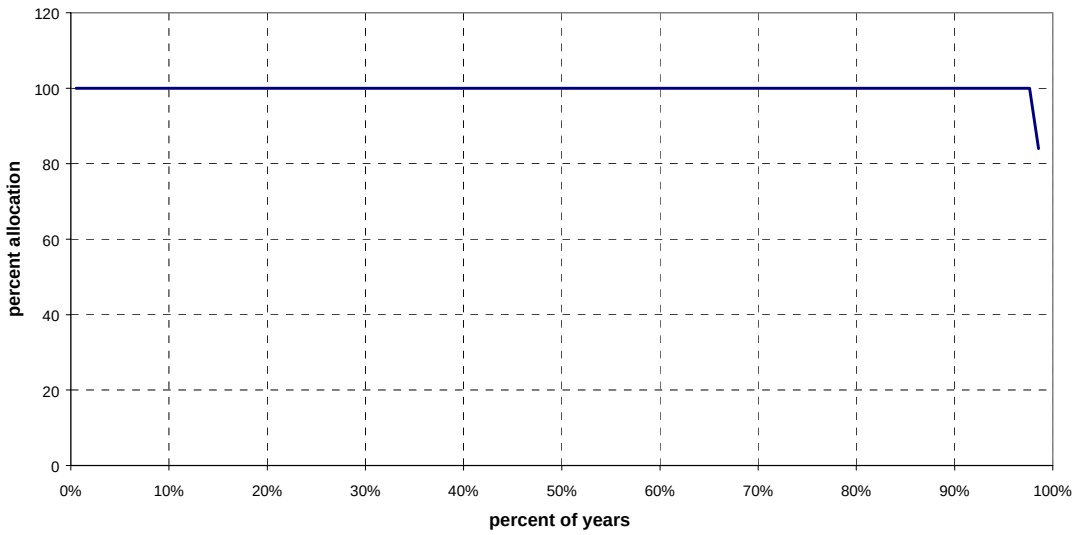
The River Murray provides 29 per cent of South Australia's harvestable water resources (Department of Water, Land and Biodiversity Conservation (DWLBC) 2002). In most years Adelaide draws more than 40 per cent of its water from the Murray, and during droughts this dependence increases to more than 90 per cent. The types of irrigation enterprises in South Australia, largely permanent plantings, also need reliable water supplies.

South Australia approaches water management conservatively, in order to ensure stability of supply. Irrigation's proportion of the Cap's minimum flow is approximately 10 per cent less than aggregate nominal licence volumes in South Australia. One of the intentions of restricted water use under 'the Cap' in Victoria and New South Wales is to increase the certainty of South Australia's water supply now and in the future.

Consequently, South Australian irrigators have almost guaranteed full allocation of their entitlement except in the most extreme drought years. In the last 20 years to 2002–03, a 100 per cent allocation has been available every year. According to modelling by the Murray-Darling Basin Commission, South Australia's full entitlement will be supplied in 103 of the 110 years modelled. Also, in 6 of the 7 years where full entitlement cannot be supplied from South Australia's allocation, the minor shortfall could likely be made up by minor reduction of anti-salinity dilution flows, and therefore it is reasonable to suggest a 109 in 110 year probability of full entitlement (MDBC 2003h).

The very strong reliability of this system as modelled is shown in Figure 2.4.

FIGURE 2. 4 RELIABILITY IN SOUTH AUSTRALIA (END FEBRUARY)



Source Volume, Reliability and Tenure of Major Irrigation Entitlement in the Murrumbidgee, Murray and Goulburn Valleys—Final Draft, Murray-Darling Basin Commission, March 2003

Water volume

The Entitlement Flow to South Australia is a minimum annual flow of 1 850 GL, under the *Murray-Darling Basin Agreement 1992*. This is to be supplied by Victoria and New South Wales to South Australia in all but the most severe and prolonged drought (on average, 1 year in 100). The median annual flow of River Murray water to South Australia is 6 702 GL, well in excess of the entitlement flow (DWLBC 2002). As of October 2001, 794 GL of water is authorised to be diverted from the River Murray Prescribed Watercourse for various consumptive purposes, 504 GL of which is for irrigation. However, actual average demand for irrigation water from 1996–97 to 2000–01 was 384 GL (DWLBC 2002).

Supply of irrigation water has effectively been 'capped' in South Australia since 1968, when licences specifying the area of crop that could be irrigated were first issued under the *Control of Waters Act 1919–1925*. Volumetric allocations from the River Murray have been issued since 1974–75. More extensive use of volumetric allocations as opposed to fixed crop area licences has given farmers an incentive to use water more efficiently, with water savings either traded (temporarily or permanently) or used to irrigate greater crop areas. For the River Murray Irrigation Management Zone, the Water Allocation Plan prescribes that from June 2005, 'water shall only be taken and used for irrigation so that the use of the water achieves a water-use efficiency of no less than 85 per cent[5]' (DWLBC 2002).

Table 2.1 sets out licence volumes in South Australia for irrigation only (ie. excluding environmental, industrial, recreation, stock and domestic and town supplies, including system losses in bulk irrigation licences).

Water trading

Intrastate or interstate transfer of licences (including allocation) for all or part of an allocation for irrigation use can be permanent or temporary. However, there are various restrictions that are designed to ensure sustainable levels of water use. One example is cumulative limits on the volume of water that can be traded out of some irrigation districts, for example a limit of 2 per cent of entitlement in the Central Irrigation Trust (National Competition Council 2003). Further discussion of water trading as it relates to the regions under investigation is found later in the chapter.

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[5] Water-use efficiency is defined by various measures, but in South Australia is expressed as the 'amount of water required by the particular crop or crops ('Crop Water Use') multiplied by 100 and divided by the amount of water applied to the particular crop or crop ('Water Applied')' (DWLBC 2002). This takes into account evaporation and crop factor, and irrigation and effective rainfall. Differing methods types of irrigation have varying water-use efficiencies influenced by factors such as land use and soil type.

TABLE 2. 1 DISTRIBUTION OF IRRIGATION ENTITLEMENTS IN SOUTH AUSTRALIA

Bulk Licence Holder	*Volume (ML)*
Central Irrigation Trust	
Chaffey	11 853
Berri	39 044
Cobdogla	32 579
Moorook	4 151
Kingston	2 523
Waikerie	19 076
Cadell	4 023
Mypolonga	4 485
Loxton	38 892
Renmark Irrigation Trust	36 605
Golden Heights Irrigation Trust	8 222
Sunlands Irrigation Trust	8 937
Other Highlands (smaller trust, individual licences)	278 135
Holding licences (not attached to any land)	11 563
Lower Murray Swamps	
Reclaimed irrigation areas (including stock & domestic)	67 300[a]
Highland (specified districts under Irrigation Act 1994)	9 300
TOTAL TRADEABLE IRRIGATION LICENCES	576 688

Note Stock and domestic not tradeable.

Source DWLBC database, in Volume, Reliability and Tenure of Major Irrigation Entitlements in the Murrumbidgee, Murray and Goulburn Valleys – Final Draft, Murray-Darling Basin Commission, March 2003.

New South Wales

Legislative controls

Under the *Water Management Act 2000*, irrigators hold a water access licence as a defined proportion of an irrigation authority's Bulk Licence, after allowance for system losses. Private diverters hold individual licences.

Licences are split into 'share entitlements' and/or 'extraction entitlements', which can be traded and owned independently, under rules set out in water sharing plans. Share entitlements are a proportional share of total resource available for allocation, whilst extraction entitlement specify the location and time extraction. NSW ceased giving out further licences in the Murray in the early 1990s (Marsden Jacob Associates 2000).

Ten-year Water Sharing Plans set rules for the sharing of water between consumptive and other uses, and between water users with different types of licences. Water users can claim compensation for cuts resulting from changes to a plan within its ten-year term, however, they cannot claim where a plan provides for a change (DLWC 2001). Many plans have provisions to enable

further data gathering and testing of assumptions and so leave the option of change open. There is no compensation for changes made when new plans are developed at the end of the ten-year period.

The first ever water sharing plans were initially to have come into force on 1 July 2003, but in June 2003 the NSW Government delayed this until 1 January 2004. Consequently, arrangements will continue as per 2002–03 (Minister for Natural Resources 2003).

Water allocation for irrigation is in two categories:

- High Security Irrigation Water (Class B Water); and
- General Security Irrigation Water (Class C Water)

Approximately 93 per cent of total entitlements of irrigators in New South Wales are for General Security water, with High Security only used by a small proportion. Those that do use High Security are much more likely to be downstream towards the west of the State (for example, with Western Murray Irrigation Ltd) which covers much of NSW Sunraysia.

As opposed to High Security, where 100 per cent allocation is available in all but years of extreme drought, the amount of water for General Security varies based on inflows and storage levels (MDBC 2002a). Allocation to General Security licence holders is only made after High Security licences have their full allocation.

Under 'the Cap', allocation for High Security does not exceed 100 per cent, however, in very dry years slightly more may be allocated to General Security users, subject to supply and ensuring long-term water use increases will not exceed 'the Cap'. For example, 105 per cent was allocated in 2001–02.

The ability to borrow from the following year's resources has been eliminated or reduced since 1997 (Marsden Jacob Associates 2000), however a carryover system has been introduced. In this system, General Security users can carryover any unused allocation from one season to the next (in 2003–04 this is limited to 41 per cent of entitlement for Murray Irrigation Ltd (MIL) shareholders (MIL 2002a). Even with the carryover, total water use (ie. announced allocation plus carryover) is still limited to 100 per cent allocation on entitlement (or more if announced) in any given irrigation year. Carryover is not available to High Security irrigators. Importantly, the current carryover system allows General Security irrigators to have a certain amount of effectively High Security water for the following year, as it already physically exists from the current year and is not affected by the occurrence of a low General Security allocation in the following year.

Supplementary (before 2000 referred to as off-allocation) water is also potentially available to General Security water users on an opportunistic basis

(and has not been available to High Security irrigators since 1997). Off-allocation volumetric limits have been halved in the Murray since 1997 (Marsden Jacob Associates 2000), restricted to 250 000 ML, subject to availability. However, when allocation for General Security users is less that 60 per cent of entitlement, all licensed General Security irrigators may divert water during Supplementary Water periods.

Under the NSW Murray and Lower Darling Water Sharing Plan, it is possible to convert a licence from General to High Security water. However, this requires the application of a conversion factor reducing the entitlement by half (ie. 2 ML of General Security water converts to 1 ML of High Security water). General Security water cannot be converted to High Security water in a given year until a full allocation for General Security licence holders in the NSW Murray is announced (MIL 2003). In addition, this converted water entitlement cannot be traded for five years from the conversion date (usually applying from the 1 July after approval).

Some licences contain both High Security and General Security components, in which case irrigators can divert supplementary water as per General Security users. Diversions in periods other than announced Supplementary Water periods are first debited to the licence's High Security component.

Water supply reliability and approach to allocation

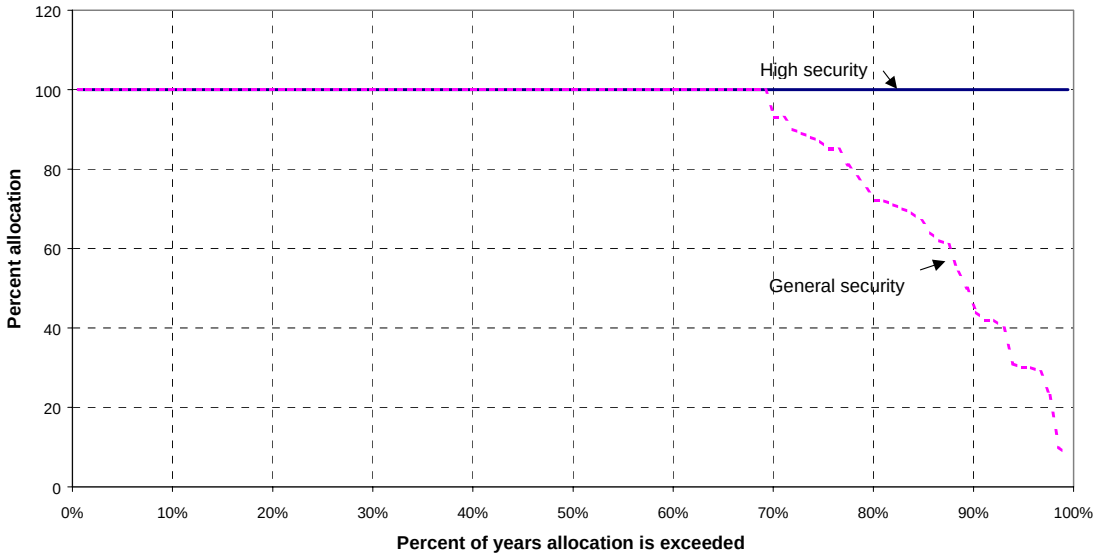
New South Wales shares (almost) equally with Victoria the water available from the Murray system, although they manage their share differently. New South Wales tends to maximise water use in each year, carrying over a minimum of water reserves into the following year. This means that River Murray water use is more volatile, higher when water is available but much lower in times of drought. As such, it takes a more opportunistic response to water management, which corresponds with the high proportion of annual crops (wheat, rice, etc.) grown in New South Wales as opposed to permanent plantings.

Because of the trade-off for less water in High Security licences, many farmers with non-permanent plantings are more willing to maintain General Security water and use carryover water as a risk management strategy. To do this, they would carry over 10–20 per cent of allocation, and at the end of the season make a decision to use at that time or in the following season.

A number of mechanisms were applied in NSW to facilitate compliance with 'the Cap'. Announced allocations have been restricted to 100 per cent since 1995, as opposed to commonly 130 per cent in previous years. This was due to the awareness that owners of sleeper licences could now trade their unused allocation, and that the unused water would not be reallocated to high volume users (Marsden Jacob Associates 2000).

Reliability of High Security and General Security water for the Murray system is shown in Figure 2.5. General Security water would be expected to have 100 per cent allocation in 7 out of 10 years, and High Security water is considered 97 per cent secure.

FIGURE 2. 5 RELIABILITY OF NSW MURRAY SYSTEM (END FEBRUARY)



Source Volume, Reliability and Tenure of Major Irrigation Entitlements in the Murrumbidgee, Murray and Goulburn Valley – Final Draft, Murray-Darling Basin Commission, 2003.

Water volume

The distribution of irrigation entitlements in the NSW Murray is shown in Table 2.2.

TABLE 2. 2 DISTRIBUTION OF IRRIGATION ENTITLEMENTS IN NSW MURRAY

Entitlement Type	*Authority*	*Volume (ML)*
Murray High Security	Murray Irrigation Ltd (irrigator entitlements)	90
	Western Murray Irrigation Ltd (irrigation entitlements)	61 243
	Private diverters and other irrigation groups/trusts	136 678
	(less stock and domestic and local water utility licences)	*47 854*
	SUB-TOTAL	150 157
Murray General Security	Murray Irrigation Ltd (irrigator entitlements)	1 479 230
	West Corurgan Private Irrigation District	80 728
	Private diverters and other irrigation groups/trusts	393 550
	SUB-TOTAL	1 953 508
TOTAL ENTITLEMENTS IN NSW MURRAY		2 103 665

Source Murray & Lower Darling Water Sharing Plan 2002, in Volume, Reliability and Tenure, Murray-Darling Basin Commission

Water trading

Both High Security and General Security water is able to be traded, subject to the fulfilment of certain conditions, both on a permanent (of entitlement) and temporary (of allocation) basis. Trades are not likely to be approved where the environment is likely to be adversely affected by the trade, and where the ability to supply other licensed users is significantly diminished. Some irrigation corporations have prohibited net trade out of their irrigation districts (National Competition Council 2003).

Licences that are for extraction above (ie. east of) the Barmah Choke cannot be traded downstream. There are also restrictions on temporary trade to below the Barmah Choke in periods of peak demand, and various restrictions in regard to temporary trades between the Murrumbidgee and Murray river valleys.

Further discussion of water trading as it relates to the regions under investigation is found later in the chapter.

Victoria

Legislative controls

The *Water Act 1989* is the main legislative tool for irrigation water in Victoria. It aims to promote the orderly, equitable and efficient use of water resources. Victoria's system is based on bulk entitlements which provide for water allocations for consumptive use (as managed through water authorities such as Goulburn-Murray Water, Sunraysia Rural Water Authority or First Mildura

Irrigation Trust) and environmental flows. They are a perpetual entitlement to water, granted to water authorities by the State of Victoria under the *Water Act 1989*. New entitlements have not been awarded in Victoria since the late 1980s (Marsden Jacob Associates 2000).

From bulk entitlements, Water Rights are the basic entitlement of water attached to a property, indicating the volume of water that would be available in most years. The tenure of these Water Rights covers an unlimited time period.

Private diverters have diversion licences (from streams or groundwater, for example) for a specific diversion volume, generally with a nominal tenure period of 15 years (although some in Sunraysia are of 5 years duration). Under the *Water Act 1989*, the Victorian Government is obliged to renew these unless there is good reason not to do so. Victoria has not issued diversion licences (exclusive of trade) in the northern systems since 1994 (Marsden Jacob Associates 2000).

Sales Water is additional water, lower reliability than the secure base allocations, offered to Water Right or diversion licence irrigators depending on availability. It is allocated after allowing for Water Right and licence volumes in both the current and next irrigation seasons, and is expressed as a percentage of Water Right or licence volume (eg. 30 per cent Sales). Sales Water can be traded within or outside an irrigation district.

Water supply reliability and approach to allocation

Victoria shares (almost) equally with New South Wales the water available from the Murray system, although they manage their share differently. Victoria's approach to water allocation is more conservative than New South Wales, but arguably less so than South Australia.

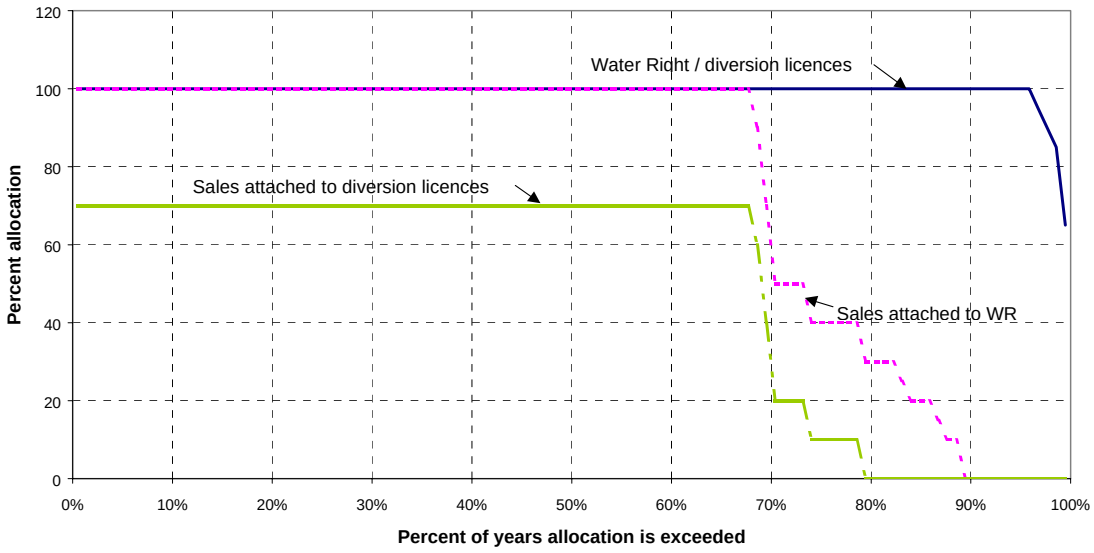
Unlike New South Wales, where irrigation water is available on both a High Security and General Security basis, irrigation water in Victoria is only available on one basis. It is termed 'general security', however the method of allocation appears to be much more reliable than New South Wales General Security. Victorian 'high security' water is reserved for stock and domestic, urban and industrial uses.

Water Right/diversion licence allocations have historically been very reliable on both the Murray and Goulburn systems; bulk entitlements define reliability on both systems as 96–98 per cent secure (MDBC 2003h). However, the Water Right / diversion licence is likely to cover less water per hectare than in New South Wales, which ensures a higher utilisation of the water allocated. Generally, the total volume of water allocated is greater than 100 per cent of entitlement, through additional Sales Water. Fieldwork revealed that many

irrigators consequently rely on the availability of Sales Water, for example on 160 per cent of entitlement for dairy.

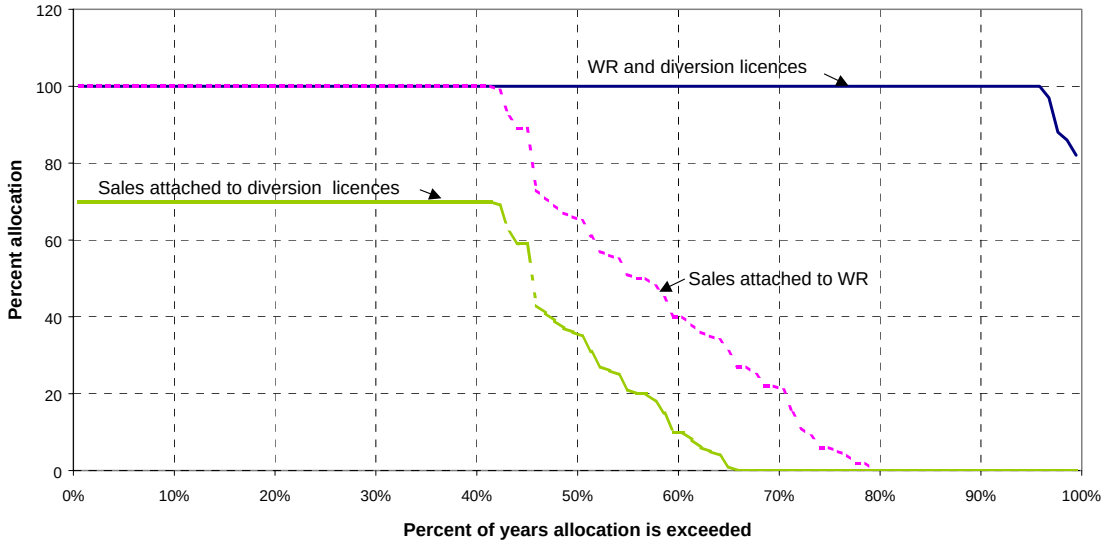
Reliability of Water Right/diversion licences and Sales Water for the Murray and Goulburn systems is shown in Figures 2.6 and 2.7 respectively. A number of properties in the Central Murray region are either serviced by both the Murray and Goulburn systems, or serviced by the Goulburn alone. As such, it is important to consider the impact of Goulburn allocations.

FIGURE 2. 6 RELIABILITY OF THE VICTORIAN MURRAY SYSTEM (END FEBRUARY)



Source Volume, Reliability and Tenure of Major Irrigation Entitlement in the Murrumbidgee, Murray and Goulburn Valleys – Final Draft, Murray-Darling Basin Commission, Canberra, 2003.

FIGURE 2. 7 RELIABILITY OF THE VICTORIAN GOULBURN SYSTEM (END FEBRUARY)



Source Volume, Reliability and Tenure of Major Irrigation Entitlement in the Murrumbidgee, Murray and Goulburn Valleys – Final Draft, Murray-Darling Basin Commission, Canberra, 2003.

Water volume

Volume on entitlements for both the Murray and Goulburn systems is distributed as described in Table 2.3.

The majority of licensed private diverters are downstream, in the western part of the State, for example Nyah to the South Australian border, an area covered mainly by Sunraysia Rural Water Authority. Private diversion ensures the flexibility of water effectively on demand, which is particularly important for horticulture.

TABLE 2. 3 DISTRIBUTION OF IRRIGATION ENTITLEMENTS IN VICTORIAN MURRAY AND GOULBURN

Entitlement Type	*Location (Authority)*	*Volume (ML)*
Murray Water Right / Licence	Total above Barmah Choke (G-MW)	304 507
	Torrumbarry Water Right excluding Tresco (G-MW)	354 021
	Nyah & Tresco (G-MW)	19 425
	Murray licences Barmah Choke to Nyah (G-MW)	36 752
	Sunraysia Water Right (SWRA)	90 826
	Murray licences Nyah – SA border (SWRA)	197 827
	FMIT entitlements – effectively Water Right (FMIT)	73 027
	SUB-TOTAL	*1 076 385*
Murray Sales Water attached to Water Right	Murray Valley Water Right (G-MW)	259 063
	Torrumbarry Water Right excluding Tresco (G-MW)	354 021
	SUB-TOTAL	*613 084*
Murray Sales Water attached to licence	Total above Barmah Choke (G-MW)	36 302
	Murray licences Barmah Choke to Nyah (G-MW)	25 727
	SUB-TOTAL	*62 029*
Goulburn Water Right / Licence	Greater Goulburn Water Right	984 021
	Goulburn regulated licences	51 247
	SUB-TOTAL	*1 035 286*
Goulburn Sales Water attached to Water Right	Nominal volume (maximum allocation) is 100% Water Right	984 021
Goulburn Sales Water attached to licence	Nominal volume (maximum allocation) is 70% licence volume	35 873
TOTAL ENTITLEMENTS IN VICTORIA MURRAY AND GOULBURN		*3 806 660*

Source G-MW BICCS database Aug 2002, Sunraysia & FMIT – water audit June 2001 (irrigation only), in MDBC 2003h.

Water trading

Victoria has the most liberal water trading rules (Hassall & Associates 2002, p. 12). Water Right and diversion licence entitlements can be either permanently or temporarily (annually) traded, if both properties are supplied by the same river system. However, Water Rights generally need to be traded to another piece of land when in Victoria. Trading is restricted to 2 per cent of total entitlement out of an irrigation district in any one season. This is in order to reduce the potential for fixed costs of delivery systems to be spread over a small number of remaining irrigators. This limits water system delivery costs (per ML) (GMW 2003a).

Further discussion of water trading as it relates to the regions under investigation is found later in the chapter.

Summary of water entitlements

Table 2.4 is a brief summary of the tenure and variations to licences in the three states under investigation. It shows the differences and similarities of water entitlements in each state.

TABLE 2. 4 SUMMARY OF WATER ENTITLEMENTS ACROSS RELEVANT STATES

State	*Legal System*
South Australia	Tenure is notionally unlimited, although conditions of access determined by water allocation plan. The Minister (for the River Murray) can change licence volumes and reduce allocations, on a permanent or temporary basis, at any time without compensation to irrigators, to comply with a water allocation plan in order to ensure sustainable water use (eg. reduction in 'the Cap', or where water is needed for the environment).
New South Wales	Nominal tenure for licences is 15 years, and is separate from land title. Ten-year water sharing plans set rules for the sharing of water between consumptive and other uses, and between water users with different types of licences. Water users can claim compensation for cuts resulting from changes to a plan within its ten-year term, however they cannot where a plan provides for a change.
Victoria	Water Right as per Bulk Entitlement is attached to land, and tenure is unlimited in time. Private diversion licence tenure is usually 15 years, and may be renewed for unlimited period. Minister must renew unless good reason not to do so.

Source

It is important to note that legislation and regulation in the various states outlining tenure conditions is only part of the environment affecting the perception of sovereign risk. The perception of sovereign risk, driven by convention and historical behaviour, is likely to be a more powerful determinant of behaviour that the legal sovereign risk to tenure itself.

For example, there is a clear assumption by many irrigators that, even though the Victorian government is not constrained by water allocation plans and has wide abilities to change the situation, there is a clear political convention in place to not exercise that power.

WATER SUPPLY SYSTEMS

The previous sections have outlined the water entitlement and allocation regime in each of the states (South Australia, New South Wales and Victoria), and indicated the area of the study through broad river systems (Murray in

New South Wales, Victoria and South Australia; Goulburn in Victoria). For each study region (Riverland, Sunraysia and Central Murray) the following section outlines: water supply authorities; distribution of water between irrigation districts; and water trading arrangements.

The Riverland

Irrigators in the Riverland draw water from the Murray through direct diversion or are supplied in privatised irrigation districts. The Riverland covers approximately 20 000 hectares of irrigated land, and the various areas were established between the late 1880s and about 1960 (MDBC 2003a).

The Central Irrigation Trust (CIT) is the largest supplier of water, supplying 1 600 growers who irrigate about 13 000 hectares in the Berri, Cadell, Chaffey, Cobdogla, Kingston, Moorook, Mypolonga, Loxton and Waikerie irrigation areas (CIT 2003).

Other irrigation trusts in the Riverland are:

- Renmark Irrigation Trust in the east of the Riverland, consisting of about 700 irrigators and 20 private diverters with an area of about 5 000 hectares of permanent plantings.
- Sunlands Irrigation Trust and Golden Heights Irrigation Trust, both around Waikerie in the west of the Riverland and having about 70 members and 8000 ML of entitlement (Hassall & Associates 2002).

The key characteristics of water infrastructure and supply in the Riverland are the universal use of piped systems and the high reliability of supply. The piping is a result of successive upgrading of the region's irrigation areas by the State and Federal Government between 1970 and the end of the last century, the most recent being the formerly Commonwealth-owned Loxton Irrigation Area. The high reliability is a result of the guaranteed supply to South Australia under the Murray-Darling Basin Agreement as set out by River Murray Catchment Water Management Board (RMCWMB) (RMCWMB 2003) (ie. under 'the Cap').

Sunraysia

Irrigators in Sunraysia draw water from the Murray through direct diversion or are supplied in irrigation districts.

First Mildura Irrigation Trust (FMIT) was established in 1887. The FMIT has a total irrigable area of 7844 hectares, with 6677 hectares of predominantly permanent plantings irrigated (FMIT 2003).

Sunraysia Rural Water Authority (SRWA) consists of Merbein (1909) and Red Cliffs (1920) irrigation districts, and also Robinvale (1947). Robinvale is between

the two areas of Sunraysia and Victorian Central Murray as defined by this study, and as such is not considered further. All these areas are gravity-fed, channel-based systems designed to support flood and furrow irrigation. Total area of Red Cliffs and Merbein irrigation districts is 9765 hectares (of which 8730 is irrigated), with a total water entitlement of 86 956 ML (SRWA 2003). An account of the history of the establishment of the area can be found in Edwards (2003).

On the NSW side, the irrigation areas of Coomealla, Buronga and Curlwaa are managed by Western Murray Irrigation Limited (WMI). These areas, totalling over 4000 hectares were redeveloped to pressurised piped systems in 1998 (Porteus 2002).

Private diverters in Victorian Sunraysia, including those in the Nangiloc-Collignan, Cullulleraine and Lindsay Point areas, comprise 19 870 hectares (with licence volumes of approximately 200 000 ML).

The key elements of the water pumping and delivery infrastructure in the region are set out in Table 2.5.

TABLE 2. 5 SUNRAYSIA IRRIGATION WATER SUPPLY CHARACTERISTICS

District	*2001-02 Area irrigated (ha)*	*Authority*	*Supply Type*	*2001-02 Allocation (ML/ha)*	*2001-02 Use (ML/ha)*	*Security Level*	*Pumping Charges ($/ML)*
New South Wales							
Coomealla	2565	WMI	Piped	~14		NSW High	~$60
Buronga		WMI	Piped	~14		NSW High	~$60
Curlwaa	770	WMI	Piped	~14		NSW High	~$60
Victoria							
First Mildura Irrigation Trust	8100	FMIT	Channel	9.1		Water Right (WR)	$80-$120
Merbein	3520	SRWA	Channel	10.5	7.1	WR/ Licence	$100
Red Cliffs	5210	SRWA	Channel	9.6	6.6	WR/ Licence	$100

Source MDBC 2003a and SRWA 2003 augmented by BTRE from discussions in the region.

The key differences evident in Table 2.5 are the piped versus channel systems in NSW and Victoria respectively and the associated differences in pumping charges (see Appendix II for explanation of types of irrigation systems). The

piped systems in NSW have pumping charges of around 40 per cent less per megalitre than their channel-based equivalents in Victoria.

In addition to reduced pumping costs, water savings were made when the systems were converted from channel to piped systems, approximately 30 per cent in the Coomealla irrigation area of NSW Sunraysia (Porteus 2002). A further 10–20 per cent saving in on-farm use is potentially made as farmers convert from flood and furrow techniques to sprinkler and dripper based systems. Therefore, irrigators with access to piped systems could be both using less water and paying less per megalitre, suggesting a saving of around 50 per cent on pumping costs.

Table 2.5 also emphasises the use of more reliable water on both sides of the river. This is consistent with the historical production of perennial, high-investment crops (citrus and dried fruit) across the region. In particular, it is consistent with a reluctance of irrigators and others to commit to investment in long-term infrastructure in the face of uncertain water supplies.

Central Murray

Irrigators in the Central Murray region draw water through direct diversion or are supplied by water authorities in irrigation districts. There are two main water authorities covering the area—Goulburn-Murray Water (GMW) and Murray Irrigation Limited (MIL).

On the Victorian side, Goulburn-Murray Water (a state-owned Government Business Enterprise established in 1994 under the *Water Act 1989*) covers an area of 68 000 km^2, from the Great Dividing Range north to the River Murray and from Corryong down river to Swan Hill. Its headquarters is located in Tatura. The region includes major storages such as Lake Eildon (which has a capacity of 3 390 000 ML but is currently at only around 8 per cent full[6]) and the major gravity irrigation areas in Victoria as well as pumped irrigation and waterworks districts (see Appendix II for further information on types of irrigation). The water resources of GMW come from two major water supply systems: the Goulburn system (Broken, Goulburn, Campaspe and Loddon River catchments) and the Murray system (Murray, Mitta, King and Ovens Rivers).

There are six management areas or irrigation districts within GMW (see Figure 2.8): Shepparton, Central Goulburn, Rochester-Campaspe, Pyramid-Boort, Murray Valley and Torrumbarry (which includes the Nyah and Tresco pumped districts). The key elements of the water supply arrangements in the

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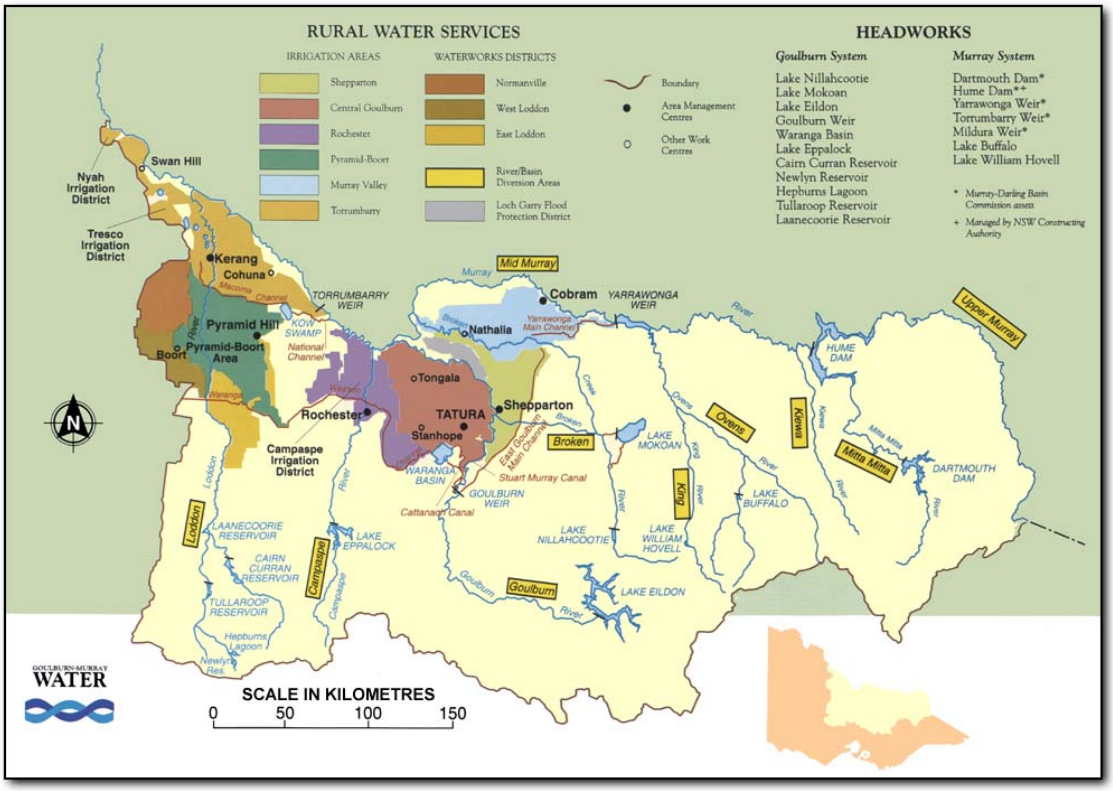
[6] As at end April 2003, 'Monthly Storage Volumes' http://www.nre.vic.gov.au/.

region are set out in Table 2.6. Private diverters are a significant part of the system, however, consultations in the region indicated that private diverters were declining in the GMW system and that the major growth area for diverters was downriver. A key advantage of private diversion is that it gives the flexibility of water on demand (which is important for horticulture).

FIGURE 2. 8 GOULBURN-MURRAY WATER—SUPPLY REGION



Source GMW 2003.

GMW supply infrastructure is predominantly an open channel delivery system. However, the Torrumbarry Irrigation Area in the north-west of the region near Swan Hill includes two smaller pumped districts (Nyah and Tresco) and a pumped pipeline to supply irrigators in the Woorinen district is currently under construction (and is expected to be completed during 2003).[7] In 2001–02, GMW capital expenditure was around $30 million (Productivity Commission 2003, p. 200).

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[7] The Woorinen district piping project is part of a Victorian State Government water saving project and is jointly funded by the State Government and GMW customers. In total it is a $22 million investment, of which $9 million is funded by the State Government and the balance from industry. The project will deliver 2.1 gigalitres of water to the Snowy River previously lost through inefficiencies.

Horticulture is the main agricultural activity in these pumped areas. In 2002–03 water delivery (or pumped) prices are in the range of $20-30/ML for the open channel districts and $50/ML for the piped systems (Goulburn-Murray Water, pers. comm., 28 May 2003).

TABLE 2. 6 CENTRAL MURRAY IRRIGATION WATER SUPPLY CHARACTERISTICS

District (Year established)	*Area irrigated (Ha)*	*Authority*	*Supply Type*	*2001–02 Allocation (ML/ha)*	*2001–02 Use (ML/ha)*	*Security Level*	*2002–03 Pumping Charges ($/ML)*
Shepparton *(1880s)*	~51 000	GMW	Channel	179 301	174 628	Water Right	~$32
Central Goulburn *(1880s)*	~113 106	GMW	Channel	389 121	444 874	Water Right	~$31
Rochester-Campaspe *(1880s)*		GMW	Channel	208 253	259 321	Water Right	~$28
Pyramid-Boort *(1880s)*	~126 400	GMW	Channel	227 653	230 027	Water Right	~$23
Murray Valley *(1930)*	~88 969	GMW	Channel	259 063	404 464	Water Right	~$24
Torrumbarry *(1880s)*	~150 000	GMW	Channel	373 446	620 176	Water Right	~$23
Tresco*(1913)*			Piped				
Nyah *(1910)*			Piped				~$52
Goulburn-Murray Total	~530 000			1 636 837	2 133 488		
Priv. Divert.	~40 786			217 385	~152 000		
Total GMW	*~570 261*			*~1 854 222*	*~2 285 658*		
Berriquin *(1934)*	~123 000	MIL	Channel			General Security	
Denibota *(1957)*	~24 000	MIL	Channel			General Security	
Denimein *(1946)*	~9 000	MIL	Channel			General Security	
Wakool *(1933)*	~36 000	MIL	Channel			General Security	
Priv. Divert.	na						
Total MIL	*~200 000*						*~$20*

Note The Murray Valley district is above the Barmah Choke and therefore not considered in detail in this report.

Source GMW 2003, GMW 2002, http://www.murrayirrigation.com.au, MDBC 2003a. Augmented by BTRE from discussions in the region.

On the NSW side of the Murray River, Murray Irrigation Limited (a private company based in Deniliquin) provides irrigation water and drainage services to four irrigation districts—Berriquin, Deniboota, Denimein and Wakool. These districts were owned and operated by the NSW Government until 1995 when they were privatised. MIL is a private company in which each of the region's irrigators is a shareholder. Shares are allocated on the basis of water entitlements. Murray Irrigation's area of operation stretches from Mulwala in the east, to Moulamein in the west and covers a total area of 716 000 hectares with 2400 irrigated farm holdings. The country towns of Berrigan, Finley and Wakool, as well as a number of private irrigation districts, are supplied with water by MIL.

Murray Irrigation is the largest privately-owned irrigation supply and drainage company in Australia, with an entitlement of approximately 1.48 million ML (1 480 GL), or approximately 70 per cent of the NSW share of Murray River irrigation entitlements. MIL supply infrastructure is an open channel delivery system (with the Mulwala Canal being the major gravity fed supply channel). Murray Irrigation's infrastructure is valued at $280 million with an annual turnover of $20 million. All operation, maintenance and refurbishment costs are covered by shareholder water charges (MIL 2003).

The vast majority of MIL shareholders have General Security water. Consistent with this, in 1999–2000, water supplied by MIL was predominantly used on annual crops such as rice (56 per cent), annual pasture (19 per cent) and summer pasture (12 per cent) (Murray Land & Water Management Plan Working Group 2001, p. 4). The major trend noted by MIL between 1992–93 and 2001–02 has been the decrease in water applied to annual pasture from 35 per cent to 22 per cent, with an increase in cereal from 2 per cent to 11 per cent of water use. This reflects a decline in returns from grazing relative to cereals (MIL 2002b, p. 21).

The key elements of the water supply arrangements in the region are set out in Table 2.6. In 2002–03, MIL water delivery (or pumped) prices are around $20/ML which is cheaper than GMW on the Victorian side (Table 2.6).

In addition to the MIL, the NSW Central Murray region is also serviced by West Corurgan Irrigation District in the eastern part of the region. In comparison to MIL's 1.48 million ML entitlement, West Corurgan has a very much smaller entitlement of about 80 000 ML (all General Security). This covers an irrigated area of 22 000 hectares, in a total area of about 212 000 hectares.

WATER TRADING

Water trading requires a clear separation of the property right between water and land and an accepted definition of a property right (for further discussion

of this issue see Sheehan and Small 2002). Temporary water trading has existed since the 1980s, from 1982 in South Australia, 1983 in New South Wales and 1987 in Victoria. Permanent water trading within the states has existed since 1982 in South Australia, 1989 in New South Wales and 1991 in Victoria (SMEC 2001).

Intrastate temporary trading between and within river systems and interstate temporary trading is generally available, although there are various exceptions and varying trade rules between water authorities. Transfers between river systems and more complex interstate trading requires consideration of such aspects as 'the Cap', state entitlements, physical constraints, water exchange rates and environmental considerations. The vast majority of trading since its establishment has been in temporary volumetric transfers.

The liberalisation of permanent water trading aims to move water to more efficient, higher value uses. For example, there in an expectation that irrigated areas in South Australia using River Murray water will expand over the next 10 to 20 years, predominantly in vines, citrus, tree crops and vegetables (DWLBC 2002) using water traded into South Australia and/or more efficient use of existing entitlements to cover a greater area. Bjornlund and McKay (2000) provide good evidence that trading leads to increased water use efficiency and allocation to higher value uses in both Victorian and South Australia. It is also argued that increased returns from more high value uses will facilitate greater private investment in more efficient water delivery systems (MDBC 2003i p. 37).

Pilot Interstate Water Trading Project

A Pilot Interstate Water Trading Project under the aegis of the Murray-Darling Basin Commission has, since September 1998, allowed permanent trade of water to exist between States. It covers the Mallee region of the River Murray between Nyah (in the western part of the Central Murray region just downstream of Swan Hill) and the barrages at the Murray mouth. In terms of this study, the pilot area comprises the Riverland, Sunraysia and western part of Central Murray.

However, the Pilot Project only involves 'high security' water licences (defined differently according to State: in NSW, private High Security licences; in Victoria, private diversion licences; in SA, water licences). As such, it excludes irrigators within group schemes (such as Central Irrigation Trust in the Riverland) and users of water with low reliability (eg. General Security water in NSW) or water dependent on seasonal variability (eg. Sales Water in Victoria). A comparison of state water property rights prepared for the pilot project can be found in MDBC 2001a.

In its first two years, the pilot project facilitated 51 interstate trades involving 9.8 GL of water transferred between states, which is in total less than 1 per cent of the water applied to relevant areas. Virtually all (99 per cent) interstate permanent trades were of water not being used by the sellers, ie. 'sleeper' or 'dozer' licences, going to high-value uses.

CSIRO Land and Water's *Inter-state Water Trading: a two-year review* (Young, MacDonald, Stringer & Bjornlund 2000) noted that 'intrastate trading is driving the market for water', interstate trading is keeping 'the various markets in place'. The major influence on the market is the fixed supply of secure water in South Australia. Seventy per cent of water traded into the Riverland (64 per cent of total water traded) went to provide water for new viticulture and horticulture (as well as a recreation area). There was a net transfer of 8.7 GL into South Australia, approximately 79 per cent from New South Wales and 21 per cent from Victoria. Although New South gained net 0.4 GL from Victoria, the net loss in permanent water entitlements in Victoria and New South Wales was 2.6 GL and 6.1 GL respectively.

The review concluded that interstate trading is increasing, generally, the economic efficiency of water use in the Murray-Darling Basin. It also noted a trend to follow significant investments in permanent water (greater than $0.5 million) with other large on-farm investments, for example, in irrigation technology and seed stock. Perhaps important is the observation that those purchasing permanent water tended to consider themselves to be amongst the top third wealthiest in their area.

Currently as part of the interstate trading pilot, there is a 1:1 exchange rate between all permanent interstate trades with the exception of trades from South Australia to Victoria (licence) and from South Australia to New South Wales (High Security).

For these two exceptions, the differences in supply sources (with South Australia serviced by the Darling's flow into the Murray) led the MDBC to apply an exchange rate of 1:0.9 (eg. an irrigator from the Riverland (SA) could sell 100 ML entitlement to an irrigator from NSW Sunraysia, however, the NSW Sunraysia irrigator would only receive 90 ML entitlement). The other way, from NSW or Victoria to South Australia, remains a 1:1 exchange rate.

In addition to permanent interstate trade, permanent intrastate trade was also significant in this period. For example, the CSIRO report identifies 30 GL net trade of water into the Victoria interstate pilot area from other parts of Victoria. However, it is important to note the concept of 'bouncing', where water traded into the pilot area from other parts of the state can then be traded on interstate.

Traded water prices

The price of temporary water is affected by announced allocations in NSW and Victoria. Historically, for General Security in NSW and Sales Water in Victoria, lower allocations are announced at the beginning of the season, with increased allocations as the season progresses. As such, water tends to be more expensive at the beginning of the season and less expensive at the end.

Permanent water prices tend not to be as affected as temporary water by seasonal variability. However, the price paid for permanent water does vary based on the irrigation district from which it is sourced. Further discussion of price variation based on buyer/seller location and land use is found in Bjornlund (2002).

Generally, permanent entitlement for highly reliable water costs above $1 000/ML. Lower reliability water generally costs about $600/ML. Typical prices for temporary water are about $30-50/ML, although in the resource constraint of the recent drought this has climbed in some instances to $500/ML (Blackmore 2003).

Water supply company/irrigation district trading policy

In a number of regions, particularly in New South Wales and South Australia, permanent trade out of irrigation districts is prohibited. There are a variety of reasons for this, as identified in Hassall & Associates (2002). In NSW Central Murray, the most notable are ghost town fears and community cohesion, driven by issues of stranded assets and indirect community impacts. A different reason, particularly notable in Western Murray Irrigation, is the preventing of permanent trade out of the district in order to maintain water entitlements for expected future development. In considering the trading policy and the reasons for such policy in the various irrigation areas, it is also important to consider the relative pressure for export trade out of a region—for example, much lower in the Riverland as compared to New South Wales.

Table 2.7 details the trading policies in the various water supply companies and/or districts.

TABLE 2. 7 TRADING POLICY BY WATER SUPPLY COMPANY/IRRIGATION DISTRICT

	Perm Trade In	*Perm Trade Out*	*Special Rules for Intrastate Permanent Water Trading*	*Trading Policy set by*
South Australia				
Central Irrigation Trust	Yes	Yes	Maximum 25% of original entitlement of property can be traded. 2% limit on water traded outside specific districts in CIT	Board
Renmark Irrigation Trust	na	No	na	Board
Golden Heights Irrigation Trust	Yes	No	None	Board
Sunlands Irrigation Trust	Yes	No	None	Board
New South Wales				
Western Murray Irrigation (S)	na	No	None	Shareholders
Murray Irrigation Ltd (CM)	Yes	Yes, but limited	Minimum 60% of entitlement in 1995 to remain on each property. Sum of water traded in must be greater than sum of water traded out of area	Board / shareholders
West Corurgan (CM)	Yes	No	None	Board / shareholders
Victoria				
First Mildura Irrigation Trust (S)	Yes	Yes	2% limit on water permanently traded out of district in a given year. Salinity constraints on water moving into an area and fees.	Vic Govt (Water Act)
Sunraysia Rural Water Authority (S)	Yes	Yes	2% limit on water permanently traded out of district in a given year. Salinity constraints on water moving into an area and fees.	Vic Govt (Water Act)
Goulburn-Murray Water (CM)	Yes	Yes	2% limit on water permanently traded out of district in a given year. Salinity constraints on water moving into an area and fees.	Vic Govt (Water Act)

Note (CM) Central Murray, (S) Sunraysia, na = not available

Source Hassall & Associates (2002).

Water trading trends by river system

Tables 2. 8 and 2.9 provide the permanent and temporary trade figures for the major river systems that provide irrigation water in the regions under investigation.

TABLE 2. 8 PERMANENT INTRASTATE AND INTERSTATE WATER ENTITLEMENT TRANSFERS, 1999–2000 TO 2001–02

Category per River system	*2001–02*	*2000–01*	*1999–2000*
Total permanent entitlement sold (ML)			
SA All Other Users from the Murray River	9 396	42 100	11 309
NSW Murray	4 072	3 556	9 143
Vic Murray	11 938	4 053	10 400
Vic Goulburn	15 369	2 172	9 226
Net inter-valley trade inwards excluding interstate trade (ML)			
SA All Other Users from the Murray River	0	210	5 371
NSW Murray	0	0	-2 564
Vic Murray	6 004	1 329	216
Vic Goulburn	-6 307	-1 407	-2 239
Net interstate trade inwards (ML)			
SA All Other Users from the Murray River	1 480	4 475	4 778
NSW Murray	184	-176	-2 564
Vic Murray	-1 664	-4 299	-2 214
Vic Goulburn	0	0	0

Source MDBC 2003i, MDBC 2002b MDBC 2001b.

TABLE 2. 9 TEMPORARY INTRASTATE AND INTERSTATE WATER ENTITLEMENT TRANSFERS, 1999–2000 TO 2001–02

Category per River system	*2001–02*	*2000–01*	*1999–2000*
Total temporary allocation sold (ML)			
SA All Other Users from the Murray River	76 118	n/a	51 867
NSW Murray	175 329	129 551	92 486
Vic Murray	62 582	11 598	73 382
Vic Goulburn	38 617	4 485	132 334
Net inter-valley trade inwards excluding interstate trade (ML)			
SA All Other Users from the Murray River	0	738	-1 112
NSW Murray	-27 439	7 791	111 654
Vic Murray	-7961	-5 420	-2 098
Vic Goulburn	14 312	9 649	1 117
Net interstate trade inwards (ML)			
SA All Other Users from the Murray River	-7 261	3 255	-1 696
NSW Murray	-2 544	-4 770	6 401
Vic Murray	-5 898	4 984	-3 146
Vic Goulburn	3 839	-1 092	-1 173

Source MDBC 2003i, MDBC 2002b, MDBC 2001b.

As these tables refer to river systems within states, they are limited for detailed analysis of inter-regional trade. However, they do give a good overview of the general direction of water trade from east to west, and the prevalence of water

trade within a system. This is particularly so for interstate permanent trade given the restrictions of the Pilot Interstate Water Trading Project.

Permanent water trade totalled between about 40–50 GL per year and temporary water totalled about 350 GL per year between 1999–2000 and 2001–02, varying significantly between years on a state and river system basis.

Transfers in South Australia

RMCWMB (2003) reports that a total of 138 gigalitres of permanent entitlement and 202 gigalitres of temporary entitlement were sold in South Australia between 1994 and 2003. Since interstate trading in 1997–98, interstate trends have been to trade in permanent entitlement (net 15.5 gigalitres) from other states and trade out temporary water (net 25.0 gigalitres) to other states. Approximately 15 to 20 per cent of licensed water is currently not used and is held in 'sleeper' or 'dozer' allocations (RMCWMB 2003).

The amount of trading in the Riverland was relatively low until the 1997–98 irrigation season. Because of the high water prices driven by low allocations elsewhere on the Murray, many Riverland growers gained from selling water on a temporary basis (Danzi 1999, p. 5).

Whilst there has been a significant increase in the number of permanent transfers (of taking licences) between 2000–01 and 2002–03, the average water volume in a transfer has decreased dramatically, from approximately 600 ML to 60 ML. The total yearly volume of temporary trade has also increased in this period, with average volume decreasing (DWR 2003).

Transfers in New South Wales

Between 1999–2000 and 2001–02, total permanent entitlement sold on the NSW Murray averaged 5.6 gigalitres a year, and total temporary entitlement sold averaged 132.4 gigalitres a year. The level of temporary trade is consistent with the predominance of annual crops in New South Wales generally (although much more in Central Murray).

Murray Irrigation Ltd (covering Central Murray) is typically a net importer of temporary water: generally about 85 gigalitres a year, although 176 gigalitres in 1999–2000 (MIL 2002b, p. 32). A typical trade of temporary water would involve irrigators from NSW Sunraysia trading to NSW Central Murray with excess water gained from irrigation efficiencies (Porteus 2002). Generally, water trading by MIL shareholders is increasing and over the longer term there is a general expectation that trading will result in water being sold out of the region, especially if permanent interstate water trading is extended from the current trial.

Under MIL rules, external transfers out of the MIL area can only occur if MIL's bulk entitlement exceeds 1.44 gigalitres (and permanent trade of water entitlements is limited to 40 per cent of original entitlements). However, permanent water trade within the authority's area did occur in recent years, flowing generally in the Berriquin district (MIL 2002b, p. 31).

The NSW Murray permanent interstate water trade figures from Table 2.8 are predominantly sales of High Security water by private diverters in NSW Sunraysia. Net 2556 megalitres was traded interstate (effectively all to South Australia) from NSW Murray between 1999–2000 and 2001–02. NSW Sunraysia is also a seller of temporary water.

Transfers in Victoria

Permanent water entitlements are flowing out of the Goulburn system to the Victorian Murray system; between 1999–00 and 2001–02 Goulburn lost a net total of approximately 10 gigalitres from inter-valley trade, compared to the Murray gaining a net total of about 7.5 gigalitres.

From Table 2.8, between 1999–2000 and 2001–02, total permanent entitlement sold on the Victorian Murray varied between about 4 and 11 gigalitres a year and total temporary entitlement sold varied between 12 and 73 gigalitres a year.

Victorian Goulburn varied in these years more significantly, between approximately 2 and 15 gigalitres permanently sold and between 4 and 132 gigalitres sold on a temporary basis.

For 2001–02, the Goulburn-Murray system had a net decrease in permanent water with 11.7 gigalitres traded out (about 90 per cent going to Sunraysia). In the same year, 32 gigalitres of temporary transfer came into the system (GMW 2002, pp. 60-61).

The general trend, which is consistent with the perceptions of those that we interviewed in the regions, is a movement of water entitlements on a permanent basis north and west, towards areas with a higher proportion of private diverters. Concurrently, temporary water is being traded back into Central Murray.

A small amount (net 154 megalitres) was permanently traded into the First Mildura Irrigation Trust in 2001–02, reflecting the Trust's small area and inability to expand. Permanent interstate trade from Victorian Murray (effectively Sunraysia private diverters) flowed mostly to South Australia, net interstate trade outwards was 5.9 gigalitres in 2001–02. However, some of this is potentially an anomaly due to 'bouncing' water from other parts of Victoria through Sunraysia for interstate trade.

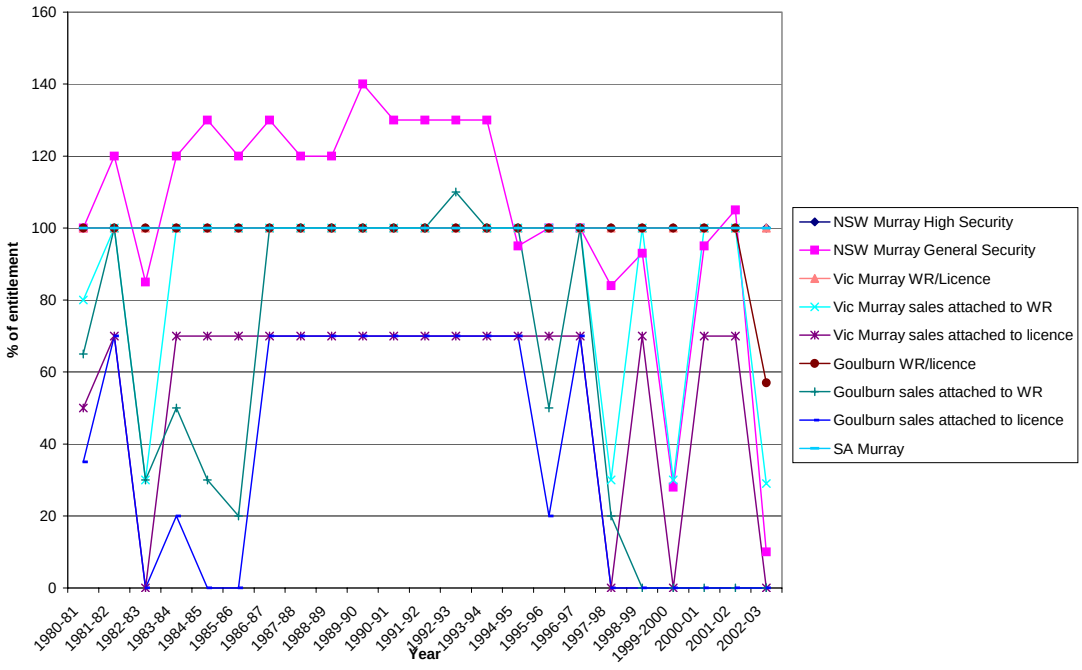
RECENT AND CURRENT WATER SITUATION ACROSS STATES

In Victoria in 2001–02, both the Goulburn and Murray received 100 per cent Water Right but only the Murray received full Sales allocation. The Goulburn system has had no Sales Water available since 1998–99.

NSW High Security has received 100 per cent water right throughout this period, and General Security has been the most volatile of all allocations, with a high of 140 per cent in 1989–90 (before 'the Cap'), but only received a 10 per cent allocation in 2002–03.

Table 2.10, charted as Figure 2.9, summarises the historical allocation by location and entitlement type since 1980–81.

FIGURE 2. 9 HISTORICAL ALLOCATIONS (END FEBRUARY) TO MURRAY AND GOULBURN IRRIGATORS IN SA, NSW AND VICTORIA



Source All MDBCe, except 2002-03 (GMW 2003b) and 2002-03 (DLWC 2003).

TABLE 2. 10HISTORICAL ALLOCATIONS (% OF ENTITLEMENT, END FEBRUARY) TO MURRAY AND GOULBURN IRRIGATORS IN SA, NSW AND VICTORIA

Year	*NSW Murray High Security*	*NSW Murray General Security*	*Vic Murray WR/ licence*	*Vic Murray sales attached to WR*	*Vic Murray sales attached to licence*	*Goulb. WR/ licence*	*Goulb. sales attached to WR*	*Goulb. Sales attached to licence*	*SA Murray*
1980–81	100	100	100	80	50	100	65	35	100
1981–82	100	120	100	100	70	100	100	70	100
1982–83	100	85	100	30	0	100	30	0	100
1983–84	100	120	100	100	70	100	50	20	100
1984–85	100	130	100	100	70	100	30	0	100
1985–86	100	120	100	100	70	100	20	0	100
1986–87	100	130	100	100	70	100	100	70	100
1987–88	100	120	100	100	70	100	100	70	100
1988–89	100	120	100	100	70	100	100	70	100
1989–90	100	140	100	100	70	100	100	70	100
1990–91	100	130	100	100	70	100	100	70	100
1991–92	100	130	100	100	70	100	100	70	100
1992–93	100	130	100	100	70	100	110	70	100
1993–94	100	130	100	100	70	100	100	70	100
1994–95	100	95	100	100	70	100	100	70	100
1995–96	100	100	100	100	70	100	50	20	100
1996–97	100	100	100	100	70	100	100	70	100
1997–98	100	84	100	30	0	100	20	0	100
1998–99	100	93	100	100	70	100	0	0	100
1999–00	100	28	100	30	0	100	0	0	100
2000–01	100	95	100	100	70	100	0	0	100
2001–02	100	105	100	100	70	100	0	0	100
2002–03	100	10	100	29	0	57	0	0	100

Source All MDBCe, except 2002-03 (GMW 2003b) and 2002-03 (DLWC 2003).

CURRENT ALLOCATION SITUATION

South Australia

Due to severe drought, South Australia has been restricted to Entitlement Flow since December 2001, the longest period on record (DWLBC 2003a). It has received its lowest flows (June/July) for 35 years. In June 2003, the Murray-Darling Basin Commission estimated a 60 per cent probability of South Australia achieving full Entitlement Flow in 2003–04 (DWLBC 2003b). Consequently, the South Australian Government announced that there would be a 35 per cent decrease in the allocation for 2003–04, in order to achieve 20 per cent less use (130 GL) for the water year, to be reviewed in October 2003. Irrigation trusts will apply this decision in different ways, however, in general, those irrigators using more than 80 per cent of their allocation (for example, because they have expanded through traded water) could be expected to be most disadvantaged.

New South Wales

Initial 2003–04 allocations of 100 per cent and 0 per cent for High and General Security water entitlements respectively were announced on 2 July 2003. With NSW's decision to delay the implementation of new water sharing plans, current water management arrangements remaining unchanged until 1 January 2004.

Victoria

Initial announcements on allocation for the 2003–04 irrigation season were 16 per cent for the Victorian Murray and 0 per cent for the Goulburn. However, there is a 8 in 10 chance the Murray will receive 100 per cent allocation by February 2004, and a 7 in 10 chance for the Goulburn. If average runoff into storages (5 chances in 10) occurs, the Murray allocation will be 46 per cent by August and 100 per cent by February, and the Goulburn allocation would be 6 per cent by August and 100 per cent by February.

IRRIGATION AND THE MURRAY RIVER—SUMMARY

Agricultural producers in South Australia, New South Wales and Victoria face differing arrangements for obtaining water for irrigation purposes. Some key differences are location and volume of water licences and entitlements awarded, pre-existing legislation and conventions in entitlement and allocation and inconsistency between states in recent reform approaches. This, as discussed in later chapters, has impacted on the type of agricultural output produced in the regions under investigation. Permanent water trading has increasingly altered the geographic distribution of water entitlements within and, to a lesser extent, between states. Temporary trading is more commonly used and has allowed flexibility in short-term reallocation of supplies.

Key points regarding the context for water for irrigators are:

- in South Australia, there is (almost) 100 per cent reliability of supply, with water-use efficiency actively promoted in the face of a fixed volumetric Cap;
- in New South Wales, High Security water has 97 per cent reliability of full allocation, with General Security allocation varying widely depending on the resource supply (full allocation available in 7 out of 10 years on average). As such, General Security users are more opportunistic, but can also mitigate some of the risk of low allocations through the carryover system;
- in Victoria, reliability is good (96–98 per cent) for allocation of base Water Right/licence entitlement, although entitlement is generally less per hectare than in NSW and many broadacre producers depend on less reliable Sales Water. Sales Water attached to a Water Right is more reliable than that attached to diversion licences;
- the flow of trade in permanent water entitlements is generally from east to west, towards regions with predominantly high reliability of supply, with the flow in temporary water the opposite way.

CHAPTER 3 SUNRAYSIA AND THE RIVERLAND

The Sunraysia region of NSW and Victoria and the Riverland region of South Australia account for a large proportion of intensive irrigated agriculture on the lower Murray River. The regional economies are dominated by irrigated agriculture and the secondary industry that depends on it. Their isolation and the relatively small amount of dryland agriculture due to the dry climate ensures that links between irrigation and community well being are strong. The distribution of the regions across three states provides an opportunity to compare the impact of differences in the approach of governments.

SUNRAYSIA

DESCRIPTION OF THE REGION

The Sunraysia region straddles the Murray River and hence the NSW/Victorian border. It includes the city of Mildura (pop ~28 000), the commercial hub of the area, and the towns of Wentworth, Dareton, Merbein, Irymple, Red Cliffs, Ouyen, Walpeup, Underbool, Cowangie, Murrayville, Cullulleraine, Meringur, Hattah, Werrimull, Colignan, Mittyack, Nangiloc and Cardross. For the purposes of this study, Sunraysia is defined as three Statistical Local Areas (SLA)—Mildura (RC[8]) Pt A and Mildura (RC) Pt B in Victoria and the Shire of Wentworth in NSW (see map below). Mildura Pt A includes the city of Mildura itself and a small amount of agricultural (mostly irrigated) land surrounding it. Mildura Pt B consists of the hinterland around Mildura on the Victorian side and contains both irrigated and dryland agriculture.

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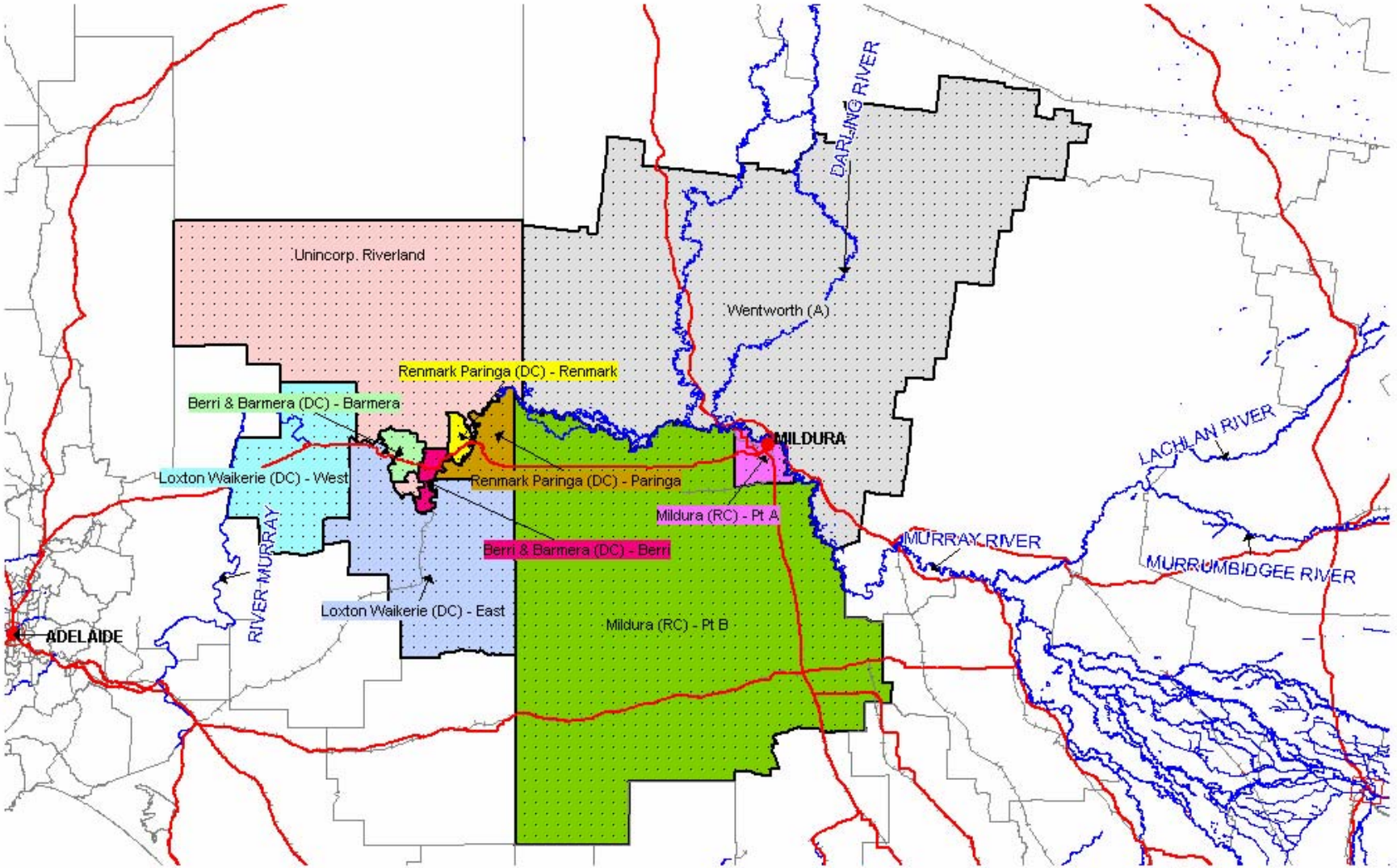
[8] Rural City.

Sunraysia and Riverland

Statistical Local Areas



The region supports broadacre dryland cereal, prime lamb and wool production on the Victorian side, whilst dryland agriculture to the north of the river is characterised by grazing leases of the NSW Western Division. Dividing these regions along the Murray are rich, irrigated wine and citrus growing areas. The Sunraysia Mallee Economic Development Board notes that large tracts of land on both sides of the river are also devoted to National Parks (SMEDB 2003).

Table 3.1 shows that the population of Victorian Sunraysia is around seven times that of NSW Sunraysia. In Victorian Sunraysia, 9 per cent of the population are born overseas compared to 6 per cent on the NSW side and an Australian average of 22 per cent. The NSW side supports a high proportion of indigenous people who comprise 7.8 per cent of the population. With 2.3 per cent of the population of indigenous extraction, Victorian Sunraysia has around the national 2.1 per cent average.

TABLE 3. 1 DEMOGRAPHIC STATISTICS—SUNRAYSIA 2001

	Vic Sunraysia	*NSW Sunraysia*
Population[a]	49 283	7 078
Total population growth 1991–2001[a]	10.5%	-2.6%
Indigenous population share[b]	2.3%	7.8%
Proportion born overseas[b]	9%	6%
Proportion speaking language other than English at home[b]	8%	4%

a. Based on ABS 2001 *Regional Population Growth*, Australia and New Zealand, 1991 to 2001 (Cat. 3218.0) Estimated Resident Population data.

b. Based on ABS 2001 *Census of Population and Housing*, Place of Enumeration data.

Irrigation-based industries dominate the regional economy producing wine grapes, citrus, almonds, table grapes, avocados, olives and vegetables. Other important industries include tourism, dryland farming and grazing, provision of services (private and public) and mineral sand mining.

The total land area of Wentworth Shire is 26 273 km^2 (Table 3.3). The area of Mildura Rural City (Mildura (RC) Pts A & B) is slightly less at 22 082 km^2 (Table 3.3). Soil types across the region are consistent and are classified in the Australian Natural Resources Atlas as Calcarosols (NLWRA 2001a). These are described as solonised brown soils, grey-brown and red calcareous soils and calcareous sands, occurring in areas with low rainfall, used for cereal growing and irrigated horticulture in the south and sparse grazing in the north.

Given that the river is the border between the two states and the Darling River joins at Wentworth, the length of riverbank available for irrigation access is greater on the NSW side.

In Table 3.2 we have estimated the amount of irrigation water used in Sunraysia by applying estimated water usage rates for different crop types in 1997 (NLWRA 2001a) to the area of these crops in the respective SLAs as reported in the Agricultural Census for 1997 and 2001.

TABLE 3. 2 IRRIGATION WATER USE—NSW AND VICTORIAN SUNRAYSIA 1997 & 2001

	Victorian Sunraysia (ML)	*NSW Sunraysia (ML)*	*Victorian Sunraysia as a percentage of NSW Sunraysia*
1997 Estimate	136 354	48 492	282%
2001 Estimate	182 796	70 619	259%

Source BTRE estimate based on NLWRA 2001a and Agricultural Census 1997 and 2001.

From these estimates, water usage on the Victorian side of the river is seen to be over twice that in NSW. As large as this difference is, it may overestimate the NSW usage. Information from the NSW region suggests that the piping of the Western Murray Irrigation Limited delivery systems will have reduced the amount of water applied to crops in that state.

GENERAL ECONOMIC PERFORMANCE

In 2003, Sunraysia is perceived by its residents as a growing prosperous region that is experiencing a short-term slow-down in growth following rapid expansion through the 1990s. This growth is seen as contributing to increased population, increased investment in the region and large residential expansion, especially in Mildura which is the service centre for the whole region.

Information and data is scarce at the small area level. As a result, a number of proxy or indicative data are used to provide an insight into economic performance and investment patterns. Three primary information sources are used here to describe recent trends in economic performance:

- data on population characteristics from the ABS 1996 & 2001 *Censuses of Population and Housing*
- Real Taxable Income data from 1990–91 to 1999–00 from BTRE July 2003 estimates derived from data published by the Australian Taxation Office; and
- regional unemployment data produced by the Department of Employment and Workplace Relations.

A variety of other sources are also used to describe the economic base and industry structure of the region:

- industry employment data from the ABS 2001 *Census of Population and Housing*;

- estimates of the area and value of production of irrigated agriculture based on the 1997 and 2001 ABS Agricultural Census data; and
- information gathered during the field trip interviews with stakeholders.

While these estimates are important in their own right, we have also used them as the basis for estimating the value of capital stock in both irrigated agriculture and manufacturing later in this chapter.

Population

Table 3.3 confirms Mildura as the focus of population growth for the whole region. Table 3.3 shows the population in Mildura (RC) Pt A (which contains the City of Mildura) grew by 14.9 per cent over the period, whilst the population in surrounding Victoria (Mildura (RC) Pt B) fell by 21 per cent. Overall, this represents population growth on the Victorian side of 10.5 per cent. Across the border, Wentworth Shire was relatively static, falling by just 2.6 per cent. Overall, the Sunraysia population growth rate was 8.7 per cent.

TABLE 3. 3 POPULATION BY SLA—NSW AND VICTORIAN SUNRAYSIA 2001

Statistical Local Area (SLA)	*2001 Population*	*Pop growth 1991–2001*	*Area km²*	*Population density 2001*
	no.			*persons/km²*
Wentworth (A[9])	7078	-2.6%	26 273	0.3
Mildura (RC) Pt A	45018	14.9%	483	93.1
Mildura (RC) Pt B	4265	-21.0%	21 599	0.2

Source ABS 2001 *Regional Population Growth*, Australia and New Zealand, 1991 to 2001 (Cat. 3218.0) Estimated Resident Population data.

Taxable income

Figure 3.1 sets out the change in gross real taxable income from 1990–91 to 1999–2000 for the three SLAs in Sunraysia. Gross real taxable income is an indicator of economic activity, and along with population and employment growth, indicates economic growth over time for a region. In this case, the graph clearly indicates the quite dramatic growth of Mildura (RC) Pt A (59.3 per cent over the period) compared to Mildura (RC) Pt B (0.3 per cent) and Wentworth (10.0 per cent). This confirms the local observations and population trend of the concentration of economic activity into Mildura itself. When converted to annual growth rates (Table 3.4) it can be seen that whilst Mildura (RC) Pt A (5.3 per cent) has grown significantly above the Australian rate

[9] Area.

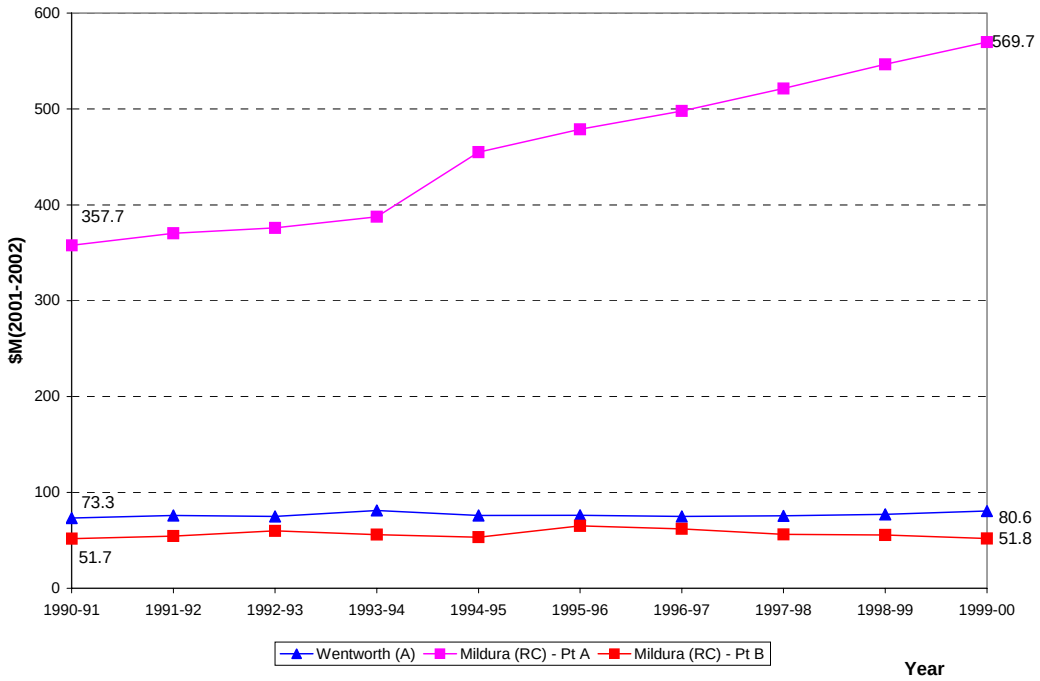
(3.0 per cent), Mildura (RC) Pt B and Wentworth fall well short (0 per cent and 1.1 per cent respectively).

These observations are consistent with the 'sponge city' effect where regional cities grow seemingly at the expense of growth in neighbouring centres due to forces of agglomeration (a discussion of regional development theories can be found in BTRE 2003a). In this case, all the areas are growing in terms of Gross Real Taxable Income, if not in population, suggesting that the impact may be due to expansion of industry in Mildura, rather than simply drawing business away from the surrounding area. This is borne out by the rate of growth for the whole Sunraysia region (4.3 per cent) being above the Australian average: a noteworthy result in Australia for a region based on agricultural industries.

Service areas in Mildura that support the whole Sunraysia population include a new medical centre, Latrobe University campus, Freshwater Co-operative Research Centre, Sunraysia TAFE, CSIRO horticultural centre and NSW Agriculture's Dareton research centre. These are generally located in or close to Mildura. These services along with the development of new manufacturing such as the BRL Hardy winery and expansion of agriculture underpin the population growth of Mildura.

Local information suggests that these developments have significant implications for Mildura itself, even when they are located in Mildura (RC) Pt B or Wentworth Shire. This in part reflects the desirability of Mildura as a residential location with more services than Wentworth, but also the relative scarcity of good residential and irrigation land around Wentworth. Only 6 per cent of the land in Wentworth Shire is freehold (David McMillan, pers. comm., 29 April 2003), the rest being crown land, much of it held as Western Lands Lease (WLL). Although individual titles vary, generally WLL permits extensive grazing but not farming except with the permission of the managing government department. As a result, it is not regarded as suitable for development of irrigation. This results in strong competition between residential and irrigation interests for the limited freehold land and the seemingly incongruous situation of a shortage of suitable land for development in a Shire with a population density of 0.3 persons/km^2. This is seen as a major constraint to both agricultural and residential expansion on the NSW side. Victorian Sunraysia, on the other hand, has freehold land and the title issues in NSW provide a spur to growth in Mildura.

FIGURE 3. 1 GROSS REAL TAXABLE INCOME BY SLA—SUNRAYSIA 1990–91 TO 1999–00



Source BTRE July 2003 estimates, based on Australian Taxation Office data.

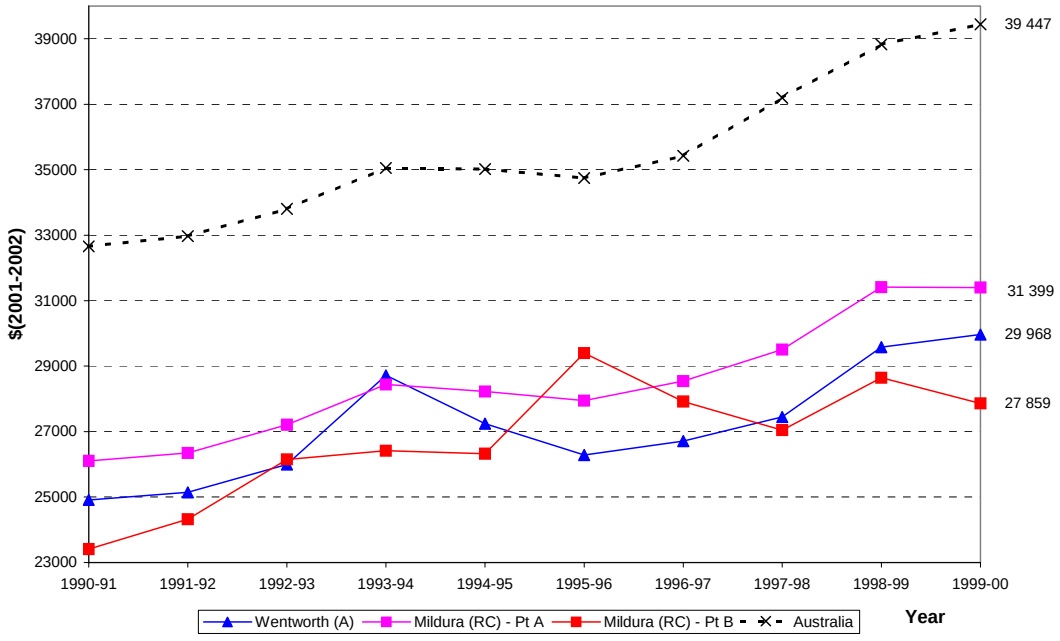
TABLE 3. 4 ANNUAL RATE OF GROWTH OF GROSS REAL TAXABLE INCOME—SUNRAYSIA 1990–91 TO 1999–00

	Annual Growth Rate between 1990–91 & 1999–00
Mildura (RC) - Pt A	5.3%
Mildura (RC) - Pt B	0.0%
Wentworth (A) (NSW Sunraysia)	1.1%
Vic Sunraysia	4.8%
All Sunraysia	4.3%
Australia	3.0%
Australian annual growth of GDP (chain volume measure)*	3.7%

Source BTRE estimates based on Australian Taxation Office data. *ABS Cat 5204.0, 2001-02 (Australian System of National Accounts, Time Series Spreadsheets, Table 10).

Figure 3.2 graphs the mean real taxable income by SLA for Sunraysia. The most striking feature of this graph is the relatively low taxable income of all three regions compared to the Australian average. This dwarfs the differences between the SLAs, although as expected the higher proportion of manufacturing and service employees in Mildura raises the income level there. Mildura (RC) Pt A is also less volatile than the other two areas that have higher proportions of income from agriculture.

FIGURE 3. 2 MEAN REAL TAXABLE INCOME BY SLA—SUNRAYSIA 1991 TO 2000



Source BTRE July 2003 estimates, based on Australian Taxation Office data.

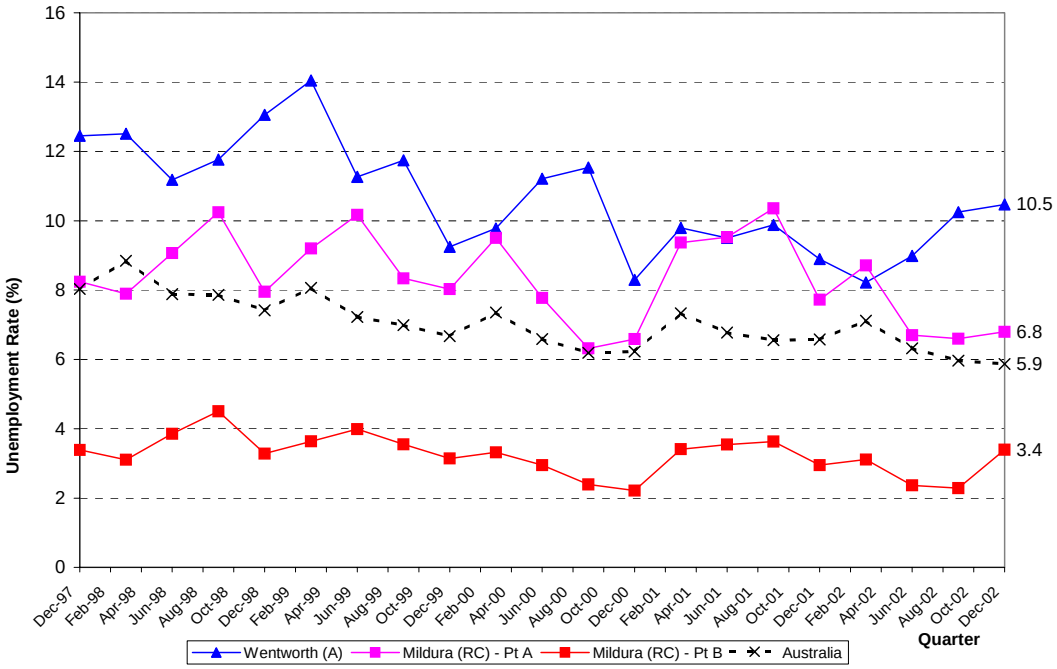
Unemployment

Figure 3.3 shows Wentworth Shire and Mildura Pt A with unemployment rates consistently higher than Australia and much higher than Mildura Pt B.

Mildura Pt B is typical of the low rates of unemployment found in small rural areas, usually explained by migration towards larger centres to find work. This situation is consistent with the higher unemployment of Mildura Pt A, typical of a larger regional centre. By contrast, Wentworth's high unemployment rates may, in part, reflect the relatively high remote indigenous population. It should also be noted that although all SLAs show elements of seasonality, the regional changes tend to be more pronounced than the national patterns, suggesting short-term employment is closely related to specific (agricultural) industry demands.

The diverging unemployment rates between regions shown in Figure 3.3 may explain the business community's wide range of opinions on the issue. This ranged from 'not a problem' to 'high rate of unemployment that has persisted for years with a heavy reliance on social services'. However, there is general agreement on a shortage of skilled tradesmen and professional workers.

FIGURE 3. 3 UNEMPLOYMENT RATES BY SLA—SUNRAYSIA 1997 TO 2002



Source DEWR Small Area Labour Markets.

Regional industry structure

General

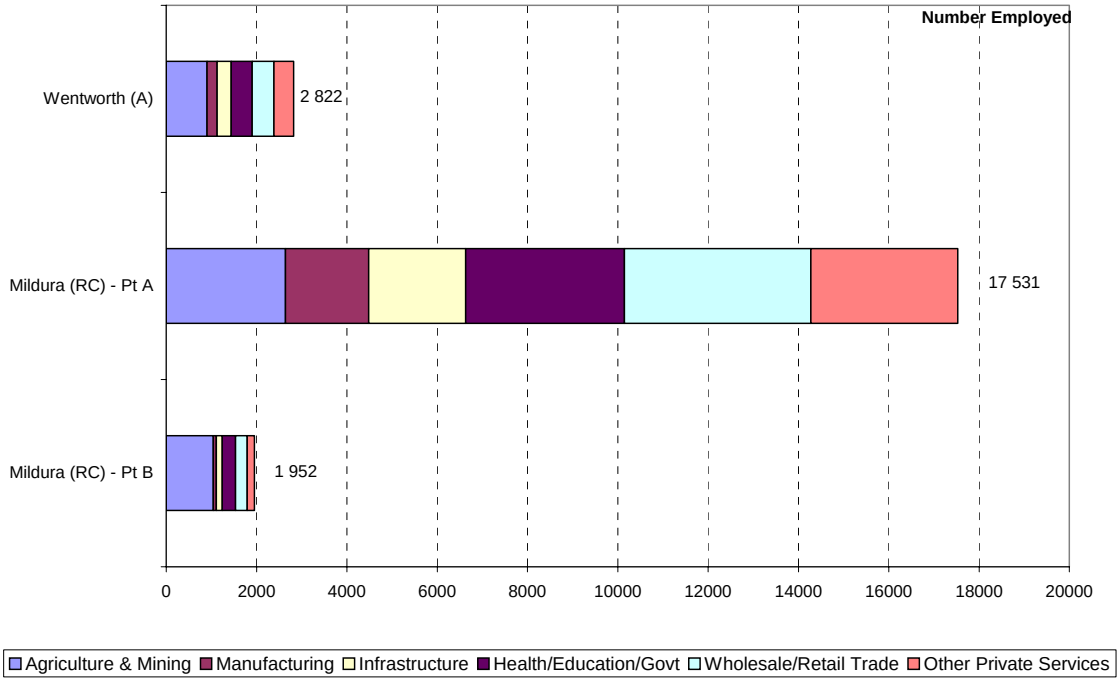
Employment numbers can be a poor indicator of production and investment levels because high value capital-intensive investment will not show up in the figures. Some care also needs to be exercised in interpreting the spatial patterns associated with this employment data as some figures are based on 'enumerated at home' data while others are based on total 'place of enumeration' data and therefore include visitors. This slight difference in data sources also means that the total employment may not be consistent across all of the figures presented. A further complication when comparing these figures is that the 'enumerated at home' data are based on where people live which is not necessarily where they work. However, despite these limitations, the charts and tables presented below do provide an overall picture of the major industries in the region and their relative size.

Figure 3.4 emphasises the dominance of Mildura on economic activity in the region. Although the Census records where people live rather than their place of work, with almost 80 per cent of the regional workforce living in Mildura (RC) Pt A, it is clearly the centre of both industrial and social activity. It is also the big service centre with only small amounts of non-agricultural industry in Wentworth and even less in Mildura (RC) Pt B. In particular, note the small numbers employed in the infrastructure, health/education/government and

wholesale/retail trade in these SLAs compared to Mildura. This implies that these areas are using services provided by Mildura. Wentworth Shire has avoided this trend more than Mildura Pt B, presumably assisted by the existence of the state border, which ensures parallel state and local government administrations.

A recent business survey conducted by the Wentworth Shire (French 2003) seems to confirm this, suggesting that Wentworth businesses have only limited success in selling products to the rest of Sunraysia with 57.3 per cent sold to Wentworth Shire, 16.4 per cent to elsewhere in Sunraysia and 21.9 per cent outside the region altogether. However, the same survey suggests that business confidence is very high in Wentworth Shire with 56.8 per cent of businesses expecting increased demand for their product over the next two years and only 2.4 per cent expecting a decrease. This indicates that any losses to Mildura businesses are expected to be more than offset by the high overall growth rate of the region.

FIGURE 3. 4 EMPLOYMENT BY INDUSTRY SECTOR—SUNRAYSIA 2001



Note Infrastructure sector includes Construction, Communication, Transport, Electricity, Gas & Water. Other Private Services includes Accommodation, Cafes and Restaurants, Property and Business Services, Finance and Insurance, Cultural and Recreational Services and Personal and Other Services.

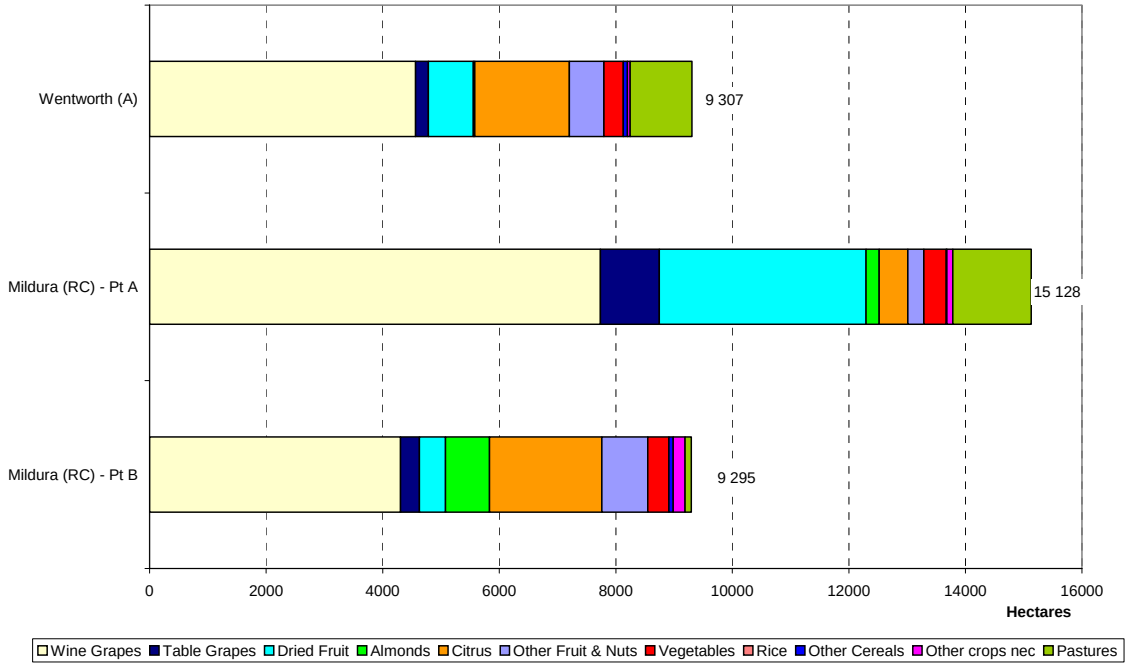
Source BTRE estimates based on ABS 2001 Census of Population and Housing (place of enumeration data, persons enumerated at home).

Irrigated agriculture

The local consensus is that the key driver of growth in Sunraysia has been the expansion of irrigation industries and, in particular, grapes for wine. Strong export demand for wine that translated into long-term winery contracts to growers has been the basis for expansion in this sector.

Figure 3.5 reinforces this point, showing the dominance of wine grapes over other irrigation types across the region. The recent opening up of export fresh fruit markets now helps underpin the current general prosperity with the region the largest exporter of fresh citrus. Citrus has been (and remains) a key employer in the region with local estimates of 400 people on-farm and an additional 1200 employed in downstream processing.

FIGURE 3. 5 AREA OF IRRIGATED AGRICULTURE BY CROP TYPE—SUNRAYSIA 2001

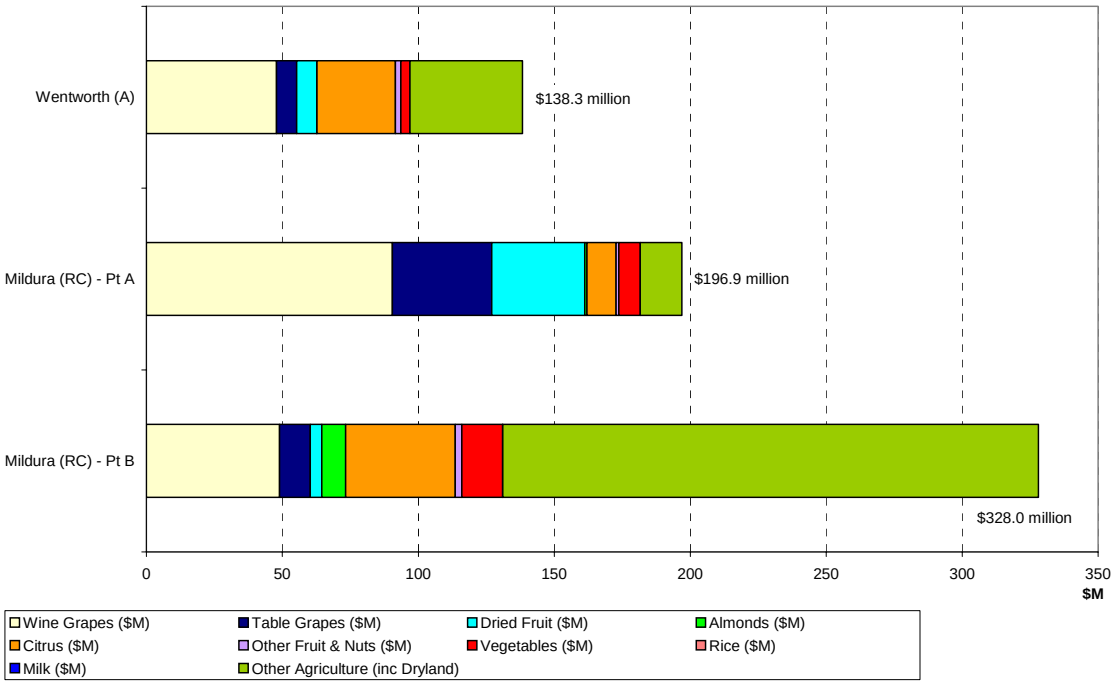


Source Based on ABS Agricultural Census 2001.

Value of agricultural production

Figure 3.6 shows the value of agricultural production in Sunraysia. Note that, unlike Figure 3.5, it includes all production including dryland agriculture, not just irrigation. Dryland agriculture remains an important group of industries in Wentworth and Mildura (RC) Pt B.

FIGURE 3.6 VALUE OF AGRICULTURAL PRODUCTION BY INDUSTRY—SUNRAYSIA 2001



Source ABS Agricultural Census 2001.

The inclusion of dryland agriculture in Figure 3.6 in part explains the smaller proportions of wine grapes, table grapes, almonds and other fruit and nuts in this figure. However, looking at Table 3.5 these crops are increasing in area. This suggests that the proportionally smaller value of production may be a consequence of the lead times (in the order of 3 to 6 years) involved between planting and full production of some crops.

Table 3.5 contains a summary of recent trends and confirms the view of those in the region of a general expansion of irrigation across the region. The overall expansion of irrigated area has been 8770 hectares or 35 per cent growth over the period. Looking behind the figures presented in Table 3.5, this comprised 6127 hectares (33.5 per cent increase) on the Victorian side and only 2643 hectares (39.7 per cent increase) on the NSW side. The fact that more than twice the absolute increase occurred on the Victorian side of the border is not explained by existing activity. Relative growth rates are poor indicators of performance, since agronomic conditions are similar and the region has a common supporting infrastructure. Two explanations have been advanced from the region for the difference in absolute growth. Firstly, the lack of suitable freehold land in NSW and secondly a reluctance of some large Victorian-based investors to engage the NSW water management system.

TABLE 3. 5 CHANGES IN IRRIGATION AREA BY CROP TYPE—SUNRAYSIA 1997 TO 2001

Crop Type	*Sunraysia (Ha)*	*Sunraysia (%)*
Wine Grapes	8264	99
Table Grapes	444	40
Dried Fruit	-1405	-23
Almonds	112	13
Citrus	-194	-5
Other Fruit & Nuts	875	112
Vegetables	193	22
Other Cereals	-444	-74
Other crops nec	106	43
Pastures	820	48
Total	8770	35

Source Based on ABS Agricultural Census 2001.

The local view is that the expansion of wine grapes and fresh citrus has been accompanied by a fall in the production in the dried fruit and citrus juice industries for which the region has historically been renowned. Close inspection of Table 3.5 shows that not only is new investment directed toward wine grapes, table grapes, almonds and other fruit and nuts, but these crops are also supplanting dried fruit and cereals in existing irrigation areas. However, this transition has not always been smooth. In particular, regional advice is that there are 'a lot' of under-performing dried fruit properties within existing irrigation areas for sale without a ready market. These are smaller, tied to older irrigation technologies, that either by choice or necessity have not undertaken large investment.

Although not directly shown by Table 3.5, there has been strong pressure on citrus growers to undertake new investment in different varieties. This has been to a large extent the result of reduced returns for orange juice and the relative profitability of fresh orange fruit exports especially to the US market. In order to take advantage of these changes in the market, there has been a move from valencia to navel oranges. The extent of these changes is shown in Table 3.6. For Sunraysia, there has been an increase of 21 per cent in navels sown and a decrease of 37 per cent in valencias. By just focussing on the area of navel and other varieties that reported an increase in Table 3.6 it can be seen that there has been planting of new citrus stocks of over 10 per cent between 1997 and 2001. This is likely to underestimate the total amount of plantings as it only represents the net change within varieties across the region. Later figures from the Murray Valley Citrus Board (2002) suggest that although these varietal changes are maintained, the overall decline in total citrus area has turned around in the Sunraysia and Central Murray regions, with an overall increase in area of over 3 per cent between 2001 and 2002 for the combined regions.

TABLE 3. 6 CHANGES IN AREA OF ORANGE VARIETIES—SUNRAYSIA 1997 TO 2001

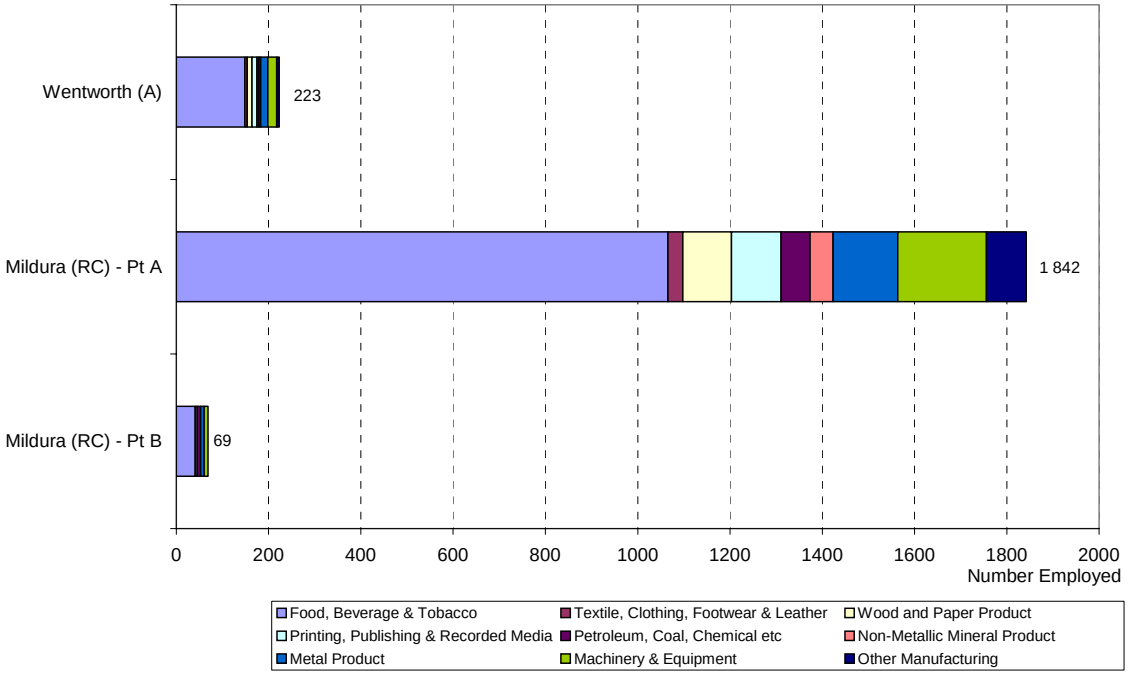
Variety	*Change in Number of Trees*	*Sunraysia % Change*
Navel	192 479	20.6
Valencia	-311 251	-36.8
Grapefruit	3 817	10.3
Lemons and limes	-10 438	-15.2
Mandarins	10 099	5.0
All other citrus	7 866	69.8
Total Citrus Trees 1997	2 119 004	

Source ABS Agricultural Census 2001.

Manufacturing

Figure 3.7 demonstrates the pre-eminence of Mildura as the processor of primary produce and as a supplier of inputs for the region. Secondary industry is heavily biased toward downstream processing of agricultural and mining products. Other manufacturing is almost exclusively confined to Mildura itself. Information provided to BTRE during discussions with regional business people suggested that it includes activities such as labelling; wine tank manufacture; mineral sands processing and machinery and equipment manufacturing that are closely linked to agricultural production.

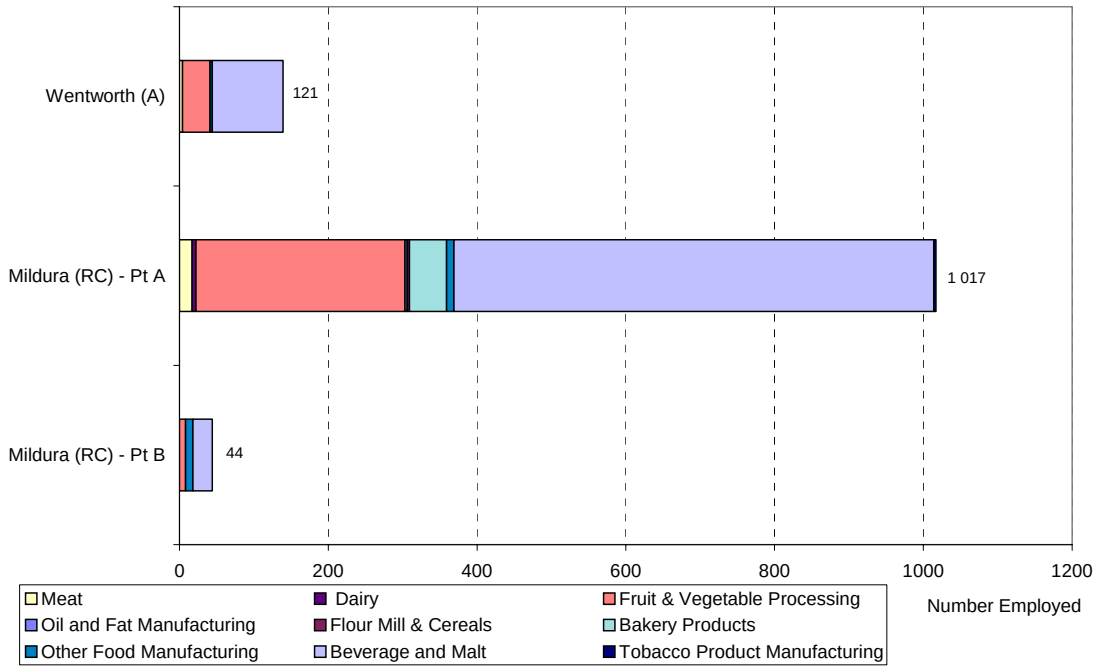
FIGURE 3. 7 EMPLOYMENT BY MANUFACTURING TYPE BY SLA—SUNRAYSIA 2001



Source BTRE estimates based on ABS 2001 Census of Population and Housing (place of enumeration data, persons enumerated at home).

Figure 3.8 explores the type of food and beverage manufacturing in the region. It shows that this is dominated by wine production and bottling plants, fruit and vegetable processing (particularly citrus and dried fruit processing) with few people employed in meat, bakery and other food manufacturing.

FIGURE 3. 8 EMPLOYMENT IN FOOD AND BEVERAGE MANUFACTURING BY SLA—SUNRAYSIA 2001



Source BTRE estimates based on ABS 2001 Census of Population and Housing (place of enumeration data, persons enumerated at home).

Other industries

Local business interests note that Mildura also maintains transport and other direct support services and has become an important regional service centre in providing business, health and recreational services to the surrounding regions on both sides of the border.

They also report that in addition to the industries set out above, mineral sand mining for zircon, rutile, ilmenite and other rare metals would seem set for considerable growth. Major regional deposits are produced at Wemen and Ginko (near Pooncarie) with five other sites in the region being developed for production. Construction of the world's largest solar-powered electric generating plant in Wentworth Shire is being considered. Leighton Contractors are currently conducting feasibility studies and due diligence activities on the project, which is estimated to cost about $US560 million (A$1 billion) if it proceeds. A completion date of 2006 is envisaged (Holloway 2003).

Tourism is also an important industry. The industry has been traditionally based on river attractions and produce, but the distance from the main market (Melbourne) and the sophistication of the tourism facilities at the much nearer Echuca, makes for strong competition. The regular regional air service to Mildura, the 'outback' feel and the mix of innovative and traditional sights and venues are advantages for the region. It is expected that, if completed, the solar tower will significantly boost this industry.

Although relatively small at present (estimated to employ some 60 people in Victorian Sunraysia and a similar number at Pooncarie, NSW), some locals predict that the mineral sands industries will drastically impact on future growth. They believe that this industry along with increased citrus production and almonds provides a basis for the upgrading/building of a standard gauge rail link from Melbourne to Broken Hill (and hence Darwin), thereby creating even further opportunity in the transport area.

OBSERVED INVESTMENT PATTERNS

In order to gain an insight into the flows of capital investment, we have developed estimates of the capital stock used in specific industries in 1997 and 2001. This report focuses on capital stock as the ongoing result of investment. As a result, we have chosen capital stock as the key indicator to provide an insight into investment in the regions being studied. This section presents estimates of capital stock in both irrigated agriculture and manufacturing for each region. Data limitations mean that different methodologies are used to calculate these estimates and the estimates are based on different valuation methods (for more detail on this issue see Appendix I). As a result, we have chosen not to add the two figures.

The capital stock in irrigated agriculture has been estimated from Agricultural Census data on areas under irrigation (Ha) and regional estimates of the replacement value of on-farm works and equipment in each industry, as described in Chapter 1 and Appendix I. For the dairy industry, a further amount was added on a per farm basis to account for the investment in milking shed plants.

Estimates of capital stock in manufacturing industries have been obtained by apportioning Australian data on non-current assets for two-digit manufacturing ANZSIC classes (ABS Cat. 8225.0 *Manufacturing Australia* data cube) on the basis of the number of employed persons in that industry in each region (from the ABS 2001 *Census of Population and Housing*).

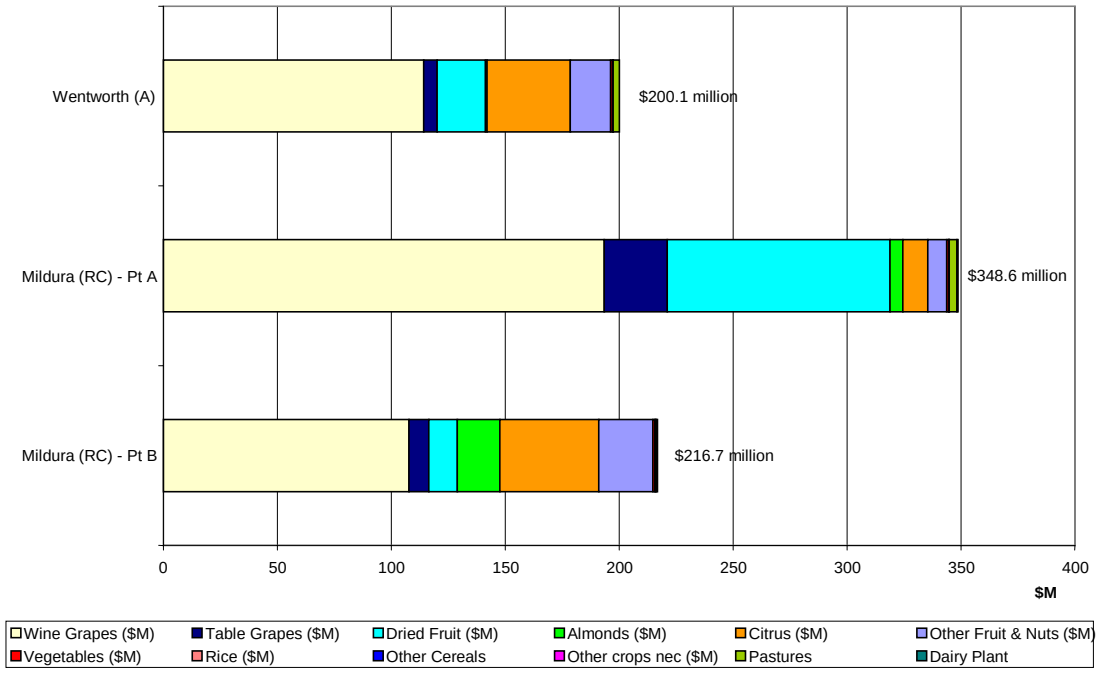
Obviously these estimates do not cover the entire capital for a region. They do not, for example, cover service industries, government investment or investment in private housing. However, irrigated agriculture and manufacturing are the core industries exporting from the regions under study

and therefore are the most important in terms of driving underlying economic productivity.

Irrigated agriculture

Figure 3.9 and Table 3.7 describe the capital stock in irrigated agriculture in Sunraysia and the changes between 1997 and 2001. The overall pattern of irrigation is similar across the region, consisting almost entirely of high value horticultural investment. Where there are differences between SLAs, these can reflect history. For example, the high level of capital stock in Mildura (RC) Pt A in dried fruit, despite capital stock in this industry falling over time (Table 3.7). Other differences result from more recent developments, such as the investment in almonds in Mildura Pt B and Mildura Pt A.

FIGURE 3. 9 CAPITAL STOCK IN IRRIGATED AGRICULTURE—SUNRAYSIA 2001 ($M)



Source BTRE estimate based on ABS Agricultural Census 2001.

TABLE 3. 7 CHANGES IN CAPITAL STOCK IN IRRIGATED AGRICULTURE—SUNRAYSIA 1997 TO 2001 ($M)

	Wentworth (A) ($M)	*Mildura (RC) Pt A ($M)*	*Mildura (RC) Pt B ($M)*	*Total Sunraysia*
Wine Grapes	73.4	102.4	30.8	206.6
Table Grapes	0.0	10.0	2.2	12.2
Dried Fruit	-12.1	-5.6	-20.9	-38.6
Almonds	0.6	3.5	-1.4	2.8
Citrus	-1.5	-7.2	4.3	-4.4
Other Fruit & Nuts	9.2	-0.8	17.9	26.2
Vegetables	0.2	0.3	0.0	0.5
Other Cereals	-0.9	-0.1	-0.2	-1.1
Other crops nec	0.0	0.0	0.3	0.3
Pastures	0.5	2.2	-0.6	2.1
Dairy Plant	0.0	0.3	-1.2	-0.9
Net Total	69.3	105.1	31.3	205.7
Net Total (%)	53.0%	43.2%	16.9%	36.7%

Source BTRE estimate based on ABS Agricultural Census 1997 & 2001.

As noted above, there is greater potential for physical access to the Murray and Darling rivers on the NSW side. However, not only is the irrigated area (Figure 3.5) and value of production (Figure 3.6) higher on the Victorian side, but the level of capital stock greater by a factor of almost 3:1 (~$565 million against ~$200 million for NSW). Whilst this could be a hangover from the historical development of irrigation schemes by the respective State governments, it would seem that the trend is continuing. Table 3.7 indicates that the absolute increase in capital stock in Victorian Sunraysia was almost double that on the NSW side.

These figures confirm local observations that activity on the Victorian bank is considerable, with private diverters opening up new land for irrigation using permanent water purchased from the Central Murray region, specifically from users in the dairy industry—some 10 000 megalitres per annum have been traded to downstream of Swan Hill over the last four years (Hassall & Associates 2002). Although yet to come to fruition, a considerable amount of effort by FMIT, SRWA, the Mallee Catchment Authority (MCA) and independent representatives, supported by the Victorian State Government, has gone into assessing the feasibility of a new irrigation scheme using water purchased from outside the region—the Deakin Project (SMEC 2001).

Considerable development has occurred upstream of Mildura on the Victorian side (eg. the Colignan–Nangiloc area) despite difficulties and costs associated with antiquated channel delivery systems. There has also been considerable development toward the SA border by corporate operators.

On the NSW side, development of on-farm systems has followed the upgrading of irrigation supply to piped systems. In addition, Table 3.5 suggests that there has been an expansion of the area under irrigation as a whole in Sunraysia. More detailed analysis shows that NSW Sunraysia expanded by 2643 hectares and Victorian Sunraysia by 6127 hectares. However, the local evidence emphasised the difficulty in obtaining access to further irrigable land in NSW and the loss of some existing farms to residential development (a trend also observed on the Victorian bank close to Mildura).

Reliability of supply is seen as an important issue, with irrigation districts across the region maintaining allocations at a high level. Irrigators only engage in temporary sales (or 'leasing'), thereby maintaining their long-term rights as a reserve against reduced supplies and to allow future expansion of their areas. Interestingly, the consensus is that High Security water in NSW is more secure than the Victorian equivalent. This is due to its relative rarity in a NSW system that is essentially based on sales of General Security water.

The relative size of investment in irrigated agriculture between the states is curious. Despite the enhanced physical access of two rivers, common regional support services (albeit based in Mildura) and the availability of both inter and intrastate water trading, new investment is still heavily biased toward the Victorian side. Whilst this broadly reflects the existing capital stock ratio and hence maintains the status quo, the question arises as to why there is not roughly equal development on both banks or higher investment into the previously relatively underdeveloped NSW region.

Manufacturing

Figures 3.10 and 3.11 and Table 3.8 provide estimates of the levels of manufacturing capital stock in Sunraysia for 1996–97, 2000–01 and the changes in the intervening period. Of note is the significant growth in manufacturing, both in absolute amounts and growth over the period, the dominance of food and beverage manufacturing and the concentration of industry in Mildura (RC) Pt A (ie. Mildura city).

Growth in capital stock over the four year period was 97 per cent overall. Australia-wide this figure is only 29 per cent. This very strong growth confirms local reports for the sector and ultimately the demand for housing and industrial land in the region.

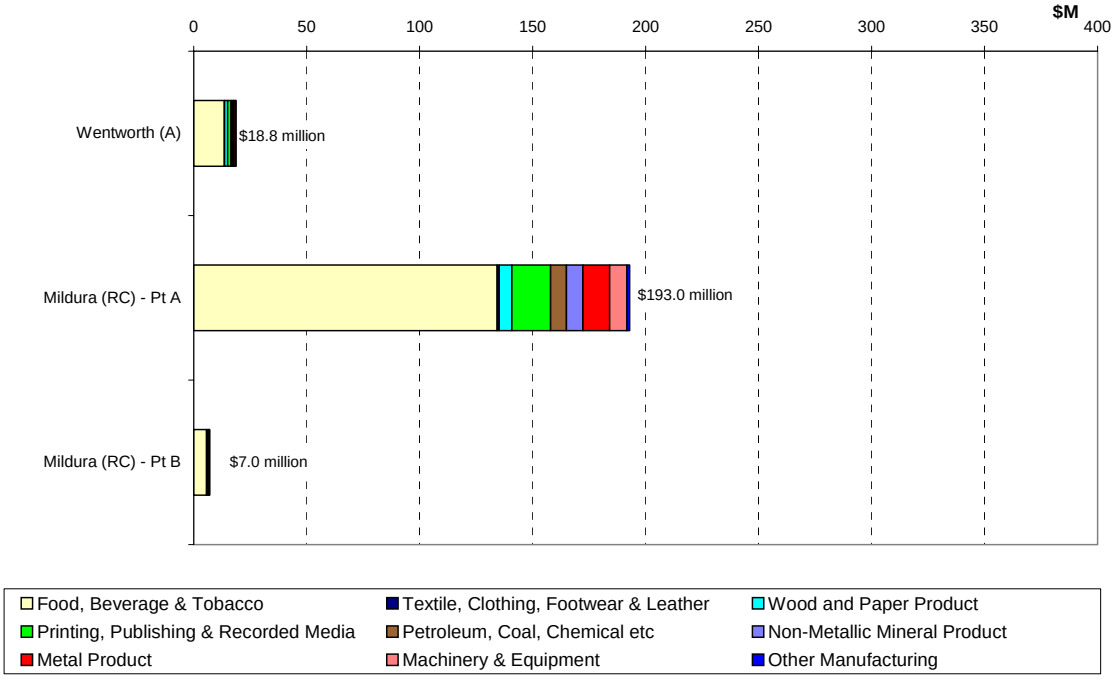
The capital stock in food and beverage manufacturing comprised 75 per cent of the total manufacturing capital stock in Sunraysia in 2000–01. This emphasises the very high level of dependence of regional manufacturing on irrigated agriculture. However, it would seem that the trend is for food and beverage manufacturing to increase even further as the sector accounted for 81 per cent

of the growth in manufacturing capital stock over the period 1996–97 to 2000–01.

In addition, much of the other manufacturing in the region either directly services agriculture or services regional markets. It is difficult to escape the conclusion that with the exception of some tourism and mining, the economy is heavily dependent on irrigation water.

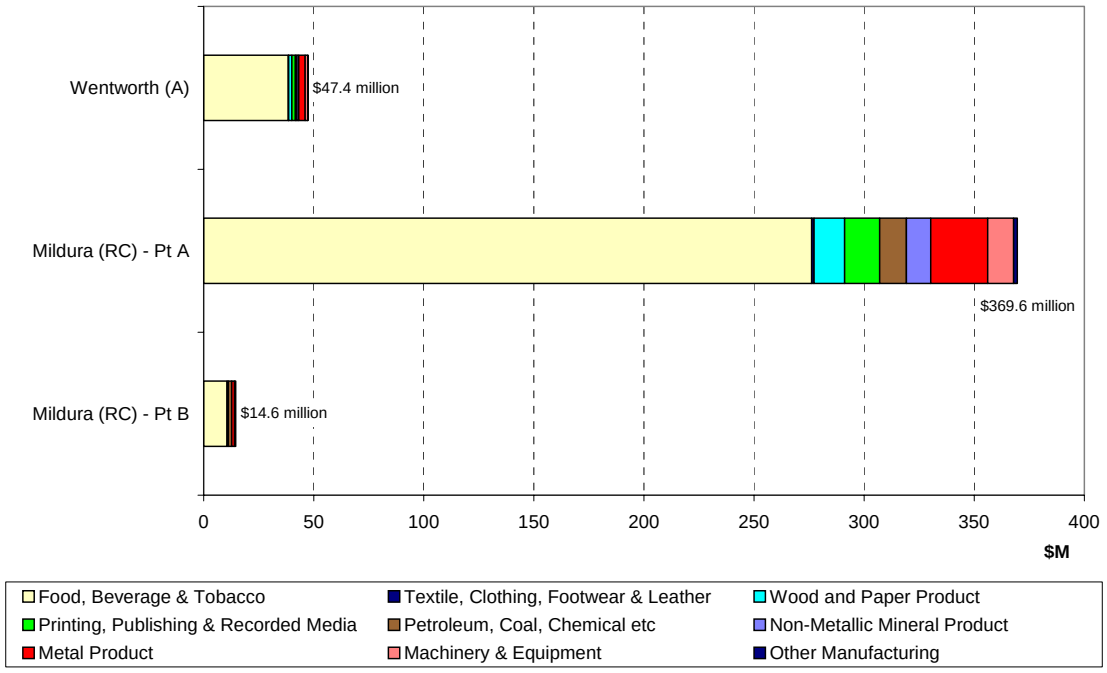
The spatial distribution of investment strongly favours Mildura itself with almost 86 per cent of the manufacturing capital stock of the region in 2000–01 (and 83 per cent of growth over 1996–97 to 2000–01 was also in Mildura). This reinforces the economic dominance of Mildura over the region. This is likely to continue despite the rate of growth in capital stock in the four years to 2000–01 favouring Wentworth (152 per cent) and Mildura (RC) Pt B (107 per cent) compared to Mildura (RC) Pt A of (91 per cent). Despite these relative growth figures, Table 3.8 reveals that Mildura had almost five times the increase in capital stock as the other two areas combined.

FIGURE 3. 10 CAPITAL STOCK IN MANUFACTURING—SUNRAYSIA 1996–97 ($M)



Source BTRE estimates based on ABS estimates of Non-current Assets in Manufacturing subdivisions 1996–97 & 2000–01, industry employment data from the ABS 1996 & 2001 Censuses of Population and Housing.

FIGURE 3. 11 CAPITAL STOCK IN MANUFACTURING—SUNRAYSIA 2000–01 ($M)



Source BTRE estimates based on ABS estimates of Non-current Assets in Manufacturing subdivisions 1996–97 & 2000–01, industry employment data from the ABS 1996 & 2001 Censuses of Population and Housing.

TABLE 3. 8 CHANGES IN CAPITAL STOCK IN MANUFACTURING—SUNRAYSIA 1996–97 TO 2000–01 ($M)

	Wentworth	*Mildura Pt A*	*Mildura Pt B*
Food, Beverage & Tobacco	24.8	141.9	4.9
Textile, Clothing, Footwear & Leather	0.1	0.2	0.0
Wood and Paper Product	0.1	8.3	0.0
Printing, Publishing & Recorded Media	0.1	-1.3	0.6
Petroleum, Coal, Chemical etc	0.3	5.1	0.8
Non-Metallic Mineral Product	0.1	3.7	0.0
Metal Product	2.2	14.1	1.0
Machinery & Equipment	0.7	4.2	0.4
Other Manufacturing	0.1	0.4	-0.1
Total Manufacturing	28.6	176.6	7.6

Source BTRE estimates based on ABS estimates of Non-current Assets in Manufacturing subdivisions 1996–97 & 2000–01, industry employment data from the ABS 1996 & 2001 Censuses of Population and Housing.

SUMMARY

- General economic growth (as measured by real taxable income) is strong in Sunraysia averaging 4.3 per cent per annum from 1990–91 to 1999–00, exceeding the Australian average (3.0 per cent) on the same measure.

- Economic growth is heavily centralised in the city of Mildura, which is growing faster at 5.3 per cent than either surrounding Victoria (0.0 per cent) or NSW's Wentworth Shire (1.1 per cent).
- Investment in irrigated agriculture is focussed on horticulture across the region with wine grapes dominating in terms of the amount of capital stock and growth. Growth in capital stock in irrigated agriculture is estimated at 37 per cent between 1997 and 2001.
- Manufacturing capital stock is also growing quickly by 97 per cent between 1996–97 and 2000–01. 83 per cent of this growth was in Mildura itself.
- Despite the greater potential for physical access to the Murray and Darling rivers on the NSW side, Victorian Sunraysia has more area under irrigation, a higher value of production and almost three times the level of capital stock.

THE RIVERLAND

DESCRIPTION OF THE REGION

The Riverland region of South Australia comprises an area of around ten kilometres either side of the Murray River from the NSW/Victorian border to Waikerie. The region includes the Local Government Areas of Renmark Paringa DC[10], Loxton Waikerie DC, and Berri Barmera DC. There is no one single major centre for the region, rather the population is spread among a number of townships in relatively close proximity (around 40 kilometres) to each other—Renmark, Loxton, Berri, Barmera and Waikerie (Table 3.11).

The population is ethnically diverse. Table 3.9 shows the proportion of people born overseas to be 11 per cent compared to the Australian average of 22 per cent. The indigenous component (2.3 per cent) is close to the national 2.1 per cent average.

Irrigated agriculture is the main focus of the region's economy with wine grapes and citrus predominating, but with significant production of vegetables, stone fruit and almonds. These industries support an extensive packing and manufacturing sector—especially wineries. In addition, the Mallee soils south of the river produce high quality prime hard wheat and the region also has extensive grazing regions to the north. Tourism is also a significant industry as are the service industries that support the population of around 35 000 people.

TABLE 3. 9 DEMOGRAPHIC STATISTICS—RIVERLAND 2001

	SA Riverland
Population[a]	33 546
Total population growth 1991-2001[a]	1.3%
Indigenous population share[b]	2.3%
Proportion born overseas[b]	11%
Proportion speaking language other than English at home[b]	9%

a. Based on ABS 2001 *Regional Population Growth*, Australia and New Zealand, 1991 to 2001 (Cat. 3218.0) Estimated Resident Population data.

b. Based on ABS 2001 *Census of Population and Housing*, Place of Enumeration data.

The total land area of the Riverland SLAs included in this study is 20 952 km^2 (Table 3.3). However, well over 50 per cent of this (11 520 hectares) is in the unproductive and extremely sparsely populated Unincorporated Riverland. Soil types in the region are classified in the Australian Natural Resources Atlas

10 District Council.

(NLWRA 2001a) as Calcarosols. These are described as solonised brown soils, grey-brown and red calcareous soils and calcareous sands, occurring in areas of low rainfall, used for cereal growing and irrigated horticulture in the south and sparse grazing in the north. This description of dryland land use correlates with local advice that also notes that, closer to the river itself, heavier clay soils types predominate.

In Table 3.10 we have estimated the amount of water used for irrigation in the Riverland and Sunraysia for 1997 and 2001. In both years the estimated water use in the Riverland is only slightly higher than in Sunraysia.

TABLE 3.10 IRRIGATION WATER USE—RIVERLAND 1997 & 2001

	Riverland (ML)	*Total Sunraysia (ML)*
1997 Estimate	188 300	184 847
2001 Estimate	274 785	253 416

Source BTRE estimate based on NLWRA 2001a and Agricultural Census 1997 and 2001.

GENERAL ECONOMIC PERFORMANCE

Like Sunraysia, the Riverland is perceived as a prosperous region that is experiencing a minor downturn amid a long-term expansionary period. Growth is seen to have flowed from investment in high profit irrigated agricultural activities tied to astute global marketing and sound environmental practice.

Population

The population growth figures in Table 3.11 do not support the view of unambiguous growth, more that the population is relatively static or growing slowly. The population of the largest centre (Renmark) has grown by 5.9 per cent over the period. Adjoining Renmark is Paringa, which has grown by 12.3 per cent (albeit from a small base). Of the other major centres, only Berri (0.8 per cent) has grown, whilst Barmera (-2.2 per cent), Waikerie (-0.5 per cent) and Loxton (-1.2 per cent) have registered population declines.

TABLE 3.11 POPULATION BY SLA—RIVERLAND 2001

Statistical Local Area (SLA)	*2001 Population*	*Pop growth 1991–2001*	*Area km²*	*Population density 2001*
	no.			*persons/km²*
Berri & Barmera (DC) - Barmera	4389	-2.2%	297.9	14.7
Berri & Barmera (DC) - Berri	6977	0.8%	219.0	31.9
Loxton Waikerie (DC) - East	7441	-1.2%	4979.3	1.5
Loxton Waikerie (DC) - West	4756	-0.5%	3020.6	1.6
Renmark Paringa (DC) - Paringa	1745	12.3%	739.8	2.4
Renmark Paringa (DC) - Renmark	8091	5.9%	175.7	46.0
Unincorp. Riverland	147	-21.4%	11520.0	0.0

Source ABS 2001 *Regional Population Growth*, Australia and New Zealand, 1991 to 2001 (Cat. 3218.0) Estimated Resident Population data.

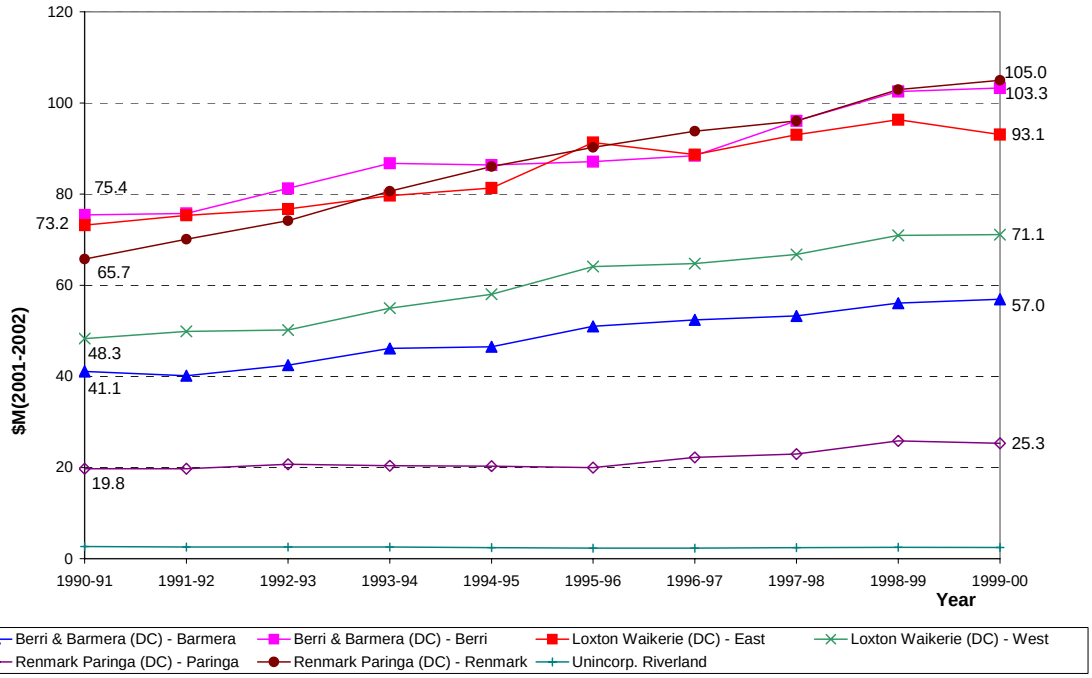
Taxable income

On the other hand, Figure 3.12 shows that gross real taxable income for the region has grown significantly over the period. The rate of growth of taxable income is approximately 40.2 per cent for the region as a whole, varying from 6.4 per cent for the Unincorporated Riverland to more than 60 per cent for Renmark. These rates compare with growth of 45.5 per cent for Sunraysia and 31.0 per cent for Australia as whole over the same period.

In annual growth rate terms (Table 3.12), the region has outperformed the Australian economy over the period, with Renmark experiencing an exceptional growth rate. Only the Unincorporated Riverland lagged significantly.

Figure 3.12 also emphasises the Riverland phenomenon of six roughly equal SLAs, each based on its own urban centre, operating side by side with similar rates of growth, without one appearing to dominate. This contrasts strongly with Mildura's dominance of Sunraysia. The reasons for these differences are outside the scope of this study, but a discussion of relevant regional development theories can be found in BTRE (2003a).

FIGURE 3. 12 GROSS REAL TAXABLE INCOME BY SLA—RIVERLAND 1990–91 TO 1999–2000



Source BTRE July 2003 estimates based on Australian Taxation Office data.

TABLE 3. 12 ANNUAL RATE OF GROWTH OF GROSS REAL TAXABLE INCOME—RIVERLAND 1990–91 TO 1999–00

	Annual Growth Rate between 1990–91 & 1999–00
Berri & Barmera (DC) - Barmera	3.7%
Berri & Barmera (DC) - Berri	3.6%
Loxton Waikerie (DC) - East	2.7%
Loxton Waikerie (DC) - West	4.4%
Renmark Paringa (DC) - Paringa	2.8%
Renmark Paringa (DC) - Renmark	5.3%
Unincorp. Riverland	–0.7%
All Riverland	3.8%
Australia	3.0%
Australian annual growth of GDP (chain volume measure)*	3.7%

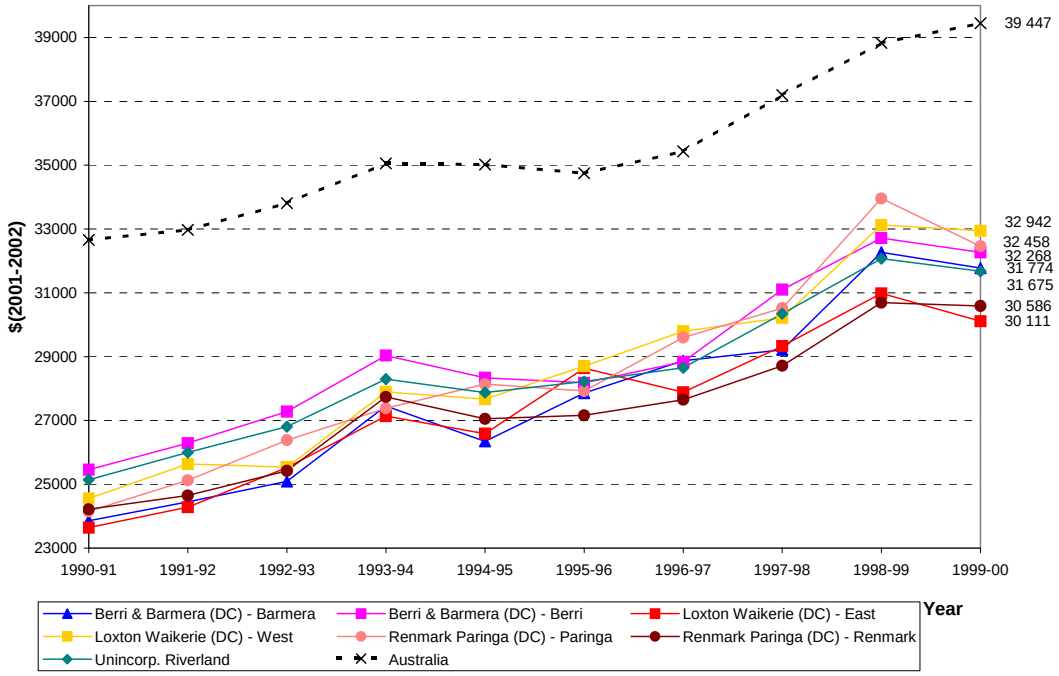
Source BTRE estimates based on Australian Taxation Office data. *ABS Cat 5204.0, 2001-02 (Australian System of National Accounts, Time Series Spreadsheets, Table 10).

The apparent disparity between the growth in population for the Riverland (1.3 per cent) and taxable income (40.2 per cent) is in part explained by an increase in the number of taxpayers (up by 8.6 per cent). This is supported by the unemployment figures for the region that show a decrease of 10.1 per cent (17.3 per cent to 7.2 per cent) for the period 1991 to 2000 (BTRE estimates based on DEWR Small Area Labour Market data).

The decrease in unemployment is only a partial explanation. Clearly, the increase in gross income has come through a significant gain in individual personal income. This is borne out by Figure 3.13, which shows an increase in mean taxable income in the Riverland of $7095 (a 29 per cent increase) compared to a national increase of $6789 (21 per cent). These increases have occurred across the SLAs.

An increase in average taxable income greater than the Australian average is rare for an agriculture-based region in recent years. More commonly, high and growing average income is a feature of the major cities and very remote (mining) regions (BTRE 2003b).

FIGURE 3. 13 MEAN REAL TAXABLE INCOME BY SLA—RIVERLAND 1990–91 TO 1999–2000



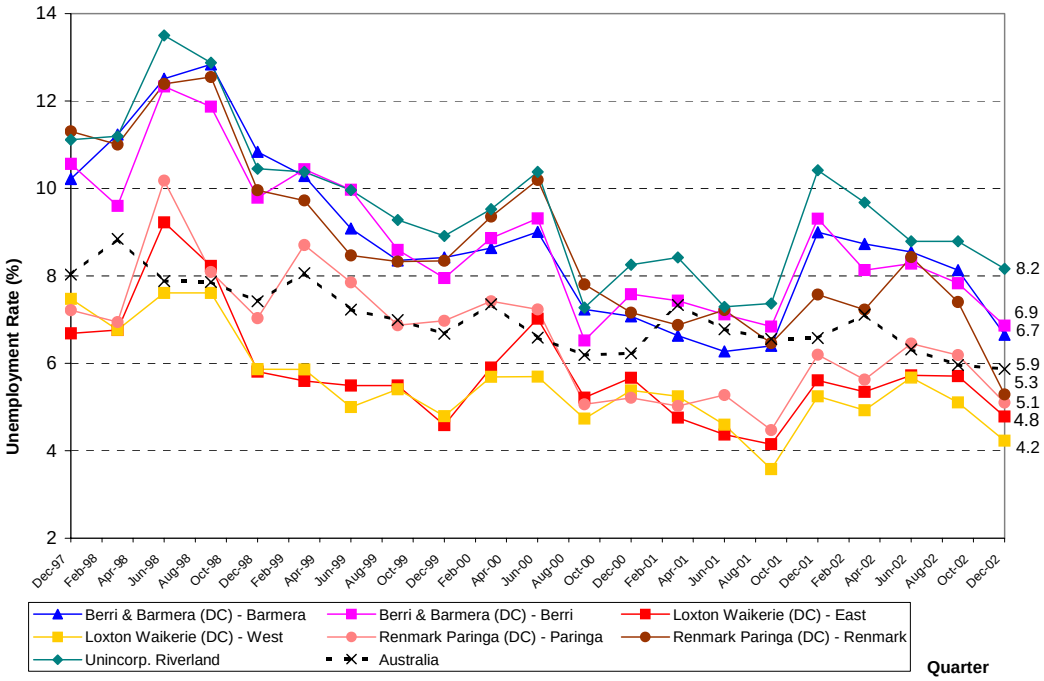
Source BTRE July 2003 estimates, based on Australian Taxation Office data.

Unemployment

The unemployment rates for the region are shown in Figure 3.14. The graph suggests that there are two groups of SLAs. One group comprising the SLAs based on Loxton, Waikerie and Paringa have unemployment generally lower than the national average and with trends that often move independently of it. This pattern is typical of many rural regions, where employment is heavily dependent on agriculture tied to export markets with relatively small secondary or service sectors. The second group, the SLAs based on Berri, Barmera, Renmark and the Unincorporated Riverland display rates generally higher than

the national average, but trend in a similar direction. This may be due to agricultural production being more dependent on domestic markets or a higher level of service and manufacturing industries in these regions. In the case of the Unincorporated Riverland, the high rate of unemployment may be explained by the very high proportion (66 per cent) of indigenous residents in a region with limited employment opportunities.

FIGURE 3. 14 UNEMPLOYMENT RATE BY SLA—RIVERLAND 1997–2002



Source DEWR Small Area Labour Markets.

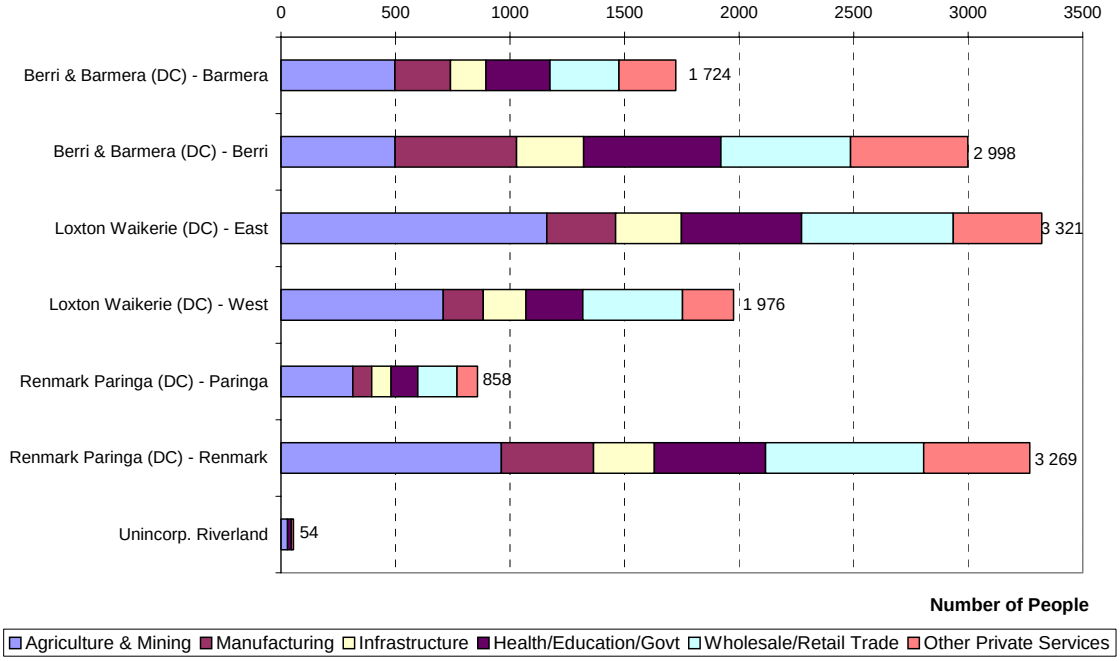
Regional industry structure

General

With the exception of the Unincorporated Riverland, Figure 3.15 shows a surprisingly consistent pattern of industry type within each shire. This is consistent with the phenomenon of a number of relatively small centres co-existing close together in this region. This contrasts with the more often described 'rural sponge city' model of a single dominant centre. The reasons for this phenomenon in the Riverland are unclear, but may be related to the fact that the combined agriculture and manufacturing sectors are much more dominant in the Riverland (totalling 42 per cent of employment) than in Sunraysia (30 per cent). This may be taken to imply a greater degree of value adding in the Riverland, although given the similarity of the type of agricultural output in the two regions, this is unlikely. More feasible is the suggestion of a

less developed tourism sector and the proposition that larger proportions of services are imported into the Riverland (perhaps from the relatively close State capital) than in Sunraysia.

FIGURE 3. 15 EMPLOYMENT BY GENERAL INDUSTRY TYPE BY SLA—RIVERLAND 2001



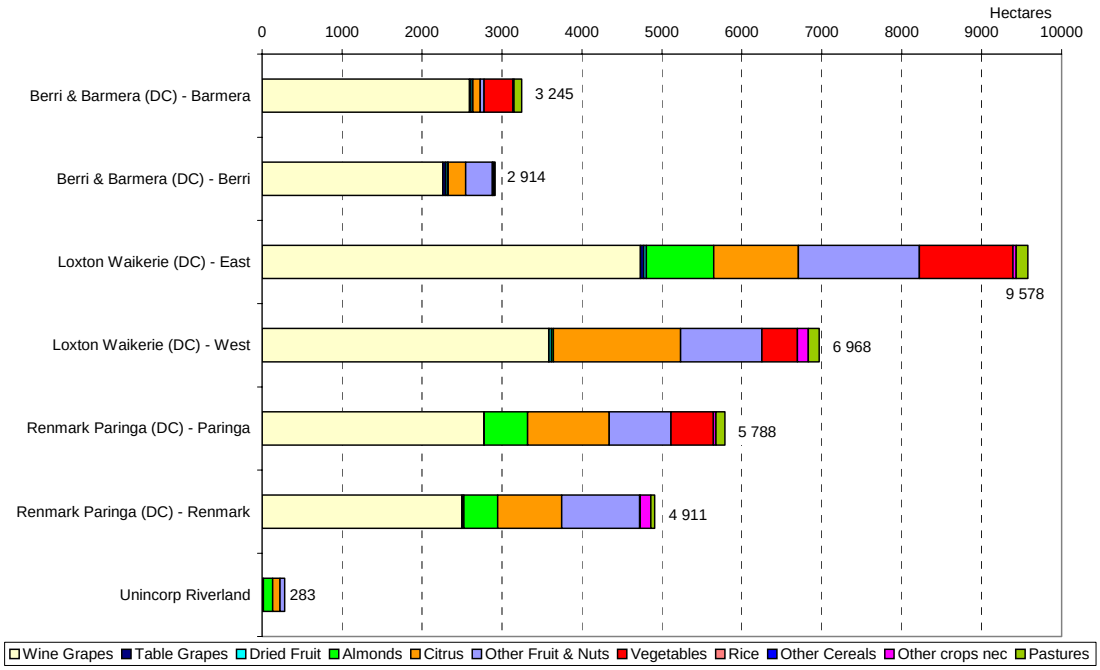
Note Infrastructure sector includes Construction, Communication, Transport, Electricity, Gas & Water. Other Private Services includes Accommodation, Cafes and Restaurants, Property and Business Services, Finance and Insurance, Cultural and Recreational Services and Personal and Other Services.

Source BTRE estimates based on ABS 2001 Census of Population and Housing (place of enumeration data, persons enumerated at home).

Agriculture

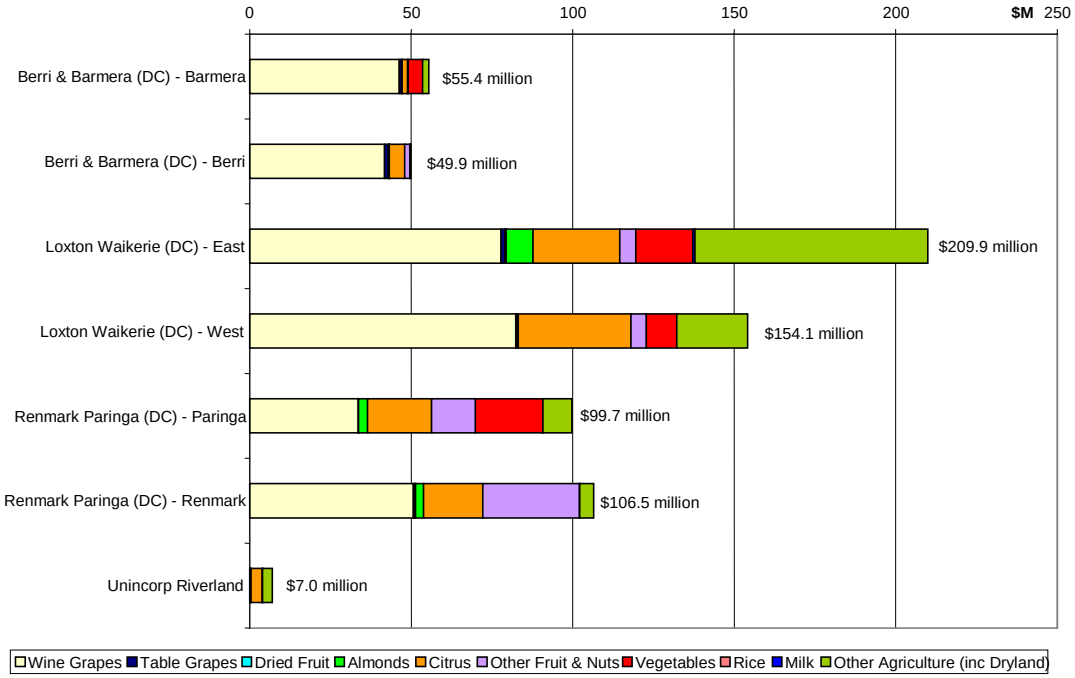
The area of irrigated agriculture in the Riverland (shown in Figure 3.16) demonstrates the overwhelming importance of the wine industry to the region and the importance of the growing almond and stone fruit industries. This dominance is also reflected in the value of production figures provided at Figure 3.17. The emergence of new long-term cropping industries (especially almonds) is masked in the value of production figures by the delay in establishment of the trees. Note also the significant contribution of dryland agriculture, especially in the Loxton and Waikerie areas.

FIGURE 3. 16 AREA OF IRRIGATED AGRICULTURE BY CROP TYPE—RIVERLAND 2001



Source Based on ABS Agricultural Census 2001.

FIGURE 3. 17 VALUE OF AGRICULTURAL PRODUCTION BY INDUSTRY—RIVERLAND 2001



Source ABS Agricultural Census 2001.

The irrigation industries experiencing rapid growth between 1997 and 2001 are identified in Table 3.13. Within an overall growth in irrigation area of 10 948 hectares (48 per cent), the big growth industries were wine grapes at 8548 hectares (86 per cent), almonds at 613 hectares (46 per cent), other fruit and nuts at 1010 hectares (27 per cent) and surprisingly vegetables at 1280 hectares (103 per cent). Small falls occurred in table grapes (25 hectares), dried fruit (85 hectares), irrigated cereals (195 hectares), other crops (42 hectares) and pastures (301 hectares).

TABLE 3. 13 CHANGES IN IRRIGATION AREA BY CROP TYPE—RIVERLAND 1997 TO 2001

Crop Type	*Riverland (Ha)*	*Riverland (%)*
Wine Grapes	8548	86
Table Grapes	-25	-17
Dried Fruit	-85	-40
Almonds	613	46
Citrus	145	3
Other Fruit & Nuts	1010	27
Vegetables	1280	103
Other Cereals	-195	-100
Other crops nec	-42	-10
Pastures	-301	-35
Total	10948	48

Source Based on ABS Agricultural Census 2001.

In the Riverland as in Sunraysia, there has been strong market pressure on citrus growers to undertake new investment in navel oranges at the expense of valencias. The extent of the change in the Riverland is shown in Table 3.14. There has been an increase of 18 per cent in the number of navel orange trees, an increase of 25 per cent in mandarins and a decrease of 13 per cent in valencias. The extra area of different varieties reported in Table 3.14 represents an increase of about 9 per cent in citrus plantings. This is likely to be an underestimate as it only represents the net change across the region.

TABLE 3.14 CHANGES IN AREA OF ORANGE VARIETIES—RIVERLAND 1997 TO 2001

Variety	*Change in Number of Trees*	*Riverland % Change*
Navel	149 246	17.8
Valencia	-141 392	-12.6
Grapefruit	-10 705	-33.7
Lemons and limes	-4 149	-4.3
Mandarins	60 117	24.7
All other citrus	3 055	14.2
Total Citrus Trees 1997	2 365 750	

Source ABS Agricultural Census 2001.

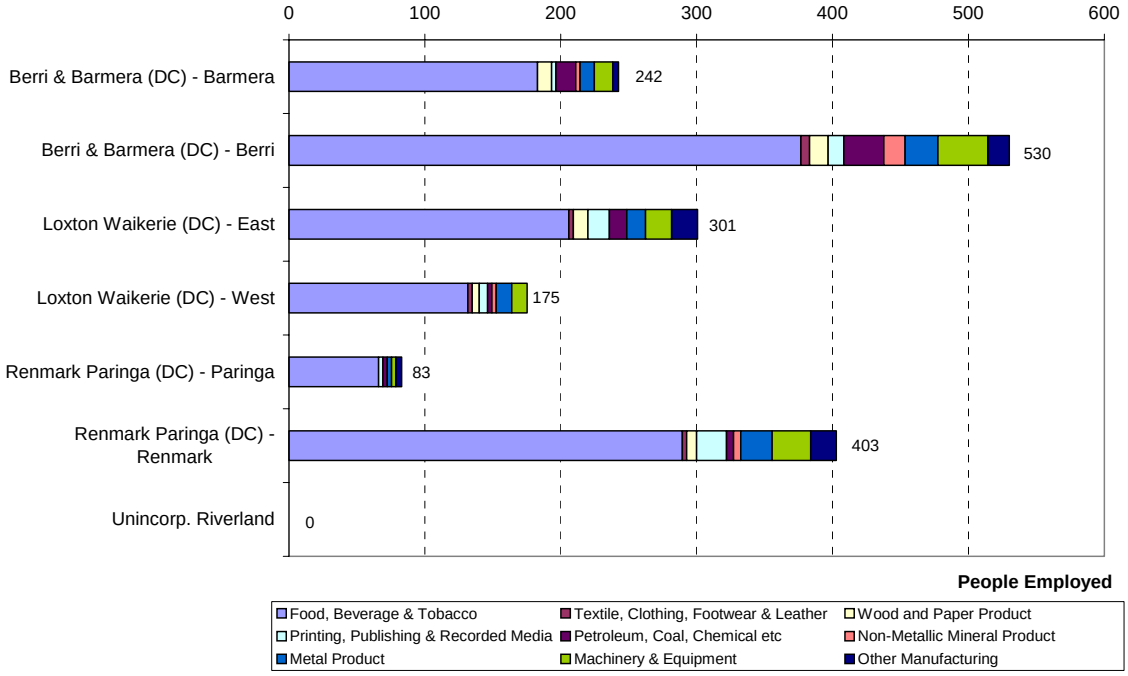
Given this overwhelming emphasis on permanent horticulture plantings, permanent water allocation is prized for the long-term reliability that it brings to the operation of the high investment, high return agriculture of the region. Hence, permanent water is purchased from within or outside SA for the rapid development of new irrigation areas in the Mallee areas to the south of the river (particularly around Loxton). However, most sales of water tend to be on a temporary basis, with many farmers seeking to hold entitlement beyond their immediate and even long-term requirements. Many do this to ensure that even if allocations are reduced in order to meet environmental or other water uses, they will hold enough entitlement to allow normal operations to continue.

Interestingly, a number of farmers indicated that they did not try and recoup money through temporary water trading and that they were happy for entitlement water excess to their immediate needs to go 'down the river' as a contribution to the environment. This behaviour would obviously moderate the impact of any future regulation claiming an additional amount of water for environmental flow.

Manufacturing

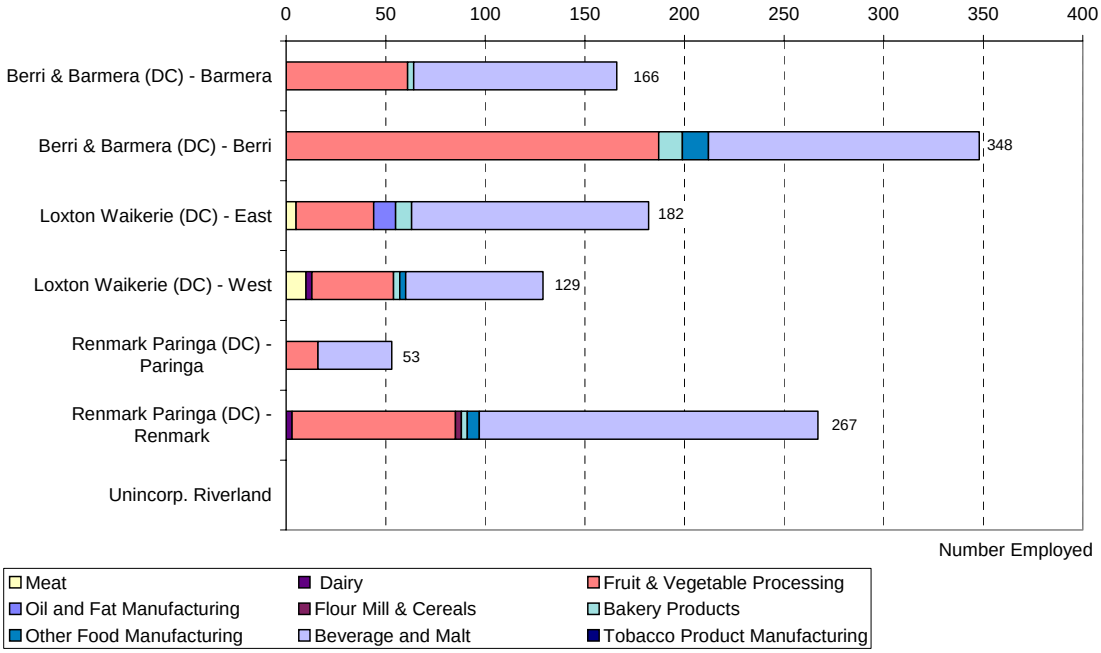
Figure 3.18 shows that, like Sunraysia, secondary industry in the region is largely confined to downstream processing of agricultural products and supplying the agricultural sector. Figure 3.19 teases out manufacturing in the dominant food and beverage sector. The wineries, citrus packing, almond processing and packing dominate, with only small meat, bakery and other food manufacturing sectors present. Figure 3.19 suggests that manufacturing is distributed between the SLAs. However, this may not reflect the true location of industry given the figures are based on the place of residence of employees, rather than the actual place of employment, and travel between centres is not onerous.

FIGURE 3. 18 MANUFACTURING EMPLOYMENT BY SLA, BY TYPE—RIVERLAND 2001



Source BTRE estimates based on ABS 2001 Census of Population and Housing (place of enumeration data, persons enumerated at home).

FIGURE 3. 19 EMPLOYMENT IN FOOD AND BEVERAGE MANUFACTURING BY SLA—RIVERLAND 2001



Source BTRE estimates based on ABS 2001 Census of Population and Housing (place of enumeration data, persons enumerated at home).

The key driver of growth in both agriculture and manufacturing has been the expansion of the wine grape industry and associated wineries. Strong export demand for wine, which has been translated into winery contracts for growers, has been the basis for expansion in this sector. The opening up of export fresh fruit markets now helps underpin the current general prosperity, as does the emerging almond industry. The Riverland produces 33 per cent of Australia's wine grapes, 35 per cent of its oranges and 21 per cent of its stone fruit (Citrus Growers of SA 2001).

The expansion of wine grapes and fresh citrus has been accompanied by a fall in the citrus juice industry for which the region has historically been renowned. However, juicing remains an important enterprise with around 50 per cent of the region's orange production going to juice. Berri Limited is the national market leader.

Tourism

Tourism is a developing industry in the Riverland, and is typified by new enterprises rather than established businesses. Tourism depends heavily on the South Australian (Adelaide) market with the major drawcards being the Murray River itself (fishing, boating, paddle steamers, house boats etc) and the produce from the associated industries (wineries, olives and fruit growing). Whilst the backpacker labour force for the fruit picking season provides a market for basic accommodation services, other domestic tourism demand now has more sophisticated tastes in accommodation and cuisine. The region provides 270 000 bed nights and local operators claim tourism to be the fastest growing industry. Over the last ten years it has become more professional, with the Riverland Tourism Association drawing funds from operators, State and Local Government. The industry is very aware of the need for a positive environmental image. The Banrock Station development enhances this image by supplementing wine production with high profile environmental activities. Major competitors in the tourism market are the Murraylands of SA and Sunraysia.

Investment in the tourism industry is characterised by its local nature. Whilst the backpacker market is important (four new establishments in the past ten years), the focus of much of the development has been more sophisticated infrastructure. This includes conventional investments in improved accommodation, houseboats, restaurants, boutique wineries (the region now has some 12 wineries offering cellar door sales) and diverse enterprises such as boutique chocolate making. Local investors dominate, many investing the profits from other local agricultural industries. The rationale for this investment is, at least in part, comfort in investing in the local region where conditions, people and institutions are familiar. In addition, it should be noted that most of

the hotels in the region are community-owned, ensuring greater benefit to the local region from growth in the tourism sector.

OBSERVED INVESTMENT PATTERNS

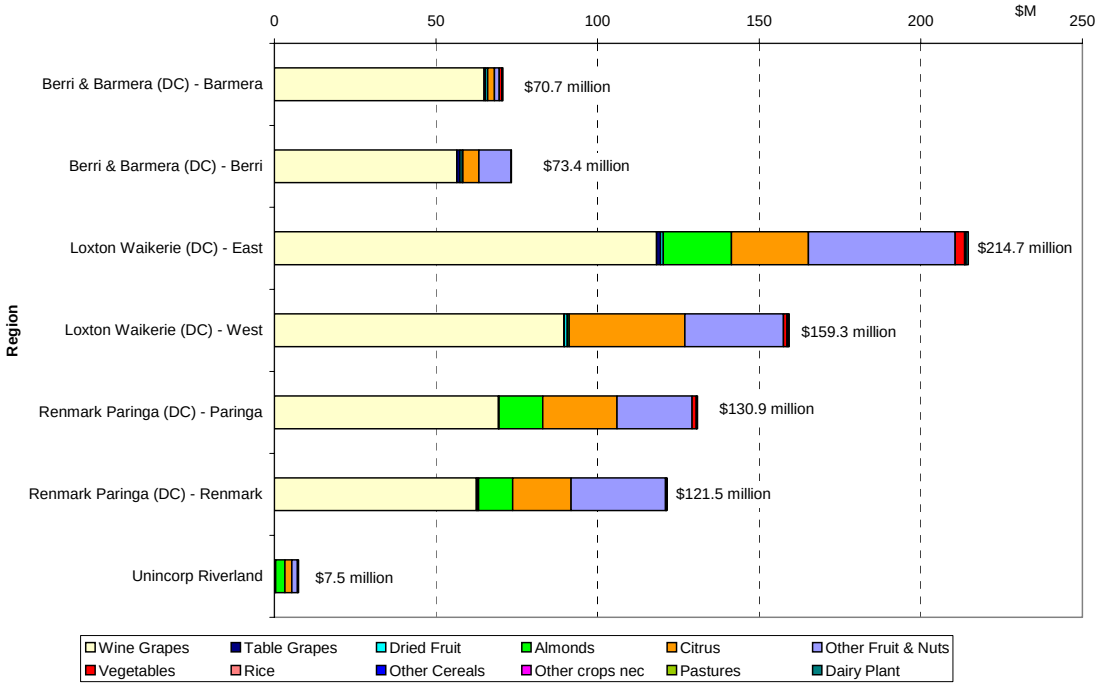
In order to gain an insight into the flows of capital investment, we have developed estimates of the capital stock used in specific industries in 1997 and 2001. This report focuses on capital stock as the ongoing result of investment. As a result, we have chosen capital stock as the key indicator to provide an insight into investment in the regions being studied. This section presents estimates of capital stock in both irrigated agriculture and manufacturing for each region. Data limitations mean that different methodologies are used to calculate these estimates and the estimates are based on different valuation methods (for more detail on this issue see Appendix I). As a result, we have chosen not to add the two figures.

Irrigated agriculture

Figure 3.20 emphasises the dominance of wine grapes across all areas of the Riverland. All areas have at least some citrus and most have significant investment in other fruit and nuts. Note, however, that almonds are concentrated in the more recently developed eastern part of the Riverland around Loxton, Paringa and Renmark. This investment is as a result of larger corporate enterprises in that industry. In a seeming anomaly, Table 3.15 suggests there has been a reduction in the investment in almond capital stock in the Waikerie area. Local advice is that profitable production is dependent on growers having an area of more than 50 hectares. The reduction could possibly indicate disinvestment by some smaller producers.

The eastern and southern parts of the Riverland are the areas attracting the most new investment overall, particularly in the wine grape industry. This is consistent with the locally reported large expansion of irrigation onto the Mallee soils south of the Murray.

FIGURE 3. 20 CAPITAL STOCK IN IRRIGATED AGRICULTURE—RIVERLAND 2001



Source BTRE estimate based on ABS Agricultural Census 2001.

TABLE 3. 15 CHANGES IN CAPITAL STOCK IN IRRIGATED AGRICULTURE BY CROP TYPE—RIVERLAND 1997 TO 2001 ($M)

	Barmera	*Berri*	*Loxton*	*Waikerie*	*Paringa*	*Renmark*	*Unincorp Riverland*	*Total Riverland*
Wine Grapes	22.5	23.8	59.8	28.7	48.6	30.6	-0.3	213.7
Table Grapes	-0.6	0.4	0.2	-0.7	0.0	0.0	0.0	-0.7
Dried Fruit	-0.8	-0.3	-0.1	0.4	-0.5	-1.1	0.0	-2.3
Almonds	0.0	0.0	16.2	-12.3	2.5	8.0	0.9	15.3
Citrus	-0.1	-1.3	0.5	-2.0	4.8	0.9	0.5	3.3
Other Fruit & Nuts	-1.0	-1.0	23.7	9.4	-3.3	2.2	0.4	30.3
Vegetables	0.5	0.0	2.3	0.4	0.1	0.0	0.0	3.2
Rice	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other Cereals	-0.1	0.0	-0.2	0.0	-0.2	0.0	0.0	-0.5
Other crops nec	-0.1	0.0	-0.2	0.0	0.0	0.1	0.0	-0.1
Pastures	0.1	-0.1	0.0	-0.1	-0.1	-0.5	0.0	-0.8
Dairy Lump Sum	-0.3	0.0	0.7	-0.6	0.0	-0.9	0.4	-0.7
Net Total	20.3	21.4	102.9	23.2	51.8	39.3	1.8	260.7
Net Total (% Change)	40.2%	41.2%	92.1%	17.1%	65.5%	47.7%	31.6%	50.4%

Source BTRE estimate based on ABS Agricultural Census 1997 & 2001.

Manufacturing

Manufacturing industry in the Riverland is based on the fruit and nut and wine industries with a mixture of corporate (eg. BRL Hardy), established family-owned businesses such as Angove's (Angove's 2003) and Simpson Packing (Simpson Packing 2003). There are also companies with mixed company structures like the Yandilla Park/Vitor group (Vitor 2003, Yandilla 2003) with links that allow trading in fruit from around the world. The operations are sophisticated export-oriented and market-focussed trading into North America, Europe, Asia and New Zealand. Whilst many are based in the Riverland, they draw product from a number of areas—in particular Sunraysia, but also other areas of NSW and Queensland.

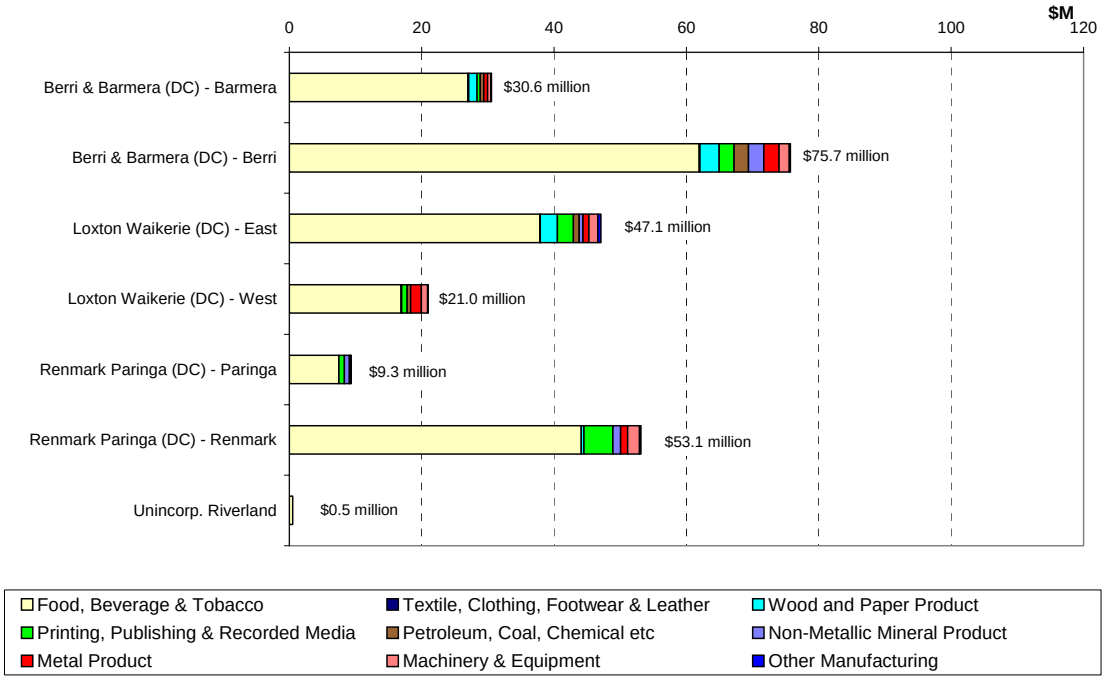
Figures 3.21 and 3.22 and Table 3.16 provide estimates of the levels of manufacturing capital stock in the Riverland in 1996–97, 2000–2001 and the changes between them. Key points are the strong overall growth over the period, the strong focus on food and beverage manufacturing and the relative distribution and growth across the region.

The growth over the period has been strong, although not as strong as in Sunraysia either in nominal or relative terms. Riverland manufacturing capital stock increased by 62 per cent from $237 million to $384 million. This is over twice the national average growth (29 per cent), but below Sunraysia's 97 per cent. As a consequence, from a position slightly less than the Riverland in 1996–97, by 2000–01 Sunraysia had overtaken the Riverland with a manufacturing capital stock of approximately $432 million. These inter-regional comparisons aside, growth in capital stock in the Riverland is very strong.

As in Sunraysia, food and beverage dominates with 85 per cent of manufacturing capital stock in this sector. In relative terms, this is somewhat higher than Sunraysia's 75 per cent although both regions coincidentally have an estimated capital stock in food and beverage of $325 million by 2000–01. In terms of recent trends, between 1996–97 and 2000–01 the Riverland trailed Sunraysia in actual growth in food and beverage capital stock by around $43 million ($129 million to $172 million). However, like Sunraysia food and beverage manufacturing is by far the biggest growth area contributing 88 per cent of the growth in manufacturing capital stock over the period. The dependence of the manufacturing sector on irrigated agriculture is even more pronounced in the Riverland than in Sunraysia.

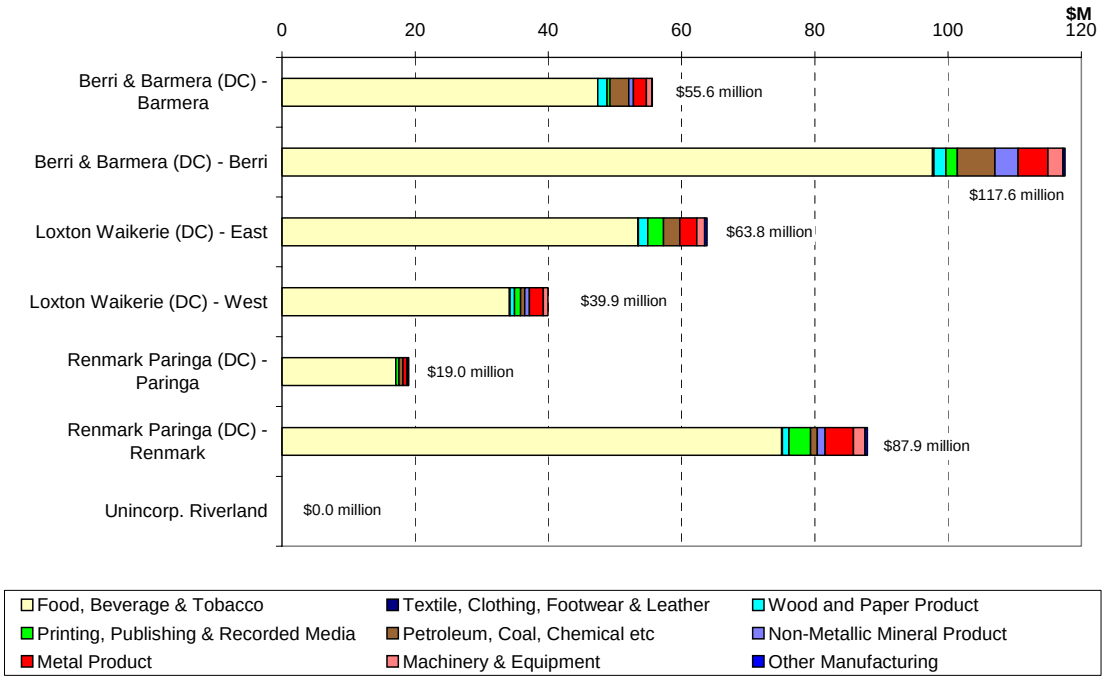
The distribution of the capital stock within the Riverland is interesting. Whilst Berri and Renmark predominate, all other areas with the exception of the Unincorporated Riverland have a significant manufacturing sector. This even distribution of investment between regions becomes even more pronounced when Figure 3.22 is viewed in conjunction with the capital stock in agriculture (Figure 3.20).

FIGURE 3. 21 CAPITAL STOCK IN MANUFACTURING—RIVERLAND 1996–97 ($M)



Source BTRE estimates based on ABS estimates of Non-current Assets in Manufacturing subdivisions 1996-97 & 2000-01, industry employment data from the ABS 1996 & 2001 Censuses of Population and Housing.

FIGURE 3. 22 CAPITAL STOCK IN MANUFACTURING—RIVERLAND 2000–01 ($M)



Source BTRE estimates based on ABS estimates of Non-current Assets in Manufacturing subdivisions 1996-97 & 2000-01, industry employment data from the ABS 1996 & 2001 Censuses of Population and Housing.

TABLE 3. 16 CHANGES IN CAPITAL STOCK IN MANUFACTURING—RIVERLAND 1996–97 TO 2000–01 ($M)

	Barmera	*Berri*	*Loxton*	*Waikerie*	*Paringa*	*Renmark*	*Unincorp. Riverland*	*Total Riverland*
Food, Beverage & Tobacco	20.4	35.7	15.6	17.3	9.6	30.9	-0.5	129.0
Textile, Clothing, Footwear & Leather	-0.1	0.1	0.0	0.0	0.0	0.1	0.0	0.2
Wood and Paper Product	0.1	-1.1	-1.2	0.7	0.0	0.5	0.0	-0.9
Printing, Publishing & Recorded Media	0.0	-0.6	-0.1	0.1	-0.3	-1.1	0.0	-1.9
Petroleum, Coal, Chemical etc	2.3	3.5	1.6	0.1	0.6	1.0	0.0	9.0
Non-Metallic Mineral Product	0.7	1.2	-0.6	0.7	-0.8	0.0	0.0	1.2
Metal Product	1.3	2.2	1.7	0.5	0.6	3.2	0.0	9.4
Machinery & Equipment	0.4	0.7	-0.2	-0.3	0.0	-0.1	0.0	0.6
Other Manufacturing	0.0	0.1	-0.1	-0.1	0.0	0.1	0.0	0.1
Total Manufacturing	25.1	41.8	16.8	19.0	9.7	34.8	-0.5	146.6

Source BTRE estimates based on ABS estimates of Non-current Assets in Manufacturing subdivisions 1996-97 & 2000-01, industry employment data from the ABS 1996 & 2001 Censuses of Population and Housing.

SUMMARY

- Economic growth (as measured by real taxable income) is very strong in the Riverland averaging 3.8 per cent per annum from 1990–91 to 1999–00, being significantly higher than Australia (3.0 per cent) on the same measure.
- Activity and growth in the region is reasonably evenly distributed across six SLAs. No centre seems to be obviously dominating or falling behind.
- Investment in irrigated agriculture is focussed on horticulture across the region with wine grapes dominating in terms of the amount of capital stock and growth. Growth in capital stock in irrigated agriculture is estimated at 50 per cent between 1997 and 2001.
- Manufacturing capital stock is also growing quickly: by 62 per cent between 1996–97 and 2000–01.

FACTORS IMPACTING ON INVESTMENT

The sources of investment in Sunraysia and the Riverland are a mix of local family-based entrepreneurs and corporate organisations. Agricultural investment is often a combination of the two, with existing family businesses sharing an interest with larger corporates. In the manufacturing sector, there is a strong corporate presence in wine making and almond processing.

Given these different sources of investment, it is reasonable to expect that there may be some differences in the factors driving investment decisions. This

section explores the factors that underlie decisions to invest. The primary source of information was interviews with various investors in Sunraysia and the Riverland.

During the interviews, water issues (including reliability and security of tenure) were the primary factor currently inhibiting investment in the region. Historically, a wider range of factors were identified by interviewees. History and government policies, local loyalties (community and culture) and infrastructure as well as water reliability and tenure were critical to explaining the investment pattern. The individual factors identified as influencing investment in Sunraysia and the Riverland are discussed below.

Land tenure and native title concerns

This was identified by a number of people as having been a major constraint on the expansion of irrigation on the NSW side of the Murray in Sunraysia. This occurs because of the limitations on use of the predominant tenure type (Western Lands Lease) combined with Government and private reaction to the uncertainty associated with Native Title claims that were made over much of this leasehold land through the 1990s. The combination of these factors has been to create uncertainty and to impede the conversion of Western Land Lease to Freehold title that would allow its use for intensive agriculture.

The impact has been to effectively place a limit on the expansion of irrigation activities on the NSW side of the river to the west of Balranald. This applies both to independent private irrigators and to expansion of existing Western Murray Irrigation Limited operations. Certainly, the latter have been constrained by the lack of available freehold land and have had existing irrigation land come under pressure from residential developers. To quote a local business person 'Victoria has always had the drop on NSW in this area and banks lend against freehold, not leasehold'. Whether or not this is strictly true, development of additional land has been difficult. Consequently, excess High Security water entitlement derived from a relatively generous initial allocation, piping and more efficient delivery and irrigation systems has not been able to be redistributed across a larger area. This is despite the potential for increased production and profit.

To some extent, land tenure constraints are now being alleviated due to recent High Court decisions on Native Title and the NSW review of the Western Division by the Hon John Kerin. In *Wilson v Anderson*, the High Court in August 2002 held that the grant of a perpetual grazing lease under the NSW *Western Lands Act 1901* extinguished any native title in relation to the land (National Native Title Tribunal 2002). This can be expected to restore some confidence in investors that future leasehold land may be able to be converted to freehold and hence used for irrigation. However, even with these changes it would be expected that the large area of Western Land Lease and the administrative and

time costs associated with conversion will continue to inhibit expansion of irrigation on the NSW side of the river.

Contracts and guarantees

The existence of forward contracts and guarantees has become a fundamental component in some industries in both Sunraysia and the Riverland. Few, if any, growers would undertake significant plantings of wine grapes in the current circumstances without a forward winery contract.

This in part reflects the relatively sombre state of the current market, typified by the circumstances of (Riverland) growers with fruit that had been contracted to a failed winery. As it was related to us, these growers found it difficult, if not impossible, to get other wineries to accept their fruit in either the short or long term. However, it also reflects the desire of the wineries to ensure their long-term supply of quality fruit, and to maintain a system that allows market signals to be provided to growers through contracts. In addition, the nature of the contracts is to encourage the production of higher quality grapes. This in turn necessitates further on-farm investment in drip irrigation systems that provide better agronomic control.

Other crops, particularly oranges for the fresh market and table grapes are more often sold directly into domestic and overseas markets at time of harvest. Citrus, either fresh, for juice or dried fruits are often marketed through Co-operatives (Co-ops) or their privatised successors such as the Mildura Fruit Company rather than through contracts. However, one of the issues around the commercialisation of these Co-ops is the shifting of marketing responsibility from the Co-op to the farmer. Specifically, Co-ops are usually obliged to take fruit produced by a Co-op member. This is not a priority for private companies that have an overriding obligation to their shareholders. Whether this increased exposure to market forces will lead to more or less investment in the short or long term remains to be seen: what is clear from the attitudes of many irrigators is that they have a high preference for reducing risk. The history of Co-ops in the regions demonstrates that, at least in the past, irrigators have been willing to forgo profits in order to reduce risk.

Water trading

Discussions with regional growers and business people revealed that the ability to access further water supplies through trade, removed the biggest obstacle to investment in Sunraysia and the Riverland. Consequently, water trading was the single biggest positive influence on investment over recent years. In particular, it has allowed the opening up of new developments by private diverters in both Sunraysia and the Riverland and made possible the consideration of new government supported schemes such as the Deakin

project (SMEC 2001, Sunraysia Daily 30 July 2003). Water trading has facilitated much of the expansion and reallocation of resources through the trading of permanent allocations (particularly on the Victorian side) resulting in the growth in number and size of private diverters. This has reflected changes in commodity returns, particularly in the wine grape and citrus industries and allowed the supply of product to lucrative, newly developed markets in North America, Asia and Europe.

Water trading has allowed water entitlements to be purchased from other areas to the east as the basis for the establishment of new areas in both Sunraysia and the Riverland. Much of this water has been purchased from the dairying areas in the Central Murray region (see Chapter 2). The same pattern is less evident on the NSW side, due to the limited availability of freehold land and relative scarcity of High Security title in NSW. In this context, the advent of water trading has opened up whole new regions for investors in irrigated agriculture.

Temporary water trading seems to serve a somewhat different function for these regions. The magnitude of the investment in irrigated agriculture and the relative profitability has encouraged many producers to ensure an adequate water supply by holding water entitlement surplus to immediate requirements. The effect of this is to provide a level of reliability and security beyond that provided by the entitlement itself. The cost of this 'insurance' can and often is offset by temporarily trading the surplus. Therefore it could be argued that even temporary trading is encouraging the development of higher investment/higher risk ventures by providing a means to insure against temporary water shortages and the possibility of unforseen changes to entitlement conditions.

Note that there is a degree of non-intuitive trading occurring. Specifically, the temporary transfer of entitlement held as insurance in Sunraysia and the Riverland being traded up the river to rice and dairy interests on a temporary basis, whilst at the same time permanent transfers are predominantly occurring in precisely the opposite direction.

Water reliability and tenure

Long-term water supply could be expected to play a very large role in investment in Sunraysia and the Riverland, and indeed is identified by almost all in the regions as the primary factor driving future investment decisions. The current drought is seen by most as a portent of a possible future where the amount of water available for irrigation is severely reduced due to increased demands for environmental flows through initiatives such as 'The Living Murray'. In this situation, most irrigators in the Riverland, and many in Sunraysia, have confidence in their large gross margins and high relative productivity, the allocation of reserves already held and their financial capacity to buy water from upstream. At least in the short and medium term, they

would bid successfully in the market for additional supplies to replace cuts from these sources, which would protect them against any need to make further real cuts to their supplies. For these established farmers, the issue is likely to be about the likely price that will be needed to purchase more water on the open market rather than a real concern about availability. For new investors, or farmers in an investment phase, long-term cuts in the available supply may have an impact on investment, as decisions become more focussed on profitability after capital costs have been met. It is important to note, however, some producers more directly involved in trading emphasise that water from the east is not a never-ending resource, and that competition for water from dairy and other industries will inevitably increase.

The differences in the reliability of annual supply between the States are relatively small in these regions. As a result of history and/or through preference, NSW irrigators in Sunraysia operate with High Security water entitlements. These are probably superior to the Victorian entitlements for reliability, although the general sentiment has traditionally been that Victoria is superior. The South Australian entitlement, guaranteed under the provisions of 'the Cap', is regarded as the most reliable of all.

It would seem that for the relatively high investment, irrigated horticulture conducted in these regions, irrigators have contrived to ensure that they have the most reliable water entitlement available under each system. This confirms that for capital intensive horticulture with long lead times for establishment, water reliability and tenure are crucial issues. As one horticulturalist from outside NSW noted when talking about that state's Water Sharing Plans 'to invest in a long-term irrigation enterprise with only a ten year guarantee of water: you would have to have rocks in your head'. Comments from the National Bank (NAB 2003) suggest lenders have come to a similar conclusion.

A practical illustration of this sentiment is given by the actions of both Riverland and Sunraysia irrigators who hold additional entitlement as insurance against either natural or man-made threats to supply. This entitlement is expensive, but many producers to whom we spoke, even in South Australia where entitlements are thought most secure, regarded it as an important component in their risk management strategies. Also for high value produce, water is a relatively low input cost.

With respect to water property rights, although irrigators support the concept, there is little evidence that interstate differences in perceived sovereign risk has shaped the existing investment pattern. This is because irrigators in all States have in the past assumed that the water right is more soundly based than it actually is (Freebairn 2003), and even now, the differences between the states are not altogether clear. Readers interested in this subject may wish to consult research undertaken for the MDBC on legal aspects of water rights (Tan 2002)

and the potential for governments to recover water from consumptive uses under current legislation (MDBC 2002c).

Whilst current perceptions of the superiority of the Victorian Water Right remain, these seem to be based more on relative recent stability compared to NSW. In addition, the negotiation of Water Sharing Plans has sensitised NSW irrigators to the legal status of their water access entitlements, in particular the potential for uncompensated revision of allocations every ten years and lack of automatic renewal of water access licences. This has raised awareness of a very real prospect of losses through government policy decisions. This is despite the NSW Government's contention, supported by the Australian Bankers Association that the Plans engender a greater degree of legal clarity and certainty than existed before or than exists in other states.

However, for the most part, interstate differences regarding sovereign risk seem less important to irrigators than the general threat from governments seeking water for the environment through national bodies. In particular, the Living Murray proposal is seen as potentially undermining the value of allocations across the board and it is claimed that irrigators in Victorian Sunraysia, for example, are buying up low value dried fruit properties so as to accumulate entitlement in anticipation of future cuts.

This behaviour suggests a significant loss of confidence in the current systems across all states with similar strategies reported in the Riverland. The strong historical relationship between high investment horticulture and high reliability of water supply is now also focused on water tenure issues. For example, industry observers comment that the ten-year planning horizon in the Water Sharing Plans will force producers toward annual cropping. The establishment of an explicit tradeable, ongoing water right may be the only way to re-establish confidence in the respective state systems and hence maintain investment levels.

Water infrastructure

Sunraysia water delivery infrastructure is characterised by open channels to the Victorian irrigation districts and pressurised piped systems to the Western Murray Irrigation Limited (WMI) districts and the private diverters. These delivery systems often reflect the on-farm systems with open channels feeding flood and furrow irrigation and piped systems linked to spray or drip systems. However, there is not always a direct correlation, with some farmers installing their own pumps to allow spray and drip systems to draw from open channels.

Table 2.5 shows some of the benefits of piped systems in Sunraysia with differences in the water charges to farmers being around $40 cheaper on the NSW side. These savings in part reflect water saved from channel leakage and

evaporation. In addition, pressurised pipe systems allow farmers more flexible access to water. On-farm pressurised systems allow much better management control of crops, water placement and improved water efficiency (usually measured as the percentage of water used by the crop).

In terms of investment, the impacts of the differing delivery infrastructure are expressed by regional businesses as a lagging of producer investment in the upgrading of Victorian irrigation areas. We also understand a number of producers within the areas are 'trapped' on smaller uneconomic blocks within irrigation areas, without the ability to readily expand their operations.[11] For these producers, upgrading to newer spray/drip technology is problematic, especially in the absence of an upgrade of the whole irrigation district to piped delivery systems, and some of these blocks are currently proving difficult to sell. We do not know of similar situations in the WMI controlled areas, although they may exist.

The business case for the conversion of Victorian irrigation areas to piped systems would seem strong (Branson 2002) and the experience of the WMI controlled districts in NSW would appear to support the case for upgrading. However, the difficulties involved in attaining the agreement of growers (at least some of whom are already carrying significant debt loads) and grower expectations of State Government assistance with funding of this infrastructure may continue to delay a decision on this issue. It is difficult to avoid the conclusion that upgrading to a piped system would have a positive impact on investment in these districts.

This conclusion is supported by the success of the Riverland systems following the full upgrade of all areas there. In addition, we note that in both Sunraysia and the Riverland new developments by private diverters are inevitably of the piped type.

History of development

The physical and human capital built up in earlier times influences current investment patterns. Investment in a particular enterprise type leads to a build up of expertise and capital. This capital can have a long life but low resale value, making continuation of the existing enterprise a more profitable exercise than moving to a new one. Consequently, producers of seemingly less profitable crops may be better off continuing to produce in the short and medium terms. Hence, it would be expected that change, particularly in high

[11] Whilst neighbouring blocks can be purchased when available, in practice there are few adjoining blocks and hence limited opportunities to buy. Further, existing farms usually have structural improvements (houses, sheds etc) that duplicate those of the existing property—increasing the effective price of the land but often providing little benefit.

investment industries, is likely to be slower than what would initially seem appropriate, and production patterns (and short-term investment) will continue to mimic historical patterns well after market signals suggest lower industry prospects. Therefore it is not surprising that, for example, significant areas and capital stock is still maintained in the orange juice and dried fruit industries.

Where downstream processing is dependent on established but declining industries, the decisions become more complex, since manufacturers are trying to anticipate the tailing off of product coming from irrigators and make their own investment decisions accordingly.

In the Riverland and Sunraysia, governments, particularly State governments have been active in the past in the development of irrigation, encouraging and sometimes taking an intrusive approach to decision-making. Whilst not indifferent to market forces, this type of approach could be expected to lead to investment patterns and outcomes somewhat different to that produced by the current market. For example, property sizes within established irrigation areas are small in the light of current technologies and economic conditions.

Local knowledge, social, community and family ties

In addition to the impact of family labour, there are a number of situations where social, community and family ties are important drivers of the type and location of investment.

Local investors made known their distinct preference for local projects. In many cases this is a risk minimisation strategy, as it allows people to draw on their local knowledge. A number of growers indicated concern over the limitations of their expertise in local farming systems and, in particular, their lack of detailed experience outside the local area. Conversely, they were aware of the profit advantage they had in being able to apply detailed 'local knowledge' to investments within their region. Interestingly, this seems to go beyond family enterprises. We understand that many of the larger corporate initiatives in the Riverland, for example, have and maintain links to established local farming families.

In addition to the knowledge issue, local investors gain confidence from dealing with known individuals and industries and the knowledge that they can oversight their investment on a day to day basis. Examples include the tourism industry in the Riverland where much of the capital employed to open new ventures has come from profits of the local horticultural enterprises.

From Tables 3.1 and 3.9 it can be seen that the proportion of people born overseas and/or speaking another language is in the order of 8–10 per cent in the Riverland and Victorian Sunraysia. This results from some strong groups in the regions such as the Greek community in Loxton, Sikh and Italian

communities in Waikerie and Renmark. We would expect investment from these groups to be centred in these regions.

Other factors

Soils and climate

Differences in soils are a basic agronomic factor driving the location of investment and development. In the Sunraysia, soils are seen as important determinants within the region, depending on the crop to be grown, but we heard of no interstate or general trends. However, we would expect that constraints imposed by soil types would exacerbate the problems outlined above relating to land tenure.

In the Riverland there is a distinct variability with the Mallee soils to the south of the river preferred to 'station' types to the north. In addition, the sandy soils of the higher areas away from the river are better than the heavier soils adjacent to the river. As a result, there has been a preference for development of the 'highland' areas to the south, particularly in the Loxton area.

Climate is less of a factor within the region, but is an important factor for Sunraysia and the Riverland when competing with other regions for horticultural investment. The key climatic benefit is the greater number of hours of sunshine when compared to regions in other latitudes or further east (where proximity to the Great Dividing Range tends to increase the amount of cloud cover).

Labour availability

The labour requirement for horticulture is the need for a harvest workforce. This is traditionally met through a mobile workforce of professional pickers, supplemented by casual labour—often new immigrants, backpackers and other young workers. There is no evidence that this labour is more difficult to attract to one area over another—respondents in all areas advise of a similar ongoing problem. Therefore, we infer no impact from this factor for most pursuits.

The one possible exception to this conclusion in agriculture is vegetable growing, particularly in the Riverland. This industry has a larger requirement for continuous labour and this is often met through the extended family of the growers. Therefore, investment in this industry may be driven at least in part by the availability of (and possibly the need to provide employment for) family labour.

Businesses across the regions report that the shortage of skilled labour is inhibiting investment in new manufacturing and service industries.

Social capital

Social capital, or the ability of communities to organise to meet their needs and infrastructure, is often quoted as a key driver of community success. In our discussions, most respondents claimed high levels of social capital in their community and thought it was a factor. However, we found no hard evidence that investors discriminated on this basis nor that there are significant differences between regions.

Urban expansion and 'lifestyle' investors

One of the drivers of investment in horticulture is the expansion of capital cities into the traditional horticultural areas on their outskirts. Farmers displaced from these areas are usually cashed up and seeking to re-establish in areas that have the necessary infrastructure (including water access). These investors tend to stay in their state of origin and consequently, many former Melbourne farmers settle in Sunraysia, and those from Adelaide move to the Riverland.

A similar spatial pattern of investment occurs with so-called 'Collins Street' and 'Rundle Mall' investors. They are not, however, a very large source of investment in these regions.

Demographics

It is claimed in some quarters that the demographic changes over the next few years will contribute to some fundamental changes in investment patterns. The argument runs that many of the post World War II immigrants are coming to the end of their working lives and that with their retirement, much of the old family-based farming will be replaced with corporate agriculture. Whilst a conceptually appealing argument, we have no hard evidence of this trend, having met a number of young energetic and capable second and third generation family farmers. In addition, we note that many of the so-called corporate farms once were family-based operations from the regions that have become larger and successful. Some of the larger winemakers, juicers and packers are now owned outside the region, and some, for example BRL Hardy, now belong to overseas interests. However, this trend is more likely to result from the need to raise capital and the advantages of forging international links in a competitive global marketplace, than the age profile of producers.

Government charges and intervention

A number of businesses complained of the impact of government charges and regulations such as Australian Quarantine Inspection Service charges and service, superannuation, electricity, payroll tax, stamp duty, work cover, registration, local government rates and sea freight transport costs. These were not generally concerns regarding differences between the States, but rather the

overall costs regardless of jurisdiction. NSW is said to have more red tape and the region is too far from decision makers. Businesses with interests in two states (NSW and Victoria) are badly affected by having to comply with the costs and regulations of both—thereby doubling the paperwork load.

On the positive side, institutions such as the Sunraysia ACC and the Barossa Riverland Mid North ACCs, the Sunraysia Mallee Economic Development Board, the Mildura Murray Outback Tourism Board and the Riverland Development Corporation encourage investment into the regions. Growers also favourably cited the Commonwealth Rural Partnership Program sponsored SunRISE21 in Sunraysia and the Riverland Rural Partnership Program as catalysts of change and investment.

In Sunraysia, we noted differences in the NSW and Victorian approaches. The NSW approach from both State and local government is more focused on projects such as the solar tower and the development of the mineral sands industry, whereas Victoria has a heavy emphasis on the development of irrigation. The extent to which the respective states have been able to channel investment to their own jurisdictions is not known, but presumably they have some success.

In passing we note that it is easy to be dismissive of the effectiveness of some of the large-scale projects that are aimed toward the more speculative end of investment thinking. However, if for example, the billion dollar solar tower does go ahead, it will have a profound effect on the investment balance within Sunraysia. Similarly, the development of a new irrigation area as a result of the work on the Alfred Deakin proposal (SMEC 2001, Sunraysia Daily 2003) will shift the focus even further toward Victoria. The fact that this may not happen in the proposed form does not mean the effort was wasted. We note that some influential regional commentators are using the Alfred Deakin work as a basis for assessing and promoting the concept of 'mini-Deakins'.

Transport and telecommunications

Interregional road transport access is adequate to both Sunraysia and the Riverland. Local roads are seen as being more problematic, largely due to the limited resources of Local Government to upgrade to the standards required for large articulated vehicles. Rail transport is an issue for the region. In particular, the lack of a high quality standard gauge line to Melbourne is seen as ensuring mineral sands development will be advantaged on the NSW side. On the other hand, it is believed that upgrading the line would create a link to Darwin and the eastern and western seaboards bringing substantial benefits to the region for transporting all of its products.

Telecommunications are regarded as barely adequate outside the major centres. Again these issues are common to all regions and do not provide a basis for competition for investment between regions.

Cluster/agglomeration effects

Both Sunraysia and the Riverland have built substantial industries around horticultural products. Corporate wineries, processors and fruit packers such as BRL Hardy, Berrivale Orchards Ltd and the Mildura Co-operative Fruit Company Limited (MCFCL 2002) that have developed sales networks in domestic and overseas markets provide an existing sophisticated marketing environment for would-be horticultural investors. The existence of these local links to global markets makes these areas a much more desirable investment destination. Established industry support structures such as the Murray Valley Citrus Marketing Board also increase its desirability as an investment destination.

On the supply side, both areas have existing irrigation, transport and other support services designed to meet the needs of horticulture and associated manufacturing. Again this gives the region advantages that other irrigation areas do not have.

Spatial diversification of supplies by manufacturers

This is a risk management technique employed by wineries, in particular, to reduce the risks to their supply of fruit from weather and disease damage and to reduce congestion by effectively extending the length of the picking season. Companies diversify across Sunraysia, the Riverland and the Murrumbidgee Irrigation Area, but also have suppliers from further afield—for example, Western Australia. Whilst for the established industries this may lead to less investment, this may be compensated for through investment in other industries supplying processors from other regions.

Distance and location

The distance of Sunraysia and the Riverland from the major capitals has both positive and negative effects. For tourism, the distance from Melbourne and Adelaide makes competing with Echuca and the Murraylands respectively, much more difficult. On the other hand, it allows the regions to sell an 'outback' related product.

Sunraysia is well placed to take advantage of some future developments. For example, the planned solar tower, if built will provide both direct employment and tourism effects. In addition, the serendipitous discovery of large deposits of mineral sands is likely to provide enhanced employment and investment for the region in the future.

Access to finance

Access to finance through the banking system is not regarded as a problem by most commentators. Banks are regarded as conservative lenders, but they do follow markets and lending policy often reflects the banks' perception of an industry. Typically the attitude is that 'good proposals will have no trouble getting finance'. This may reflect a conservative attitude to investment by horticulturalists, or a good understanding between borrowers and the banks regarding the requirements for projects to attract finance. According to lenders, water reliability and the enhanced awareness of sovereign risk have not led to a risk premium on irrigation loans, although a number suggested the possibility that this policy may be reviewed in the future. At present, loans are secured on the basis of land titles, rather than water entitlement and lending formulae also focus on land values.

One lender expressed the view that a number of projects that had been rejected under banking guidelines did have potential and could have benefited from access to alternative sources of venture capital. It is also claimed that the mainstream banks have largely vacated the field of finance on second hand assets. Whilst this demand used to be met by finance companies linked to the banks, this market niche is now filled by independent finance companies (such as, Bidgee Finance).

There is no evidence that access to finance is creating an impediment to investment in the region.

Supporting infrastructure

Public infrastructure in these regions is typical of regional Australia providing adequate access to basic public primary and secondary education, local government services, health facilities etc. However, there are fewer options for private education and health services than in major centres. Mildura itself has slightly better facilities than most of Sunraysia/Riverland. Facilities for tertiary education are limited although a Latrobe University campus has been established in Mildura.

It would be expected that these factors would have little impact on private industrial investment, with any effect likely to be slightly negative for investors from other regions seeking to physically accompany their investment.

The Freshwater Co-operative Research Centre, CSIRO horticultural centre and NSW Agriculture's Dareton research centre could be expected to encourage investment in Sunraysia, whilst South Australia's Loxton Research Centre could be expected to support investment in the Riverland. However, we do not believe that these facilities are a big factor in driving investment toward their respective regions.

SUMMARY

Economy

- The Sunraysia and Riverland regional economies are growing very strongly—at rates comparable to and in the Riverland's case exceeding the national average.
- These economies are based on high water use irrigated agriculture and associated manufacturing. The agriculture is generally horticulture, coupled to significant a manufacturing sector using produce from, and supplying inputs to, irrigated agriculture.

Investment

- The capital stock in irrigated agriculture has increased substantially in both regions between 1997 and 2001—in Sunraysia by 37 per cent and in the Riverland by 50 per cent.
- Capital stock in manufacturing has also increased substantially—by 97 per cent in Sunraysia and 62 per cent in the Riverland—compared to 29 per cent for the nation as a whole.
- In Sunraysia, investment in irrigated agricultural capital stock is spread across the region, but manufacturing capital is focussed heavily in Mildura. In the Riverland, investment in both sectors is more evenly spread between the population centres.

Factors affecting investment

- The biggest positive influences have been the rapid development of the irrigation and manufacturing sectors in response to the market opportunities in the wine, citrus and almond industries. This response to opportunity has been facilitated by deregulation of the water market, the confidence of agricultural investors in the high reliability water supplies, the use of forward contracts and guarantees by processors and the confidence of local investors in their knowledge of their region.
- The largest single negative factor impacting on investment is the lack of available freehold land in NSW Sunraysia. This has diverted agricultural, manufacturing and private housing investment away from Wentworth Shire.

Speculation over water entitlements and the push for more water to be used for the environment looms as the largest long-term issue likely to impact on investment. Whilst the profitability of the current industry mix may ensure that producers will be able to secure water in the foreseeable future, in the long term reduced supplies and/or uncertainty of supply are seen as the single biggest threat to continued growth and prosperity in these regions.

CHAPTER 4 CENTRAL MURRAY

DESCRIPTION OF REGION

The Central Murray region covers northern Victoria and southern NSW (with a population of approximately 163 000 in 2001). This analysis describes conditions in 12 Local Government Areas (LGAs). NSW Central Murray is defined as the LGAs of Berrigan, Conargo, Deniliquin, Jerilderie, Murray, Wakool and Windouran and Victorian Central Murray the LGA's of Campaspe, Loddon, Shepparton, Gannawarra and Swan Hill[12] (see map below).

The major industries are agricultural and horticultural based, with a number of regional centres (such as Echuca, Shepparton, Deniliquin and Swan Hill) providing retail and service sectors[13]. Many small towns are in decline and services are being consolidated to these regional centres. In many parts, the agriculture and horticulture is dependent on irrigation, however there are other areas involved in broadacre farming. The range of activities includes dairy, fruit and vegetables, viticulture, beef, wool and grain, particularly rice. There are also a number of value-adding food processing facilities in the region particularly for dairy, vegetables, fruit and rice. Tourism is also a feature of many parts of the region.

The region is not homogeneous. With two state governments and 12 LGAs influencing the region, there are considerable differences in policy and emphasis. There are also significant variations across the region in terms of economic performance, industries, demographics etc. This diversity means that there is a range of issues and characteristics across the region that combine to create a complex environment in which investment decisions take place.

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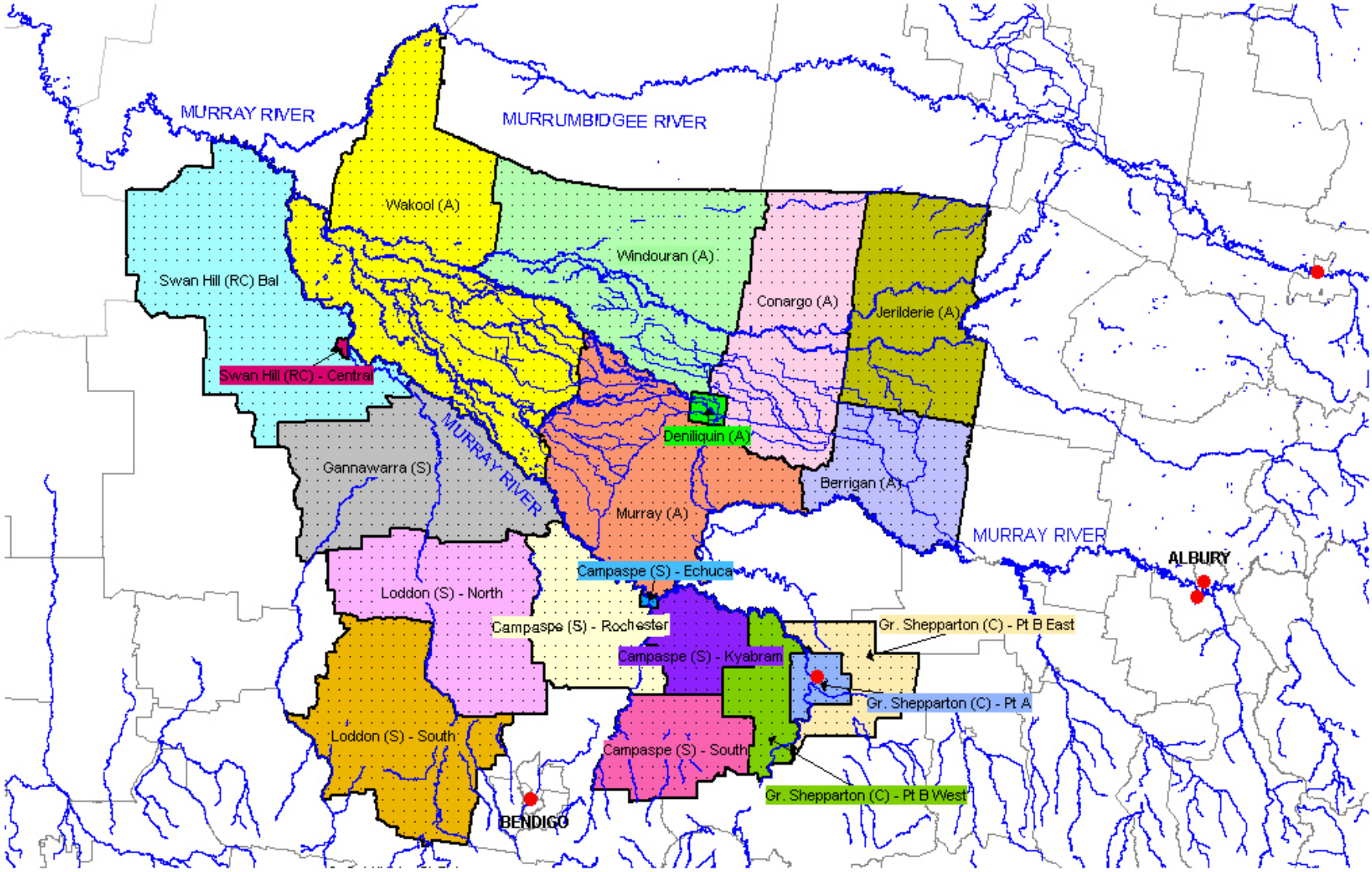
[12] The SLAs of Swan Hill RC–Robinvale in Victoria and the Shire of Balranald in NSW lie between the Sunraysia area and the Central Murray area and therefore were not included in the analysis presented in this chapter.

[13] Much of this description is drawn from the Central Murray Area Consultative Committee 1999 Strategic Regional Plan.

Central Murray

Statistical Local Areas



The total land area for the NSW Central Murray region is 26 187 km^2 (Table 4.3). The Victorian Central Murray is somewhat smaller at 22 652 km^2 (Table 4.4). Soil types across the region are similar with a mix of good light sandy mallee soils suitable for horticulture and heavier clay soils that lend themselves more to rice and cereals on both sides of the Murray River.

With respect to water access and supply, both have similar access to the Murray River and the Victorian Central Murray also has access to and draws from the Goulburn-Broken system, the Campaspe and the Loddon rivers. On the NSW side, some irrigation is supplied from the Murrumbidgee River, the Edward River and indirectly from the Murray through the Mulwala Canal. Given this diversity of access, we have estimated the amount of water used by applying estimated water usage rates for different crop types in 1997 (NLWRA 2001a) to the area of these crops in the respective statistical local areas (SLAs) as reported in the Agricultural Census for 1997 and 2001.

TABLE 4. 1 IRRIGATION WATER USE—NSW AND VICTORIAN CENTRAL MURRAY 1997 & 2001

	Victorian Central Murray (ML)	*NSW Central Murray (ML)*	*Victorian Central Murray (CM) as a percentage of NSW CM*
1997 Estimate	1 969 468	2 153 298	91.5%
2001 Estimate	2 217 828	2 455 603	90.3%

Source BTRE estimate based on NLWRA 2001a and Agricultural Census 1997 and 2001.

As described in Table 4.1, water usage on the Victorian side of the border was about 90 per cent of NSW usage in the two years calculated. Whilst the NSW portion may be expected to fall in years of shortage, in these two relatively good years the two areas are roughly comparable, with NSW having a slightly higher usage.

GENERAL ECONOMIC PERFORMANCE

Perceptions of economic performance across the region vary. In general, the region as a whole is considered to be prosperous and growing with the horticulture and dairy industries being the main drivers. However, several areas appeared to be struggling, particularly those in the outer parts of the region and those relying on traditional crops such as rice which have been hit heavily by drought-induced water shortages in recent years.

Information and data is scarce at the small area level. As a result, a number of proxy or indicative data are used to provide an insight into economic performance and investment patterns. Three primary information sources are used here to describe recent trends in economic performance:

- data on population characteristics from the ABS 1996 & 2001 *Censuses of Population and Housing;*
- real taxable income data from 1990–91 to 1999–00 from BTRE July 2003 estimates derived from data published by the Australian Taxation Office; and
- regional unemployment data produced by the Department of Employment and Workplace Relations.

A variety of other sources are also used to describe the economic base and industry structure of the region:

- industry employment data from the ABS 2001 *Census of Population and Housing*;
- estimates of the area and value of production of irrigated agriculture based on the 1997 and 2001 ABS Agricultural Census data; and
- information gathered during the field trip interviews with stakeholders.

While these estimates are important in their own right, we have also used them as the basis for estimating the value of capital stock in both irrigated agriculture and manufacturing later in this chapter.

Population

The region as a whole has been growing in population terms with total population growth of 4.1 per cent during 1991 to 2001. Most of this growth has occurred in the period since 1996. Table 4.2 shows the differences in demographic characteristics between the NSW and Victorian parts of the Central Murray—the Victorian section has a much larger population, has grown at a faster rate over the last 10 years and contains a higher proportion of people born overseas or speaking other languages.

TABLE 4. 2 DEMOGRAPHIC STATISTICS—CENTRAL MURRAY 2001

	Vic Central Murray	*NSW Central Murray*
Population[a]	132 591	31 220
Total population growth 1991–2001[a]	4.7%	1.6%
Indigenous population share[b]	2.1%	1.9%
Proportion born overseas[b]	8%	6%
Proportion speaking language other than English at home[b]	6%	2%

a. Based on ABS 2001 *Regional Population Growth*, Australia and New Zealand, 1991 to 2001 (Cat. 3218.0) Estimated Resident Population data.

b. Based on ABS 2001 *Census of Population and Housing*, Place of Enumeration data.

Tables 4.3 and 4.4 provide more detailed demographic information by SLA. The key points to note are:

- five out of seven NSW SLAs had negative population growth over the last ten years;
- five out of twelve Victorian SLAs had negative population growth over the last ten years;
- there is some evidence of the sponge city effect in both Victoria and NSW with larger centres drawing population from surrounding areas (for example, Deniliquin, Murray, Swan Hill, Echuca and Shepparton).

TABLE 4. 3 POPULATION BY SLA—NSW CENTRAL MURRAY 2001

Statistical Local Area (SLA)	*2001 Population*	*Pop growth 1991–2001*	*Area km²*	*Population density 2001 persons/km²*
Berrigan (A)	8 089	-1.4%	2 066.6	3.9
Conargo (A)	1 428	-9.0%	3 687.9	0.4
Deniliquin (A)	8 354	0.1%	129.9	64.3
Jerilderie (A)	1 879	-7.5%	3 375.4	0.6
Murray (A)	6 129	23.2%	4 344.6	1.4
Wakool (A)	4 917	-4.4%	7 519.7	0.7
Windouran (A)	424	-5.1%	5 062.9	0.1

Source ABS 2001 *Regional Population Growth*, Australia and New Zealand, 1991 to 2001 (Cat. 3218.0) Estimated Resident Population data.

While population growth is a problematic indicator of economic activity, in this case local observation accords with the population growth rates in Tables 4.3 and 4.4. In NSW, only Deniliquin and the Murray have had any population growth while in Victoria, regional centres such as Swan Hill, Shepparton, Echuca and the Campaspe area have all grown. These patterns reflect the growth of irrigated agriculture and horticulture and the location of downstream industries such as food processing which have tended to concentrate around these areas. Local intelligence suggests that some growth in smaller centres reflects overflow of growth from larger ones. Housing is expensive and difficult to obtain in Echuca, for example, and people are locating to Moama, Rochester, Kyabram and Tongala and commuting.

The 23.2 per cent population growth in Murray Shire is the largest in the region and seems quite incongruous with the other (almost entirely negative) rates in NSW. Information from locals is that this results from expansion associated with the growth in the Echuca/Moama conurbation, noting that the Shire traditionally has a relatively low population base (6129 people in 2001).

TABLE 4. 4 POPULATION BY SLA—VICTORIAN CENTRAL MURRAY 2001

Statistical Local Area (SLA)	*2001 Population*	*Pop growth 1991–2001*	*Area km²*	*Population density 2001 persons/km²*
Gannawarra (S)	12 067	-7.4%	3 732.4	3.2
Swan Hill (RC) - Central	9 956	2.3%	24.2	410.6
Swan Hill (RC) Bal	7 456	-3.5%	5 261.0	1.4
Loddon (S) - North	3 612	-11.9%	3 207.6	1.1
Loddon (S) - South	4 980	-7.6%	3 486.5	1.4
Gr. Shepparton (C) - Pt A	44 850	11.8%	389.9	115.0
Gr. Shepparton (C) - Pt B East	4 111	2.5%	1 072.9	3.8
Gr. Shepparton (C) - Pt B West	9 196	6.2%	958.7	9.6
Campaspe (S) - Echuca	11 087	14.7%	26.2	422.8
Campaspe (S) - Kyabram	12 719	3.1%	992.1	12.8
Campaspe (S) - Rochester	8 742	9.7%	1 955.8	4.5
Campaspe (S) - South	3 815	-1.5%	1 545.0	2.5

Note S = Shire, RC = Rural City, C = City

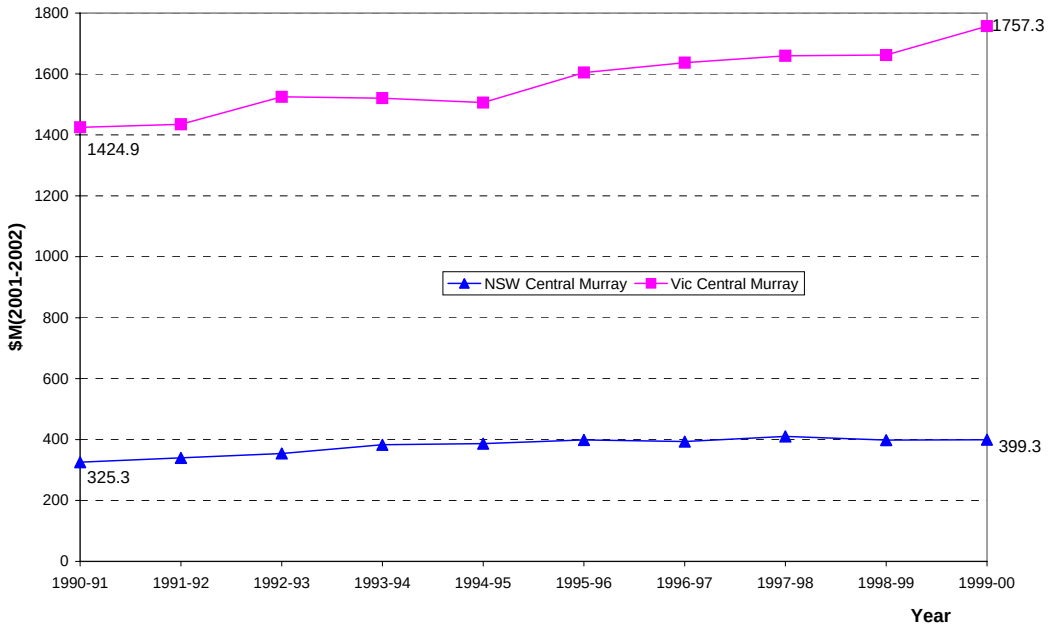
Source ABS 2001 *Regional Population Growth*, Australia and New Zealand, 1991 to 2001 (Cat. 3218.0) Estimated Resident Population data.

Taxable income

Figures 4.1 and 4.2 illustrate gross and mean real taxable income for the region from 1990–91 to 1999–2000. Gross real taxable income is an indicator of economic activity. Key points from these charts include:

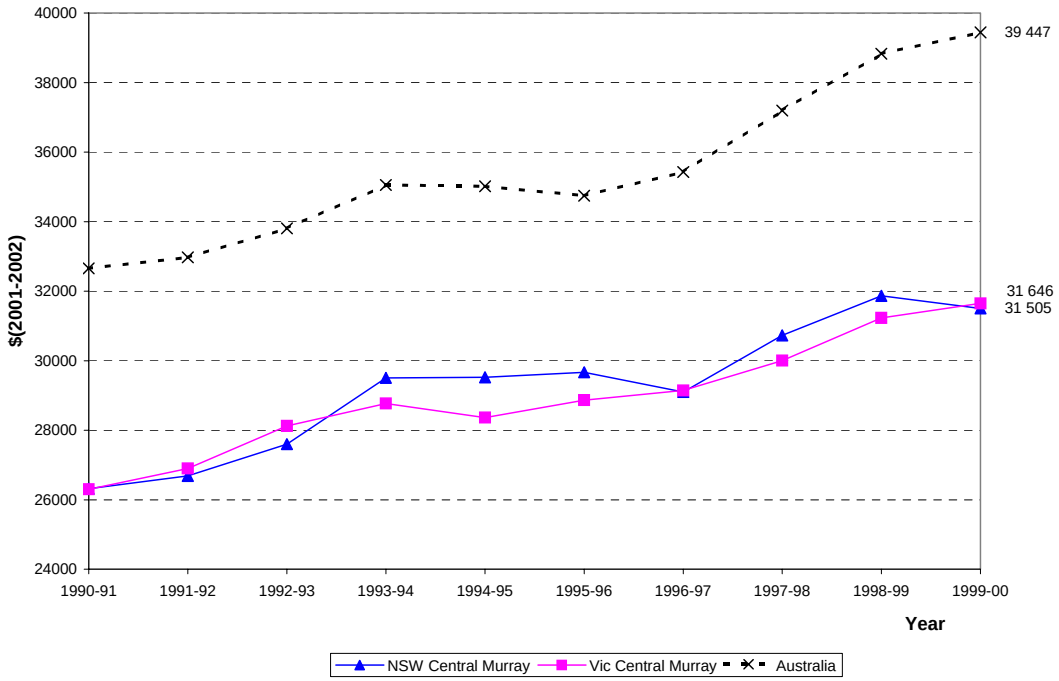
- Victorian gross real taxable income is substantially greater than NSW consistent with the larger size of the regional economy;
- in both the Victorian and NSW Central Murray, gross taxable income has grown by more than 20 per cent over the period, although this obviously represents a much larger actual increase in Victoria ($332 million compared to $74 million in NSW); and
- the mean real taxable income of both areas is very similar (at around $31 500) although both areas are significantly below the Australian average of $39 477.

FIGURE 4. 1 GROSS REAL TAXABLE INCOME—CENTRAL MURRAY 1990–91 TO 1999–00



Source BTRE July 2003 estimates, based on Australian Taxation Office data.

FIGURE 4. 2 MEAN REAL TAXABLE INCOME—CENTRAL MURRAY 1990–91 TO 1999–00



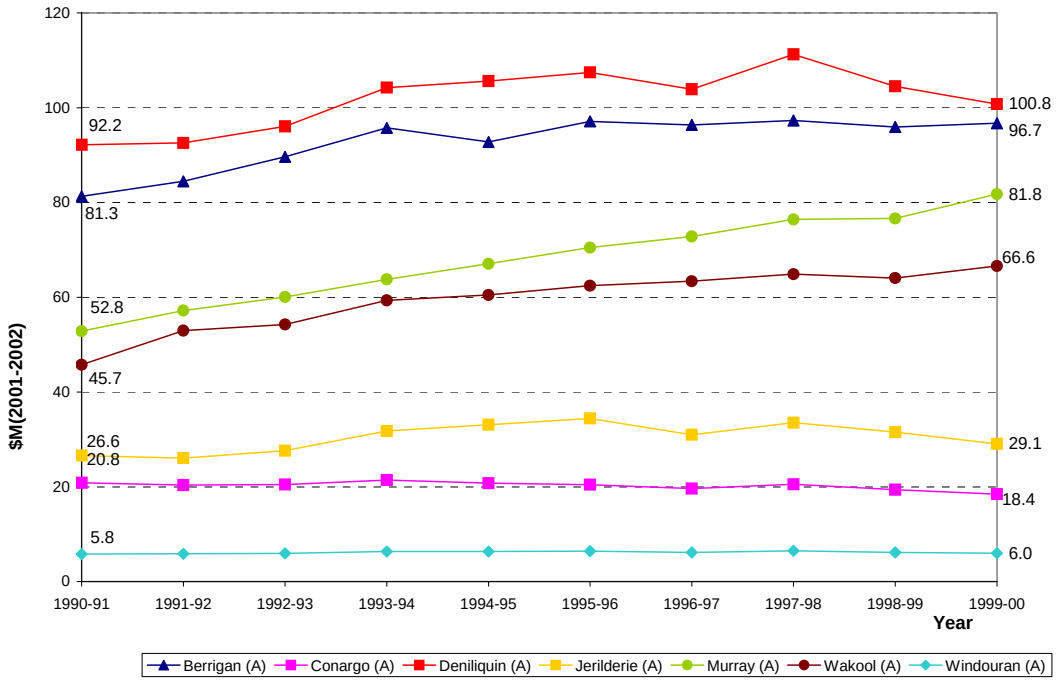
Source BTRE July 2003 estimates, based on Australian Taxation Office data.

Figures 4.3 to 4.6 set out the changes in gross and mean real taxable income from 1990–91 to 1999–2000 for the SLA/LGAs of the region. Note that:

- in NSW, Murray SLA (which includes Moama and borders the Echuca area in Victoria) has enjoyed dramatic growth in gross real taxable income (55 per cent over the period) as has Wakool (46 per cent), while Conargo has suffered a real decline (12 per cent). Consistent with the Murray Shire's relatively high population growth, the increase in the economy's size results from a 26 per cent increase in the number of taxpayers whilst the mean income remains comparable to the Central Murray regional average;
- in Victoria, Shepparton and Campaspe are not only the LGAs with the largest taxable income but they have also enjoyed considerable growth over the period (29 per cent for both) compared to the more modest growth of the remaining shires; and
- the mean real taxable income has generally been higher in NSW than in Victoria.

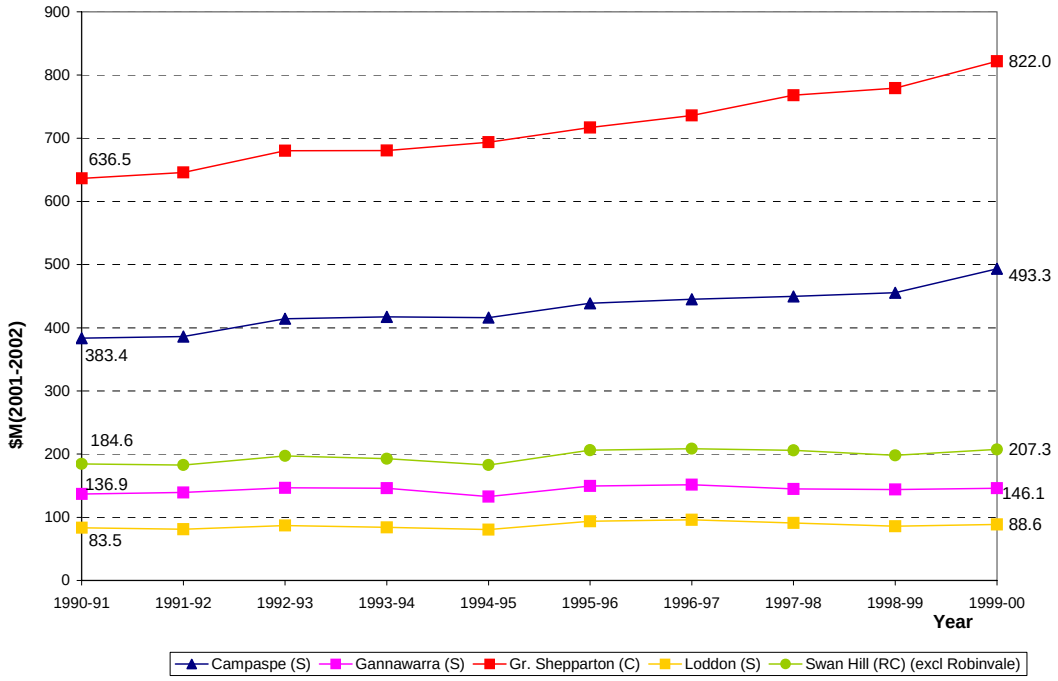
These trends in taxable income are consistent with the picture emerging from the population data and with local observation that the areas of Murray, Shepparton and Campaspe (eg. Echuca) are where economic activity appears to be strongest. However, in both states, the smaller shires with lesser economies have had slow or negative growth whilst the larger economies have all enjoyed good positive growth rates.

FIGURE 4. 3 GROSS REAL TAXABLE INCOME BY SLA—NSW CENTRAL MURRAY 1990–91 TO 1999–00



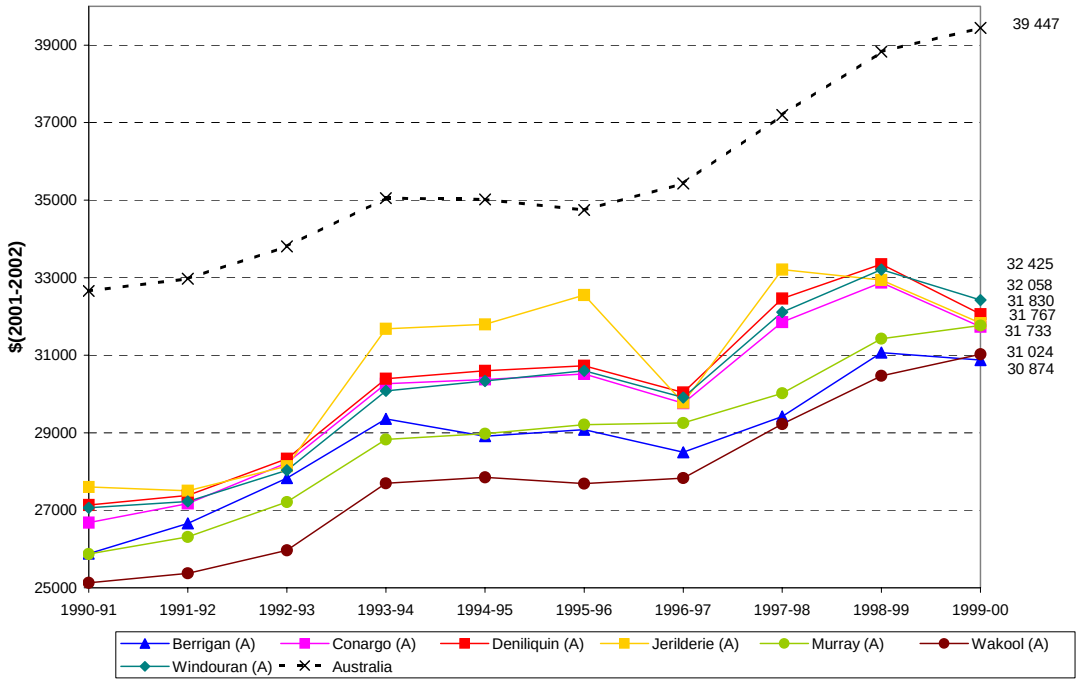
Source BTRE July 2003 estimates, based on Australian Taxation Office data.

FIGURE 4. 4 GROSS REAL TAXABLE INCOME BY SLA—VICTORIAN CENTRAL MURRAY 1990–91 TO 1999–00



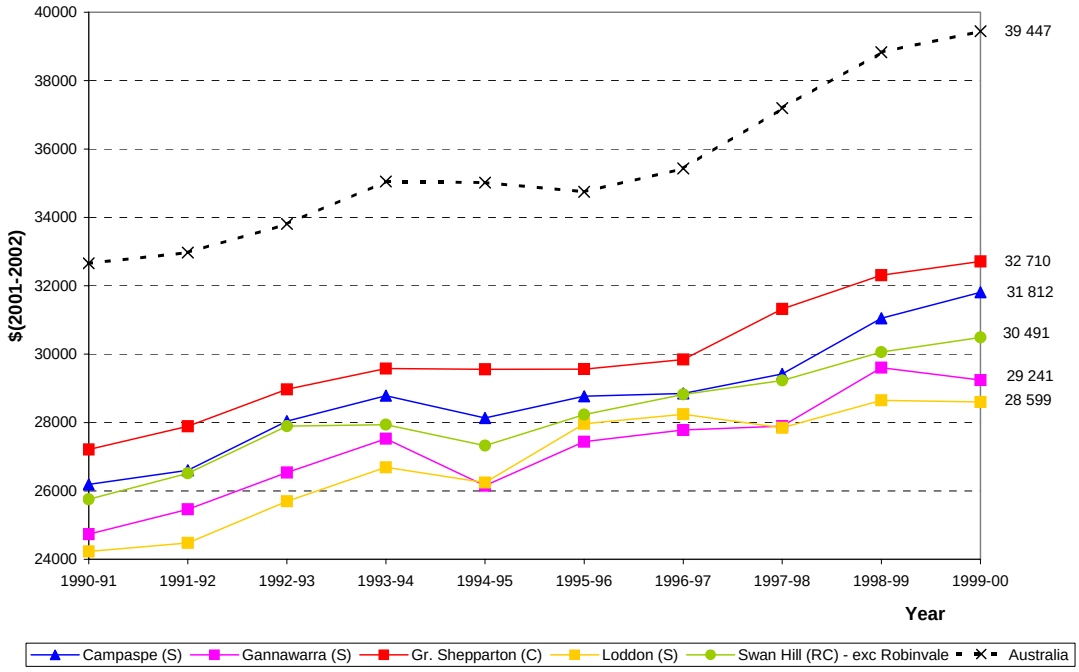
Source BTRE estimates based on Australian Taxation Office data.

FIGURE 4. 5 MEAN REAL TAXABLE INCOME BY SLA—NSW CENTRAL MURRAY 1990–91 TO 1999–00



Source BTRE estimates based on Australian Taxation Office data.

FIGURE 4. 6 MEAN REAL TAXABLE INCOME BY SLA—VICTORIAN CENTRAL MURRAY 1990–91 TO 1999–00



Source BTRE estimates based on Australian Taxation Office data.

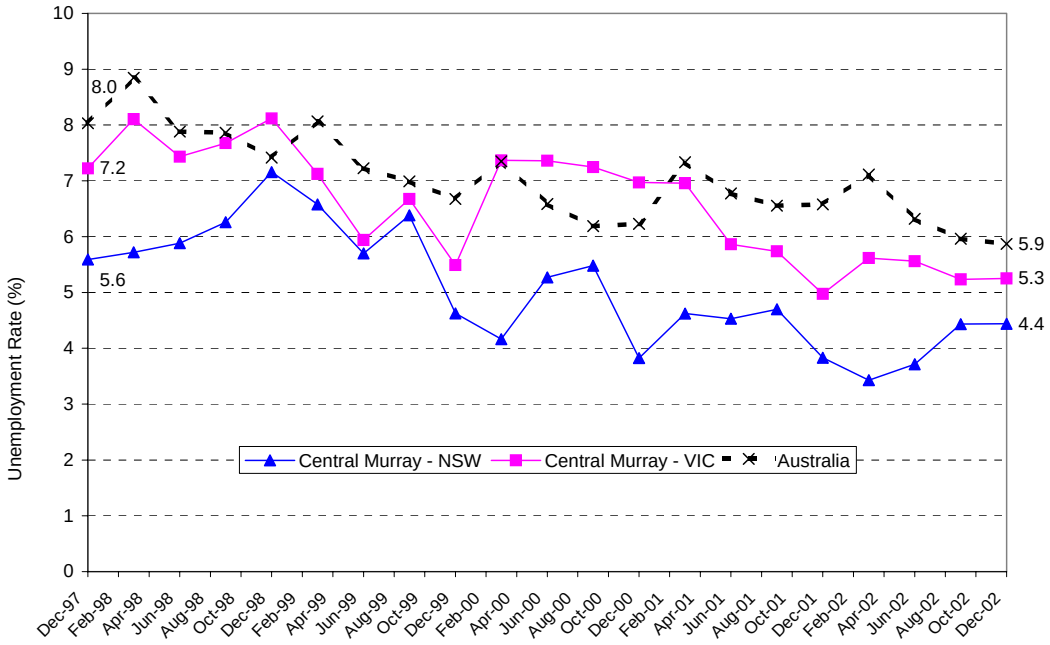
Unemployment

Unemployment rates over the last six years are provided in the next three charts. Figure 4.7 shows that the unemployment rate for the Central Murray region has generally been below the national average. Like the national average rate, unemployment rates in the region have also been declining. However, the Victorian Central Murray has had consistently higher unemployment than the NSW Central Murray.

Figures 4.8 and 4. 9 show the variation in unemployment rates between LGAs in the region. In the NSW Central Murray, the LGAs tend to move together indicating the similarity of their economic base. In contrast, the Victorian LGAs unemployment rates are more varied, often moving in different directions, reflecting regional population trends. In particular, Campaspe and Shepparton (the two main areas containing the major centres) tend to move together and in quite a different pattern to the others. This may well be indicative of a 'sponge city' effect as people from smaller towns move to larger regional centres in order to access better work, education, health or other facilities for themselves or their children. However, as the LGAs (especially in Victoria) are large and cover a range of rural and urban areas, any firm conclusion would require closer geographical and historical analysis. Such an analysis is outside the scope of this study, but a discussion of competing regional development theories can be found in BTRE (2003a).

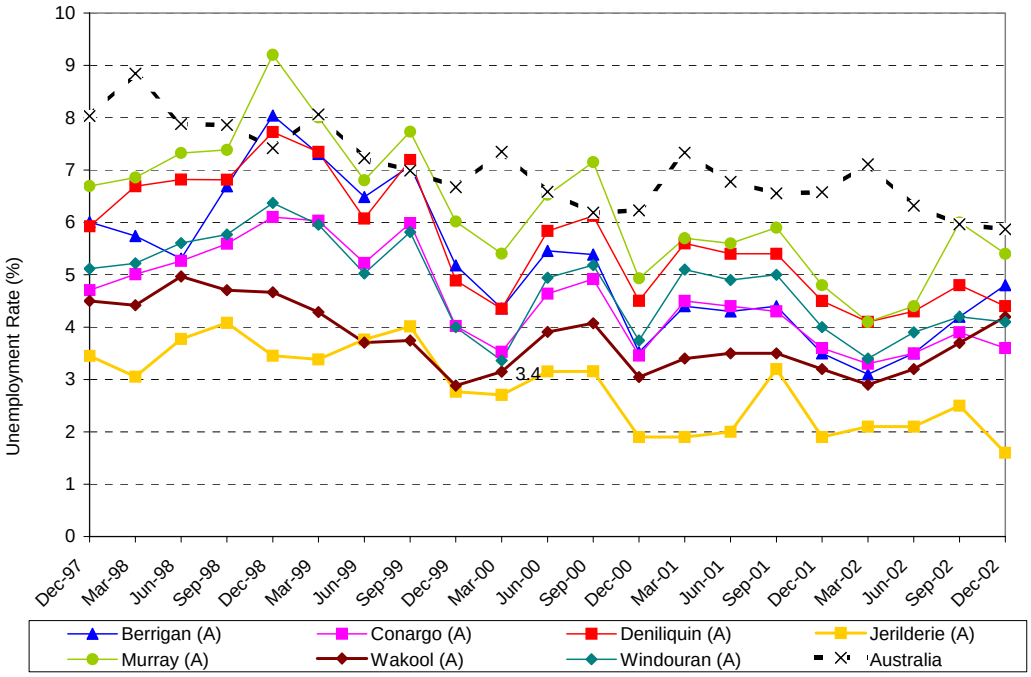
At a broader level, the underlying range of unemployment rates on an individual LGA basis ranges from lows of 1.6 per cent (Jerilderie) and 3 per cent (Gannawarra) to highs of 5.4 per cent (Murray) and 6.4 per cent (Shepparton). This pattern is not unexpected given the industrial structure. Our observations in other areas often show unemployment is lower in rural-based economies—the explanation often given is that the lack of opportunity for work in a rural environment coupled with a strong work ethic in country people encourages people to move to other areas to gain employment.

FIGURE 4. 7 UNEMPLOYMENT RATE—CENTRAL MURRAY 1997 TO 2002



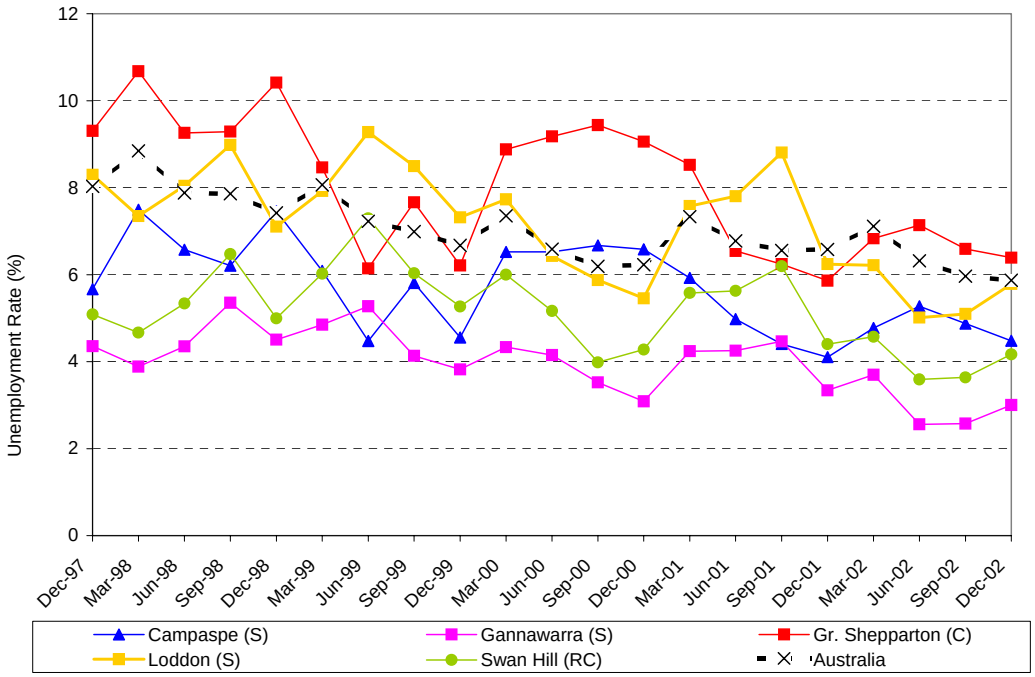
Source DEWR Small Area Labour Markets.

FIGURE 4. 8 UNEMPLOYMENT RATE BY SLA—NSW CENTRAL MURRAY 1997 TO 2002



Source DEWR Small Area Labour Markets.

FIGURE 4. 9 UNEMPLOYMENT RATE BY SLA—VICTORIAN CENTRAL MURRAY 1997 TO 2002



Source DEWR Small Area Labour Markets.

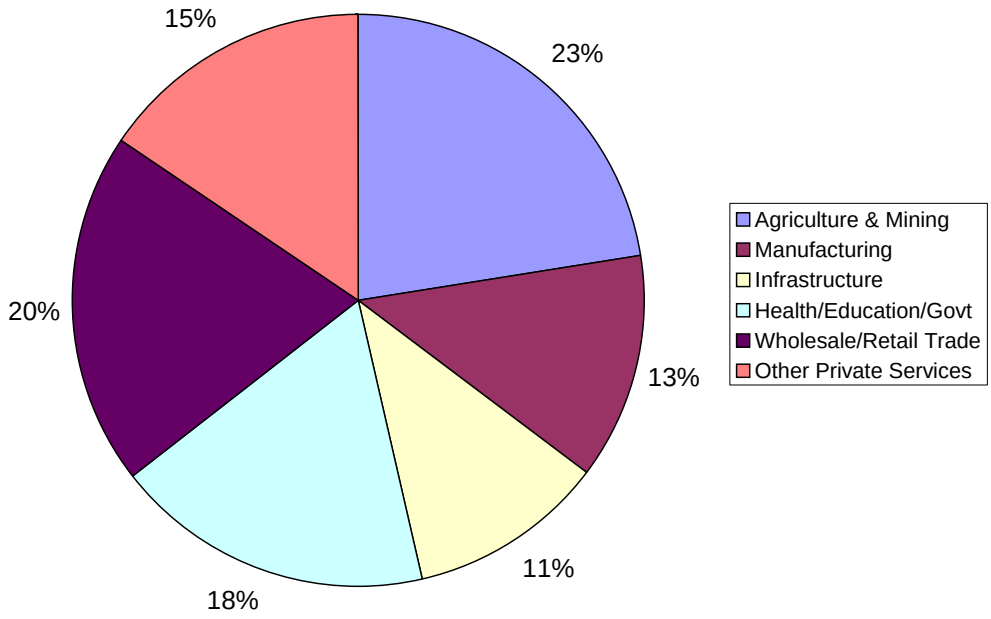
Regional industry structure

General

Employment numbers can be a poor indicator of production and investment levels because high value capital-intensive investment will not show up in the figures. Some care also needs to be exercised in interpreting the spatial patterns associated with this employment data as some figures are based on 'enumerated at home' data while others are based on total 'place of enumeration' data and therefore include visitors. This slight difference in data sources also means that the total employment may not be consistent across all of the figures presented. A further complication when comparing these figures is that the 'enumerated at home' data are based on where people live which is not necessarily where they work. However, despite these limitations, the charts and tables presented below do provide an overall picture of the major industries in the region and their relative size.

Figure 4.10 shows employment by industry sector with agriculture and mining at 23 per cent, wholesale and retail trade 20 per cent, health/education/ government 18 per cent, other private services 15 per cent and manufacturing 13 per cent. Overall, it presents a picture of a reasonably diverse economy where agriculture remains the largest employer but other sectors are also playing a significant role. However, as will be pointed out later in this section, much of the manufacturing and other activity of the region is reliant on agriculture. It is for this reason that estimates of capital stock (accumulated investment) presented later in this chapter focus on agriculture and manufacturing as the core economic base of the region.

FIGURE 4. 10 EMPLOYMENT BY INDUSTRY SECTOR—CENTRAL MURRAY 2001



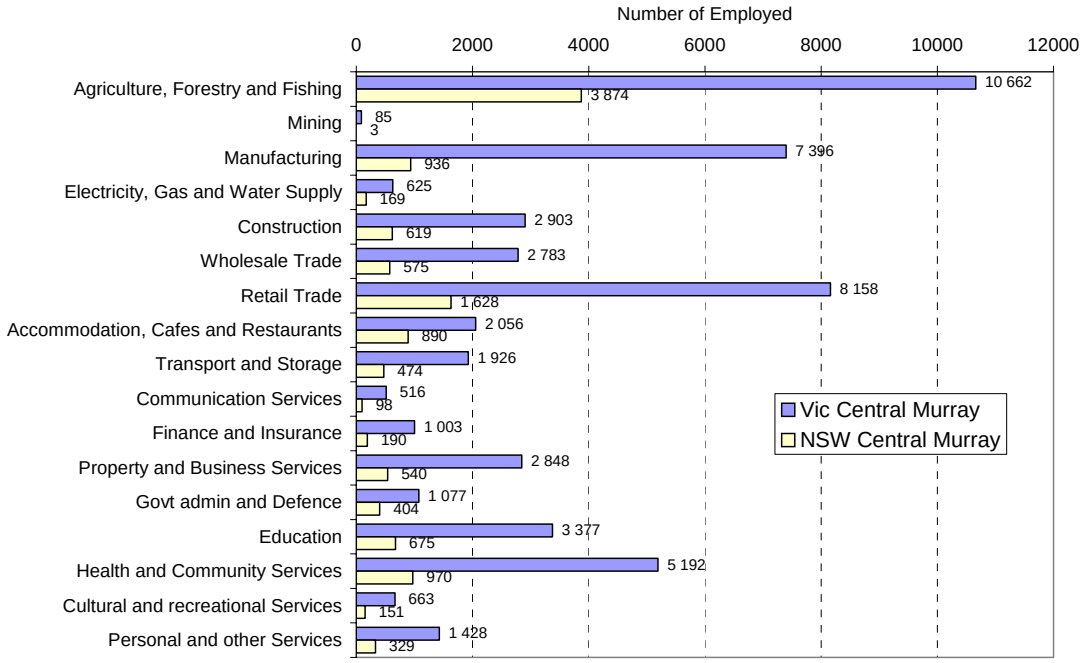
Note Infrastructure sector includes Construction, Communication, Transport, Electricity, Gas & Water. Other Private Services includes Accommodation, Cafes and Restaurants, Property and Business Services, Finance and Insurance, Cultural and Recreational Services and Personal and Other Services.

Source BTRE estimates based on ABS 2001 Census of Population and Housing (place of enumeration data, persons enumerated at home).

In Figure 4.11 the differences between the Victorian and NSW sides of the Central Murray are illustrated. It shows the concentration of industry on the Victorian side in every category, particularly for agriculture, manufacturing and services. For example, there are in excess of 10 000 people employed in agriculture in Victoria compared to less than 4000 in NSW. Within the Victorian Central Murray, agriculture employs around 20 per cent, retail trade 15 per cent and manufacturing 14 per cent. In contrast, the NSW Central Murray is more dependent on agriculture (31 per cent of total employment) and less diverse with manufacturing employing only 7 per cent and retail trade 13 per cent.

Local information suggests that part of the reason for this pattern was a history of competition between the states to attract business to their side. If so, then Victoria clearly won the battle, but now is left with the responsibility of supplying infrastructure, power and waste disposal facilities. In addition, it is suggested that much of the hoped for commitment of companies to local communities has not been forthcoming.

FIGURE 4. 11 EMPLOYMENT BY INDUSTRY SECTOR BY STATE—CENTRAL MURRAY 2001



Source BTRE estimates based on ABS 2001 Census of Population and Housing (place of enumeration data, persons enumerated at home).

Table 4.5 together with Figures 4.12 and 4.13 provide industry employment data by SLA. It is important to remember the significant differences in the scales used in the figures with Victoria employing a much larger number of people. Key points to note from these figures include:

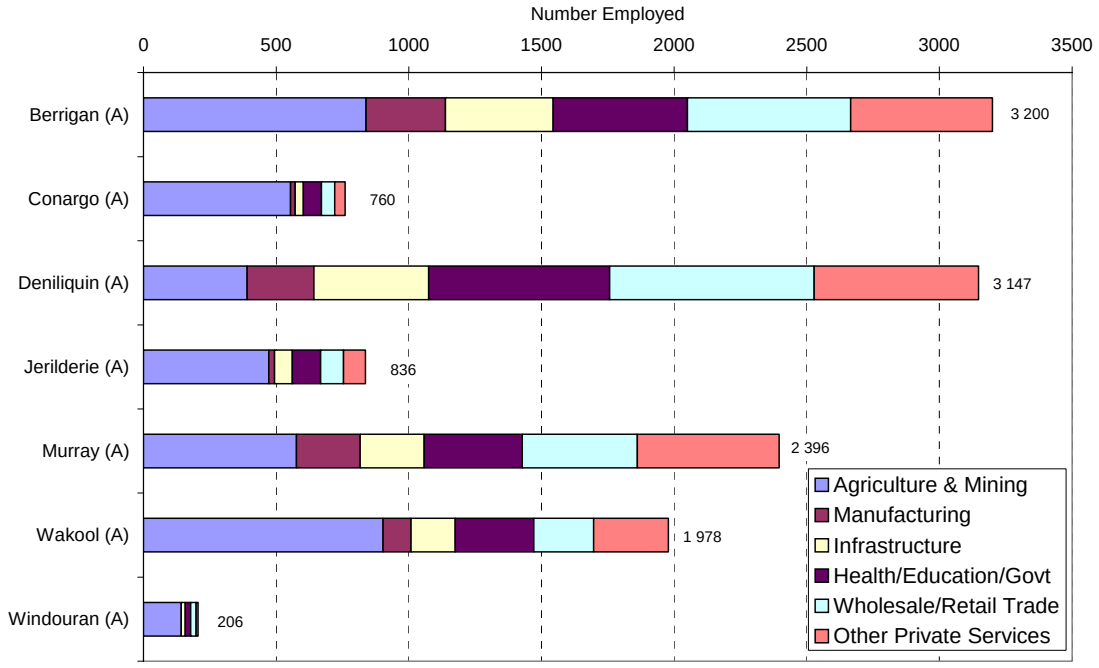
- the areas with the largest numbers of employed are Shepparton, Campaspe and Swan Hill which are all in Victoria;
- within NSW, Berrigan and Deniliquin have the largest numbers of employed but these are still small compared to the Victorian centres;
- manufacturing and services (such as retail trade, health, education) are more concentrated in Victoria, particularly in Campaspe (which includes Echuca and Kyabram) and Shepparton; and
- areas with lower levels of employment such as Conargo, Jerilderie, Wakool and Windouran in NSW and Gannawarra and Loddon in Victoria are more reliant on agriculture.

TABLE 4. 5 EMPLOYMENT BY INDUSTRY SECTOR BY SLA—CENTRAL MURRAY 2001 (PERSONS)

	Agric & Mining	*Manuf*	*Infrastructure*	*Health/ Education Govt*	*Wholesale & Retail Trade*	*Other Private Services*	*Total employed*
Berrigan (A)	839	299	407	506	615	535	3 200
Conargo (A)	554	17	31	68	50	39	760
Deniliquin (A)	390	252	432	682	771	619	3 147
Jerilderie (A)	472	22	67	107	86	82	836
Murray (A)	576	240	242	369	434	535	2 396
Wakool (A)	903	106	166	296	226	281	1 978
Windouran (A)	142	0	16	21	20	8	206
NSW CENTRAL MURRAY	*3 877*	*936*	*1 361*	*2 048*	*2 203*	*2 099*	*12 523*
Campaspe (S) - Echuca	177	651	497	870	1 032	993	4 220
Campaspe (S) - Kyabram	1 214	983	518	877	913	714	5 219
Campaspe (S) - Rochester	1 178	470	382	555	561	390	3 537
Campaspe (S) - South	494	227	146	248	187	112	1 415
Gannawarra (S)	1 679	473	508	753	887	532	4 832
Gr. Shepparton (C) - Pt A	1 228	3 015	2 306	3 614	4 504	3 140	17 807
Gr. Shepparton (C) - Pt B East	645	205	207	360	332	197	1 945
Gr. Shepparton (C) - Pt B West	1 179	564	387	504	592	483	3 710
Loddon (S) - North	830	54	108	222	159	97	1 469
Loddon (S) - South	610	238	129	278	225	184	1 663
Swan Hill (RC) - Central	277	305	494	890	1 058	852	3 876
Swan Hill (RC) Bal	1 236	211	288	475	491	304	3 005
VIC CENTRAL MURRAY	*10 747*	*7 396*	*5 970*	*9 646*	*10 941*	*7 998*	*52 698*

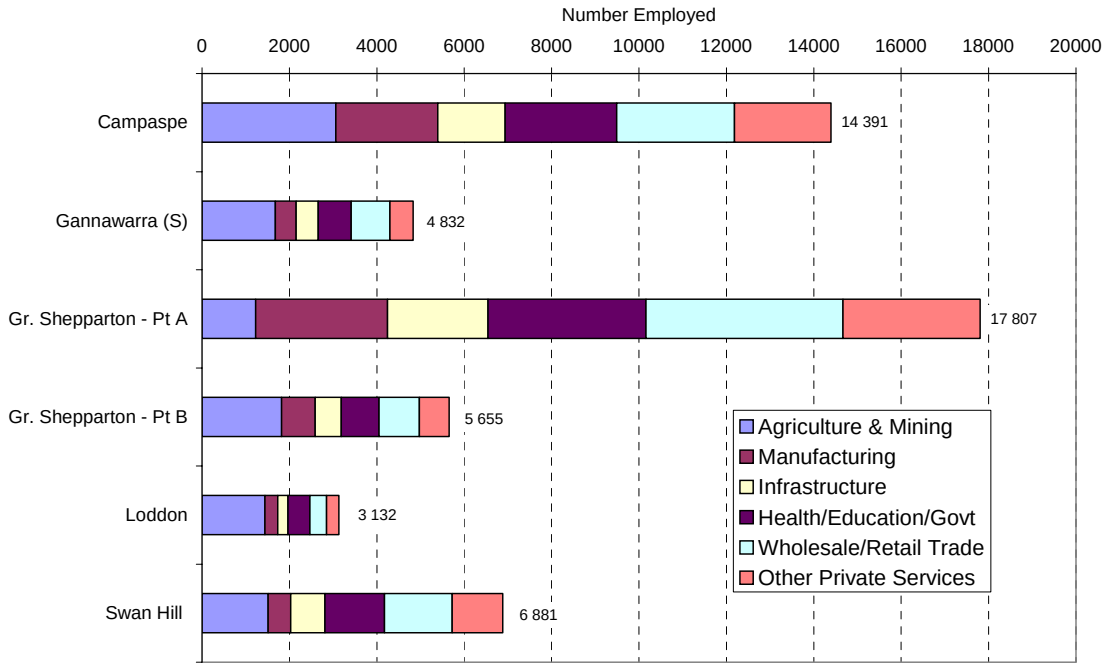
Source BTRE estimates based on ABS 2001 Census of Population and Housing (place of enumeration data, persons enumerated at home).

FIGURE 4. 12 EMPLOYMENT BY INDUSTRY SECTOR, BY SLA—NSW CENTRAL MURRAY 2001



Source BTRE estimates based on ABS 2001 Census of Population and Housing (place of enumeration data, persons enumerated at home).

FIGURE 4. 13 EMPLOYMENT BY INDUSTRY SECTOR, BY SLA—VICTORIAN CENTRAL MURRAY 2001



Source BTRE estimates based on ABS 2001 Census of Population and Housing (place of enumeration data, persons enumerated at home).

Agriculture

Given the importance of agriculture in the Central Murray economy, a further breakdown of employment data within the agriculture category is provided. Figure 4.14 reinforces the pattern evident in Figure 4.11 with the number of people employed in Victorian agriculture exceeding that of NSW. Other features to note include:

- the predominance of grain, sheep and beef cattle farming (74 per cent of agricultural employment) in NSW with only relatively small numbers employed in dairy (13 per cent) and horticulture (9 per cent); and
- the significance of dairy (42 per cent) in Victoria, accompanied by grain, sheep and beef cattle farming (32 per cent) and horticulture (21 per cent).

Note that this relative focus on dryland agricultural pursuits does not reflect actual numbers employed in dryland agriculture, where the Victorian Central Murray employs more people in this sector than NSW—a surprise given the larger total area of the NSW region and the large amount of other agriculture. Rather it reflects the very large numbers of people employed in Victoria in the dairy and horticulture sectors.

FIGURE 4. 14 AGRICULTURAL EMPLOYMENT—CENTRAL MURRAY 2001

Source ABS 2001 Census of Population and Housing (place of enumeration data).

Figure 4.15 provides a further breakdown of employment within the horticultural sector. In 2001, there were about 300 persons employed in horticulture in the NSW Central Murray compared to more than 2000 persons

in the Victorian Central Murray. For both Victoria and NSW, grape growing is one of the largest horticultural employers in the region. However, as Figure 4.24 later shows, beverage manufacturing (which includes wine processing) is relatively small in the region. Most of the grapes grown are likely to be processed by small boutique wineries or the produce transported to the Sunraysia and Riverland areas where the major wineries are located.

FIGURE 4. 15 HORTICULTURAL EMPLOYMENT—CENTRAL MURRAY 2001

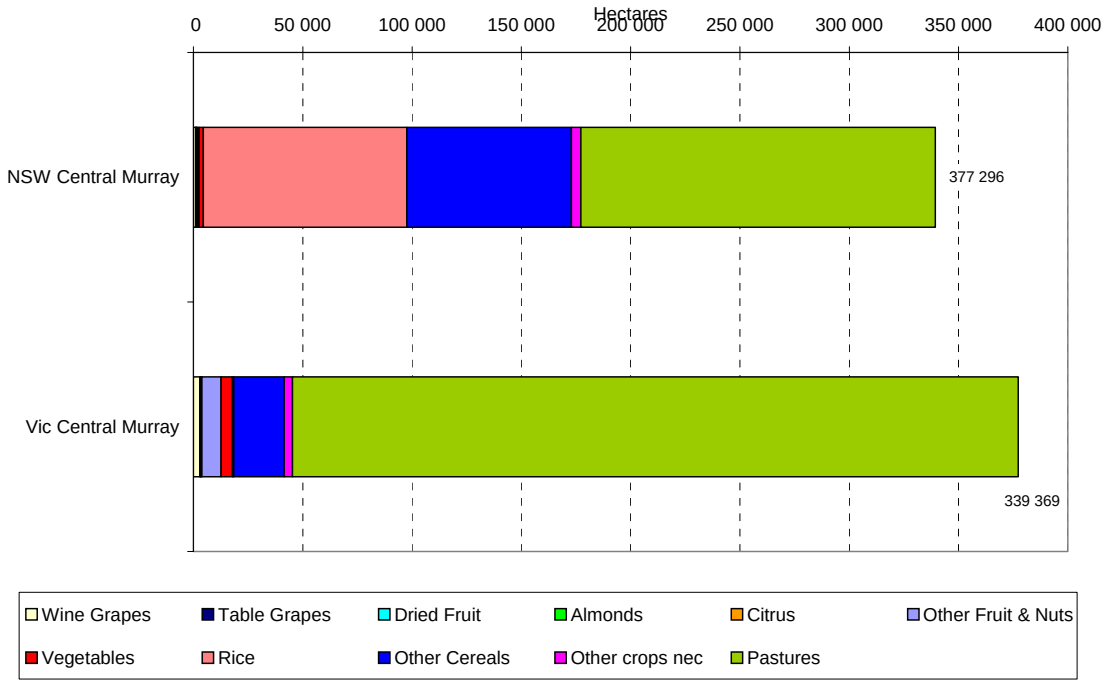
Source ABS 2001 Census of Population and Housing (Place of enumeration data).

Irrigated agriculture

The above employment data includes both dryland and irrigated agriculture. In this section, the 2001 ABS Agricultural Census is used to explore the pattern of irrigated agriculture in the region in terms of area and value of production.

Figure 4.16 shows that in 2001 the Victorian Central Murray irrigated around 377 000 hectares of land, slightly more than the NSW area which irrigated approximately 339 000 hectares. Also evident from the figure is the significance of pasture in both states (particularly dominant in Victoria) and the importance of rice and other cereals in NSW. Note that the actual area under irrigation in NSW is likely to be overestimated. The reasons for this are discussed shortly.

FIGURE 4. 16 AREA OF IRRIGATED AGRICULTURE BY CROP TYPE, BY STATE—CENTRAL MURRAY 2001



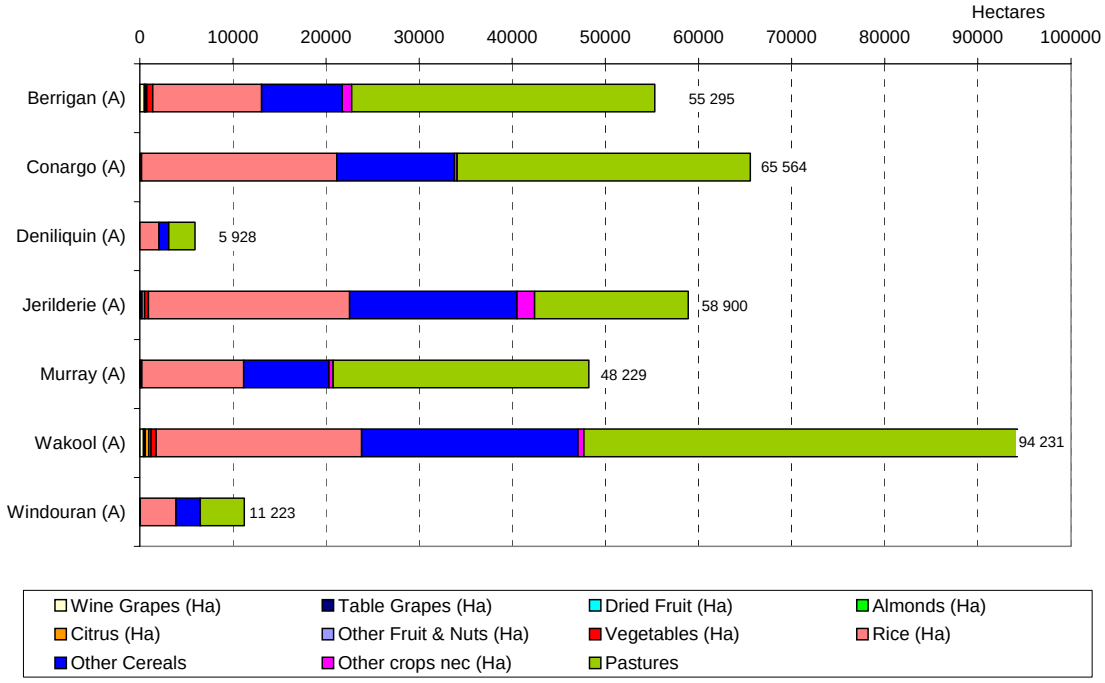
Source Based on ABS Agricultural Census 2001.

Figures 4.17 and 4.18 provide a more detailed breakdown of irrigated land use for each state by LGA. A quick glance at the two charts reveals some fundamental differences in land use on each side of the border. In NSW, the picture is reasonably consistent across the LGAs. There are three main irrigated enterprise types—rice, other cereals and pastures—which are annual in nature. Annual cropping is flexible and tends to be more opportunistic, meaning that rice farmers, for example, can adapt more easily to changing market conditions particularly to water shortages and price changes (they choose not to plant or plant something different). Recently, for example, in response to the drought some rice irrigators found it more profitable to sell their temporary water entitlement rather than plant a crop. This is a typical response from this industry which is thought to be only able to pay around half the price for water that the dairy industry can (Dunlop and Foran 2001). Perennial crops, horticulturalists and other enterprises involving long-term investment in plant and/or specialised livestock (such as dairy) do not have this flexibility. Only the LGAs of Wakool and Berrigan have significant horticulture (eg. vegetables, wine grapes, citrus).

Victorian shires are also quite consistent with each other, but very different to NSW, with pasture completely dominating. The abundance of pasture reflects the local view that dairy is the key driver of irrigation activity in the area. Dairy farmers are very dependent on irrigated pasture as the basis for feeding herds for milk production. Towns such as Kyabram, Cohuna and Tatura in the Gannawarra, Campaspe and Shepparton shires rely heavily on the dairy sector.

Other cereals are significant for several shires, as is fruit in Shepparton, but pasture mainly relating to dairy overshadows the other categories. From Figure 4.18, the north of the region around Swan Hill is the only Victorian region where wine grapes appear be a significant land use. However, we understand that significant plantings are also being undertaken in the Corop/Colbinabbin region. In the Campaspe area, pasture for dairy is the major enterprise but local observation also indicated that there is a significant presence of tomato crops in the area (this is consistent with the size of the vegetable category in Figure 4.18).

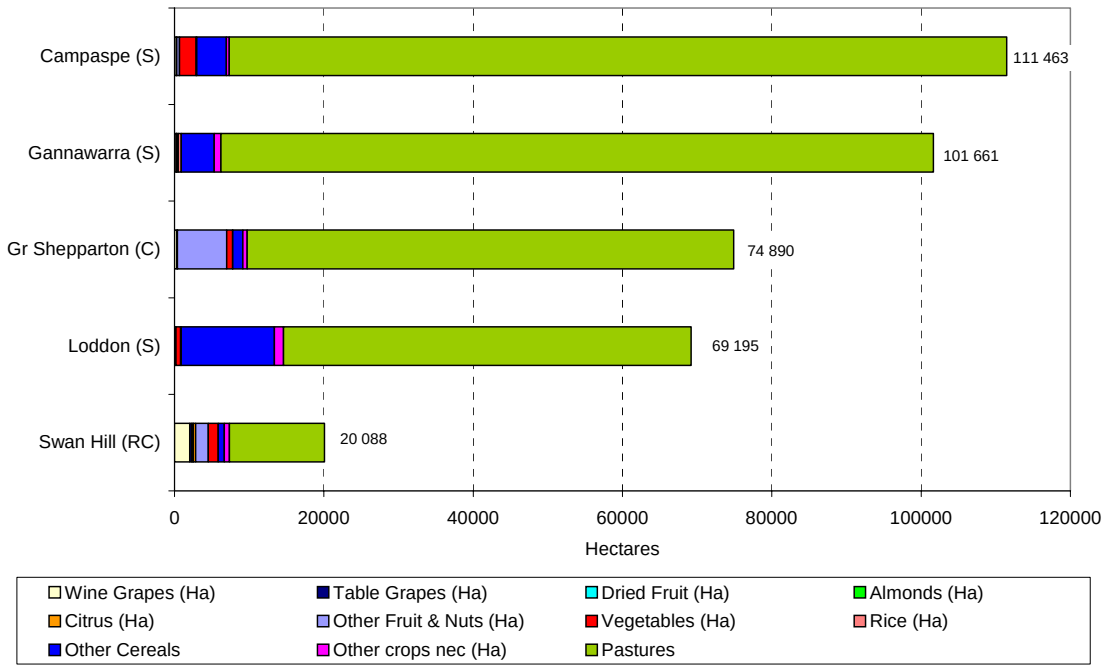
FIGURE 4. 17 AREA OF IRRIGATED AGRICULTURE BY CROP TYPE—NSW CENTRAL MURRAY 2001



Source Based on ABS Agricultural Census 2001.

Table 4.6 is a key indicator of recent trends in land use and confirms the view of those in the region that there has been a general expansion of irrigation, (partly as a result of farms in outer-metropolitan Melbourne being taken up in urban sprawl, and the principals moving further out). The reported overall expansion of irrigated area has been 105 666 hectares over the 1997–2001 period. This comprised 61 675 hectares (22 per cent increase) on the NSW side and 43 991 hectares (13 per cent increase) on the Victorian side. The table indicates that land dedicated to irrigated pasture (the dominant crop type across the region) has fallen slightly in NSW during 1997–2001 but continues to expand in Victoria.

FIGURE 4. 18 AREA OF IRRIGATED AGRICULTURE BY CROP TYPE—VICTORIAN CENTRAL MURRAY 2001



Source Based on ABS Agricultural Census 2001.

In NSW, the data show apparent dramatic growth in the irrigated area associated with other cereals (there has also been significant growth in Victoria). However, as noted above, fieldwork discussions suggest that this is a significant overestimate. While 2000–01 was a good year for rice and cereals, the size of the increase is inconsistent with Murray Irrigation Limited (MIL) land use data. The overestimate is thought to result from several factors: increased use of double-cropping techniques (that is, irrigating for both crops and pasture in the same year, meaning that the hectares are being double-counted in this data[14]); undereporting of 1996–97 data (due to it being a high rainfall year and therefore less hectares were reported as irrigated); and the activities of private diverters are not generally included in the MIL data. We expect that the majority of 'other cereals' comprise wheat, which has the advantage of requiring less water to grow than rice. Wine grapes have also experienced rapid growth on both sides of the border but this comes off a very small base. Fruit is significant and remains strong and growing in the Victorian Central Murray. Crops showing a decline in the area irrigated included table grapes and dried fruit across the whole region, vegetables in NSW and citrus in Victoria.

[14] The way the Agricultural Census question is phrased invites these areas to be counted under each enterprise use.

TABLE 4. 6 CHANGES IN IRRIGATION AREA BY CROP TYPE—CENTRAL MURRAY 1997 TO 2001

Crop Type	*NSW Central Murray*	*NSW Central Murray*	*Vic Central Murray*	*Vic Central Murray*
	Ha change 1997–2001	*% Change 1997–2001*	*Ha change 1997–2001*	*% Change 1997–2001*
Wine Grapes	749	256%	1 667	135%
Table Grapes	-1	-2%	-148	-36%
Dried Fruit	-27	-18%	-104	-39%
Almonds	98	113%	18	35%
Citrus	21	4%	-21	-5%
Other Fruit & Nuts	457	184%	2 339	36%
Vegetables	-734	-28%	1 811	54%
Rice	12 296	15%	480	545%
Other Cereals	61 851	462%	9 235	67%
Other crops nec	-9 368	-68%	-35	-1%
Pastures	-3 666	-2%	28 749	9%
Total	*61 675*	*22%*	*43 991*	*13%*

Source Based on ABS Agricultural Census 2001.

When interpreting these tables and charts it is important to remember that farm enterprises are typically a mix of several different activities. Research prepared for the Wakool Shire on small and medium enterprises (SMEs) across the region contains numerous examples of the diversity of activities occurring within individual farms. For example, many farms are engaged in wheat, rice, sheep and stone fruit all on the one property (Inland Marketing Corporation 2002).

The trend toward diversifying by, for example, running more than one crop a year is a result of a number of pressures on-farm enterprises including the increased cost of water, ability to spread the demands on and returns to labour and capital, the relative profitability of irrigated and non-irrigated crops, new farming techniques and understanding of land capability. The flexibility offered by mixed farming, particularly involving annual cereals such as rice and wheat, has been attractive to farmers on the NSW side of the river that have General Security water entitlements and who are able to reconfigure their businesses to take advantage of opportunities as they arise. Table 4.6 supports the local view that the trend over the last 10 years in NSW has been farms taking out pasture, in part because of low wool prices and rising grain prices, and replacing it with cropping (a typical crop rotation is rice, cereal and grazing sub–pasture).

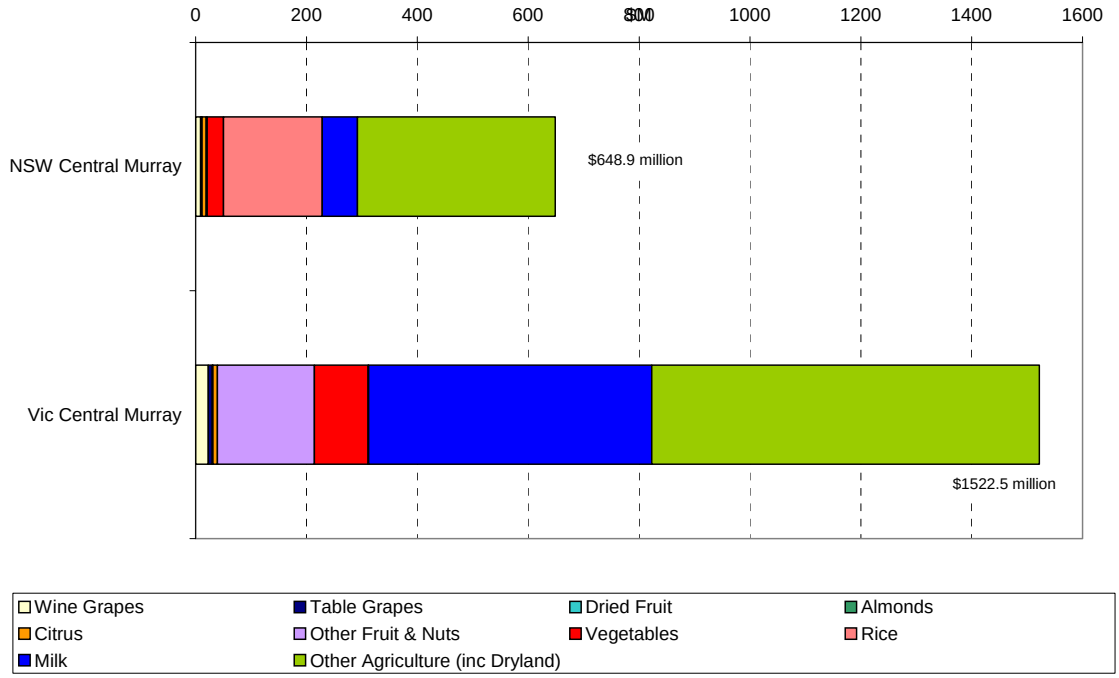
Value of agricultural production

Figures 4.19 to 4.22 show the value of agricultural production in the Central Murray. Note that, unlike earlier charts, it incorporates all agricultural production, not just irrigation. Dryland agriculture remains an important group of industries across the region.

These charts support local observations that the value of agricultural production is far larger in Victoria (approximately $1500 million) than NSW (around $650 million). Other key points include:

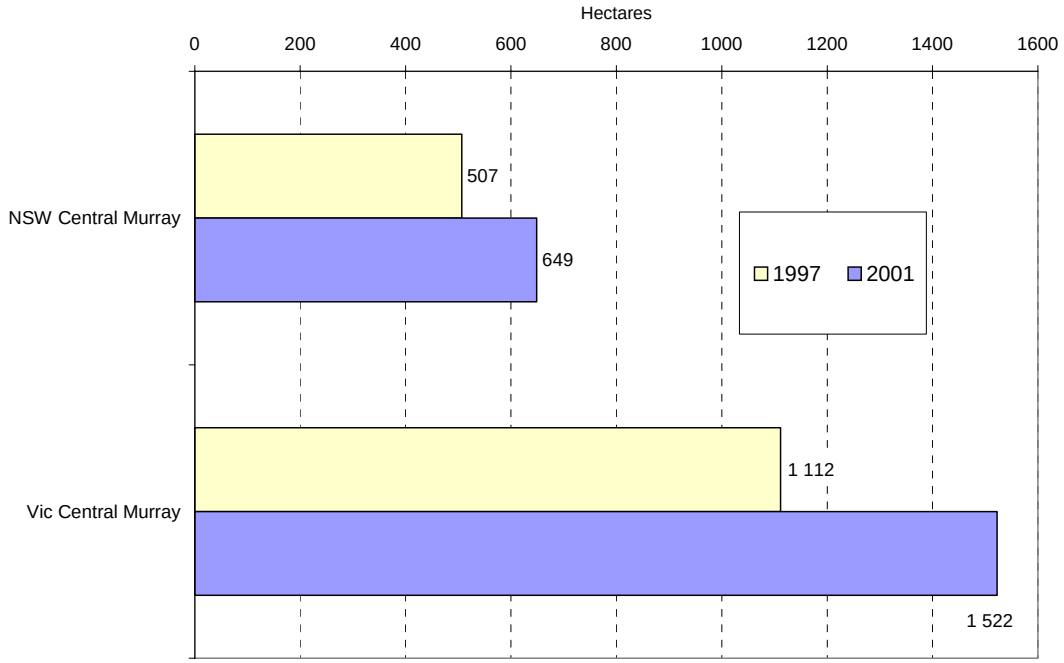
- the high importance of horticultural products in value of production terms, given their relatively small area (Figure 4.17 and 4.18);
- the significance of milk in Victoria's production value and also fruit and vegetables, and the importance of rice in NSW;
- in NSW, Wakool Shire has the largest value of agriculture with some citrus, fruit, vegetables and wine grapes;
- in Victoria, Campaspe and Shepparton have the highest values of production—Campaspe is dominated by milk, Shepparton by both fruit and milk and the value of horticulture in Swan Hill is also apparent (vegetables, wine, fruit, nuts, citrus); and
- growth in the value of agricultural production in the Victorian Central Murray is higher in both absolute and relative terms.

FIGURE 4. 19 VALUE OF AGRICULTURAL PRODUCTION BY INDUSTRY—CENTRAL MURRAY 2001



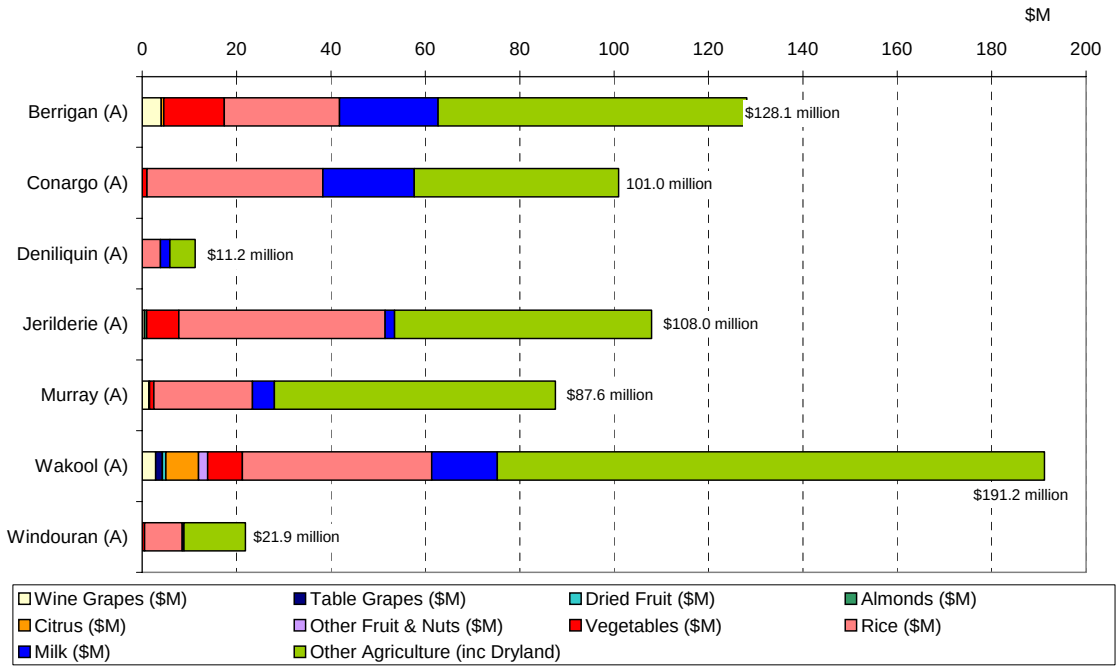
Source Based on ABS Agricultural Census 2001.

FIGURE 4. 20 VALUE OF AGRICULTURAL PRODUCTION—CENTRAL MURRAY 1997 & 2001



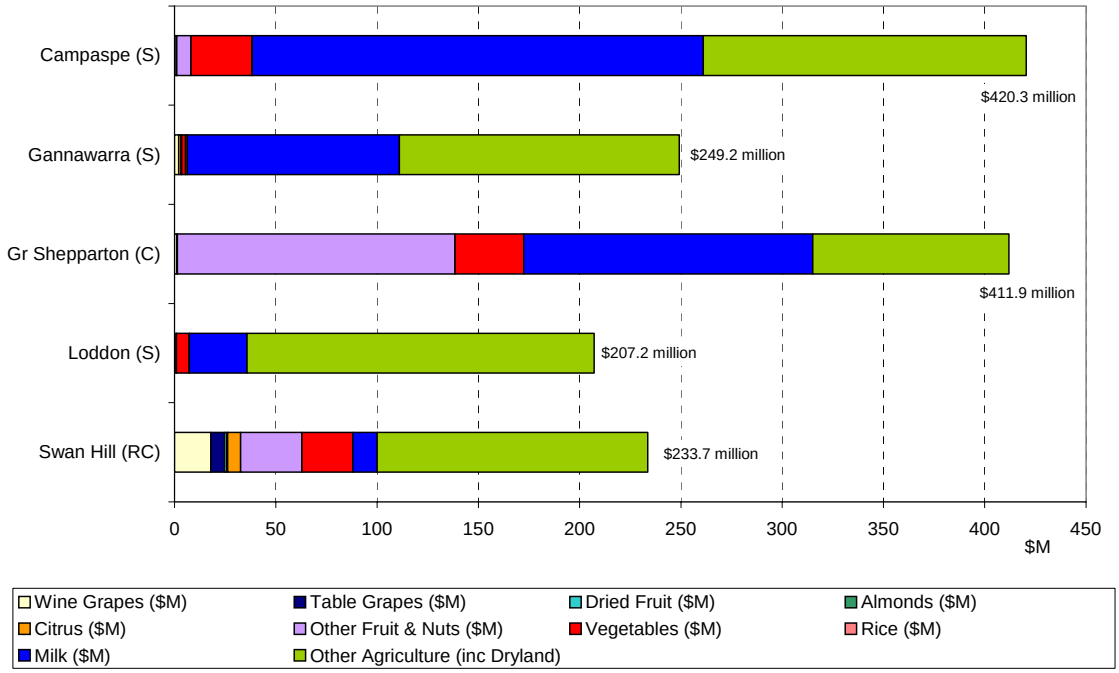
Source Based on ABS Agricultural Census 2001.

FIGURE 4. 21 VALUE OF AGRICULTURAL PRODUCTION BY INDUSTRY—NSW CENTRAL MURRAY 2001



Source Based on ABS Agricultural Census 2001.

FIGURE 4. 22 VALUE OF AGRICULTURAL PRODUCTION BY INDUSTRY—VICTORIAN CENTRAL MURRAY 2001



Source Based on ABS Agricultural Census 2001.

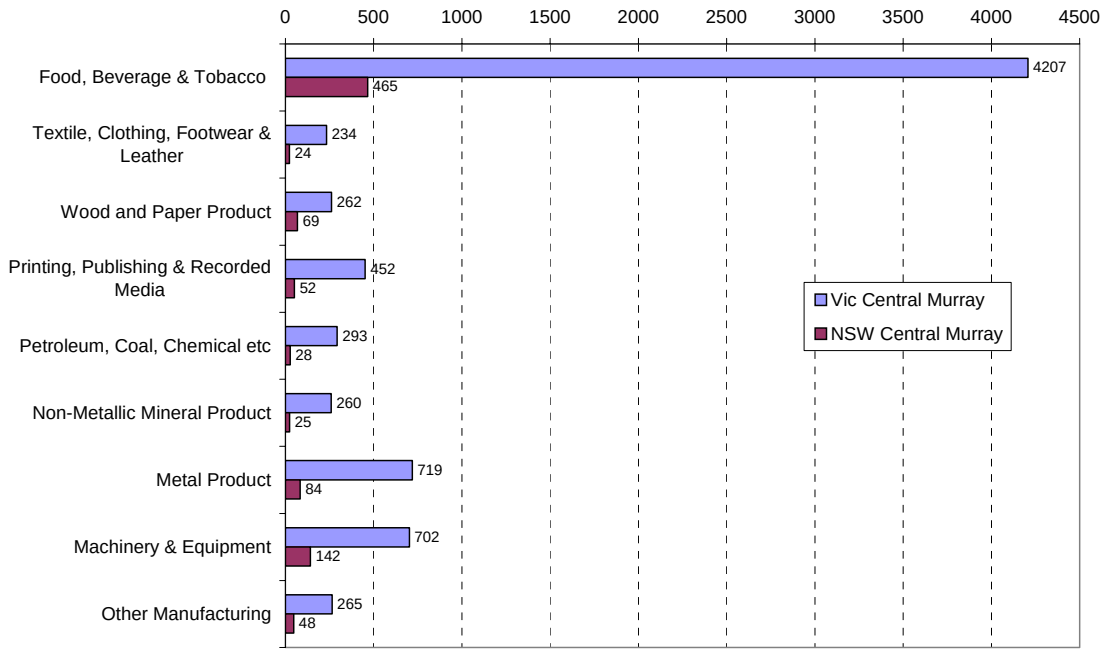
Manufacturing

Around 8300 persons are employed in manufacturing in the Central Murray region. Figure 4.23 provides a more detailed breakdown of manufacturing employment across the region. Key features to note include:

- as expected, Victoria dominates manufacturing employment for the region with around 89 per cent of the regional total;
- in Victoria, food, beverage and tobacco manufacturing dominates (57 per cent), followed by metal products (10 per cent) and machinery and equipment (9 per cent);
- the same also applies in NSW, with food, beverage and tobacco manufacturing dominating (50 per cent), followed by machinery and equipment (15 per cent) and metal products (9 per cent).

Other significant manufacturing activities identified during field interviews included steel fabrication in Shepparton and Echuca in the Victorian Central Murray and the redgum industry on both the NSW and Victorian sides of the river. The region contains several sawmills (for example, the Moama sawmill in the Murray Shire) and furniture and commercial building manufacturers (for example, in Koondrook in the Victorian Gannawarra Shire).

FIGURE 4. 23 MANUFACTURING EMPLOYMENT—CENTRAL MURRAY 2001

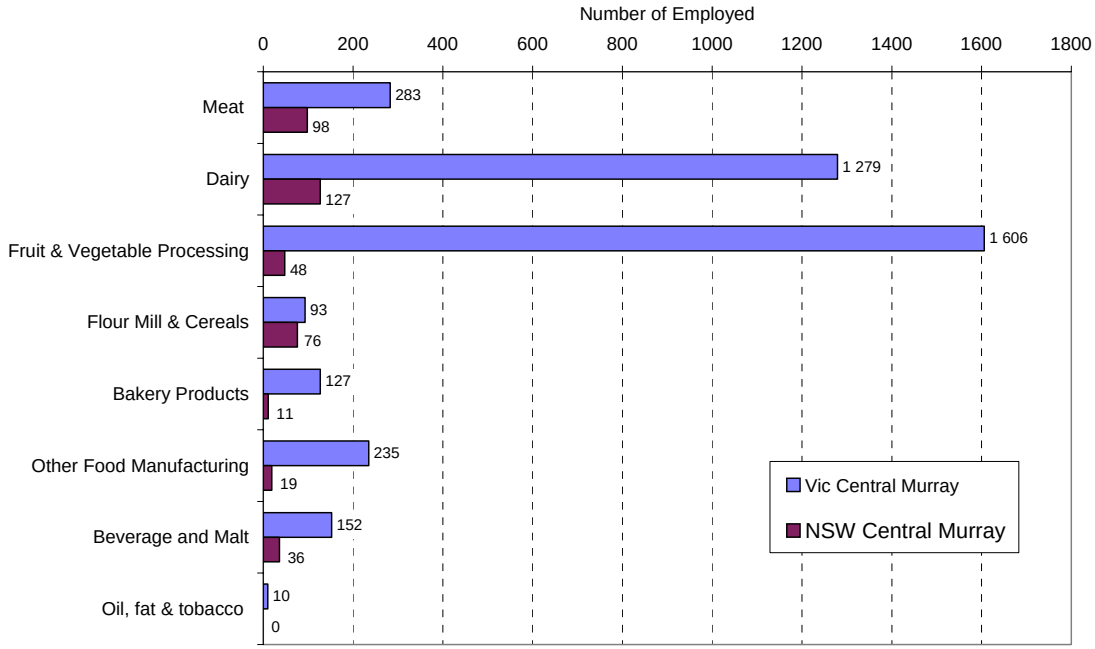


Source BTRE estimates based on ABS 2001 Census of Population and Housing (place of enumeration data, persons enumerated at home).

The dominance of the 'food, beverage & tobacco' manufacturing category across the region is consistent with and intimately tied to the predominance of agriculture. It shows that most of the secondary industries in the region are reliant on the region's agricultural base. In excess of 4000 persons are employed in food manufacturing in the Central Murray region. Figure 4.24 provides further detail about the various food manufacturing sectors. Key points include:

- for the region as a whole, fruit and vegetable processing is the largest manufacturing employer, followed by dairy and meat;
- most food manufacturing employment is located in the Victorian Central Murray (predominantly around Shepparton and in Campaspe Shire);
- for NSW, dairy is the largest manufacturing employer (31 per cent), followed by meat (24 per cent) and flour mill and cereals (18 per cent);
- for Victoria, fruit and vegetable processing (42 per cent) is the largest manufacturing employer, followed by dairy (34 per cent) and meat (7 per cent).

FIGURE 4. 24 FOOD MANUFACTURING EMPLOYMENT—CENTRAL MURRAY 2001



Source BTRE estimates based on ABS 2001 Census of Population and Housing (place of enumeration data).

The preceding charts show that the Victorian Central Murray is a major centre for fruit and vegetable processing facilities. The Shepparton area employs approximately 1000 persons in fruit and vegetable processing. The prominence of food processing in the region is a result of the location of several major manufacturing plants including the SPC Ardmona Limited manufacturing plant in Shepparton, which was established in 1918 (SPC 2003)[15]. SPC Ardmona is an Australian-owned food manufacturing company. Its core product range is deciduous fruit (pear, peach, apricots, plums and apples), tomatoes, baked beans and spaghetti. It is one of the largest employers in the region, with permanent employees numbering approximately 750 plus 150 casual employees. During the main fruit-harvesting season, an additional 2000 people are employed between the two production sites at Shepparton and Mooroopna.

According to Goulburn Broken Catchment Management Authority (GBCMA), in the Goulburn Broken Catchment (which includes Campaspe and Shepparton) the dairy, horticulture, meat processing, timber and winemaking industries have all invested heavily in manufacturing infrastructure over the last 10 years, with an estimated $1 billion of new investment, $600 million of which has occurred in the last five years. According to a report commissioned by the GBCMA, the major companies have estimated that, over the next five years, they will invest up to $440 million in increased production capacity and

15 Manufacturing operations are also based in the Goulburn Valley region of Mooroopna.

efficiency, transportation and storage, information technology and quality management to meet future market expectations (Young 2000, pp. 10).

Dairy is the other major manufacturing sector of the region. Dairy processing is concentrated on the Victorian side—Campaspe, Shepparton and Gannawarra—but Berrigan on the NSW side also has some dairy manufacturing. Major dairy manufacturers include:

- Cooperative milk factories: Bonlac Foods (Stanhope), Murray Goulburn (Cobram and Rochester) and Tatura Milk Industries (Tatura). Tatura Milk has around 360 employees and is estimated to spend approximately $35 million on capital investment every four years to keep up with growth in the demand for milk. Dairy processing is high-tech and capital intensive—the Tatura plant is estimated to have a replacement value of $230 million (Jeff Martin, pers. comm., 28 May 2002).
- Multinational dairy manufacturers: Nestle at Tongala and Echuca, Kraft at Strathmerton.
- Dairy Farmers Cooperative and Ducats also have a presence in the region as milk product packagers and distributors. Ducats has been producing milk and fruit juices since 1917 in the Shepparton region.
- Tatura Milk and Murray Goulburn Cooperative have each formed contractual relationships with Japanese companies to process and package infant milk formula. Associated with this there has been significant investment in packaging plants.
- Murray Goulburn cheese factory at Leitchville (Gannawarra Shire).
- Heinz Wattie Australasian Infant Feeding Centre of Excellence at Echuca.

Other examples of key manufacturing enterprises in or near the region include:

- multinationals: Henry Jones Foods Pty Ltd (USA) located at Kyabram who produce IXL jams and conserves, Campbell's Soups (USA) located in Shepparton/Lemnos, Simplot (USA) who produce Leggo brand products at Echuca;
- tomato-based products: Girgarre Country Foods, a division of H.J Heinz Co. Aust. Ltd at Girgarre; Unifoods, a division of Unilever (Australia) at Tatura; and Cedenco Australia at Echuca. The tomato-based product market has grown substantially in recent years and significant quantities of tomatoes for the Victorian processors are sourced from NSW;
- cereal packaging and selling is predominantly located in NSW (see Figure 4.20 flour mill and cereals category)—Ricegrowers Cooperative Limited (SunRice) at Deniliquin on the NSW side and formerly at Echuca, however, the mill at Echuca closed earlier this year (2003) due to drought. The Deniliquin plant is Australia's largest rice mill, employing over 400 people. SunRice was established in 1950 and is the fifth largest rice food company in the world;

- Coprice Feeds at Tongala (a division of NSW Ricegrowers' Cooperative Ltd)—produce rice-based stockfeeds;
- abattoirs: Cobram (Vodusek), Tongala (HW Greenhams), Tatura and Echuca (Riverside Meats), Nathalia (Ryan);
- poultry processors: Strathmerton, Numurkah;
- Riverina Oilseeds Processors Pty Ltd at Numurkah—local crushing of soybeans, canola, sunflowers and biodiesel plant based on canola oil at Moama; and
- citrus production and packing at Koondrook in the Gannawarra Shire — Border Packers and Barr-Berri Juice factory ('Daily Juice' brand)—employ around 30 persons and invested $500 000 over last two years in processing a plant.

  (Young 2000, pp. 24–25).

The above lists show that corporate investment in the region is reasonably strong (but mostly concentrated on the Victorian side), with both Australian and multinational companies investing in the region's manufacturing capacity. Discussions with local business indicated that these plants have expanded over the last 10 years and are expected to continue to expand.

Apart from SunRice, the NSW Central Murray does not contain any larger sized manufacturing businesses and NSW produce is often transported into Victoria for processing. For example, there is a small tomato processing plant near Jerilderie but most produce goes to Echuca or Shepparton. Much of the NSW-produced milk is also processed at Victorian dairy plants. Rice is the only exception to this and is processed locally at Deniliquin. The potential for more processing on the NSW side was raised in several conversations with stakeholders in the region.

Manufacturing or processing of wine grapes is not large in the region, with most grapes grown being transported to the major winery regions in the Sunraysia and Riverland areas. However, there are significant numbers of boutique wineries and some larger enterprises such as Andrew Peace Wines—a winery at Wood Wood, north of Swan Hill, which acts as a processing destination for some local grapes. The Perricoota district in NSW is a relatively new wine district with wine production centred near the town of Moama. Major wineries in the district include St Anne's and Riverview Estate.

There are also a number of processing/storage facilities for dryland agriculture produce in the region. For example, the Australian commodity logistics company Australian Bulk Alliance, in association with local operator Pearson's Transport, opened its Woorinen facility in 2000. The facility offers direct rail freight to the Port of Melbourne and bunker wheat storage and was developed to meet local demand (Australian Bulk Alliance 2000).

OBSERVED INVESTMENT PATTERNS

In order to gain an insight into the flows of capital investment, we have developed estimates of the capital stock used in specific industries in 1997 and 2001. This report focuses on capital stock as the ongoing result of investment. We have chosen capital stock as the key indicator to provide an insight into investment in the regions being studied. This section presents estimates of capital stock in both irrigated agriculture and manufacturing for each region. Data limitations mean that different methodologies are used to calculate these estimates and the estimates are based on different valuation methods (for more detail on this issue see Appendix I). As a result, we have chosen not to add the two figures.

Irrigated agriculture

The estimates of capital stock in irrigated agriculture have been obtained using the method described in Chapter 1 and Appendix I. Note that an item for dairy plants has been included to augment the 'per hectare' estimates. This recognises the considerable on-farm investment in dairy (particularly milking) equipment. Readers should remember that these are estimates only and small differences and changes are unlikely to be significant.

Evidence from the Goulburn Broken Catchment indicates that on-farm investment in capital stock is substantial—'rural landholders are investing between $30–40 million annually in farm infrastructure to support the implementation of the Goulburn Broken Regional Catchment Strategy'. This includes investment in water use efficiency, drainage, etc (Young 2000, pp. iv). Murray Irrigation Ltd notes $105 million investment by landholders in landforming, associated improvements to irrigation layouts and on-farm drainage construction between 1998–99 and 2001–02 (MIL 2002b, pp. 20).

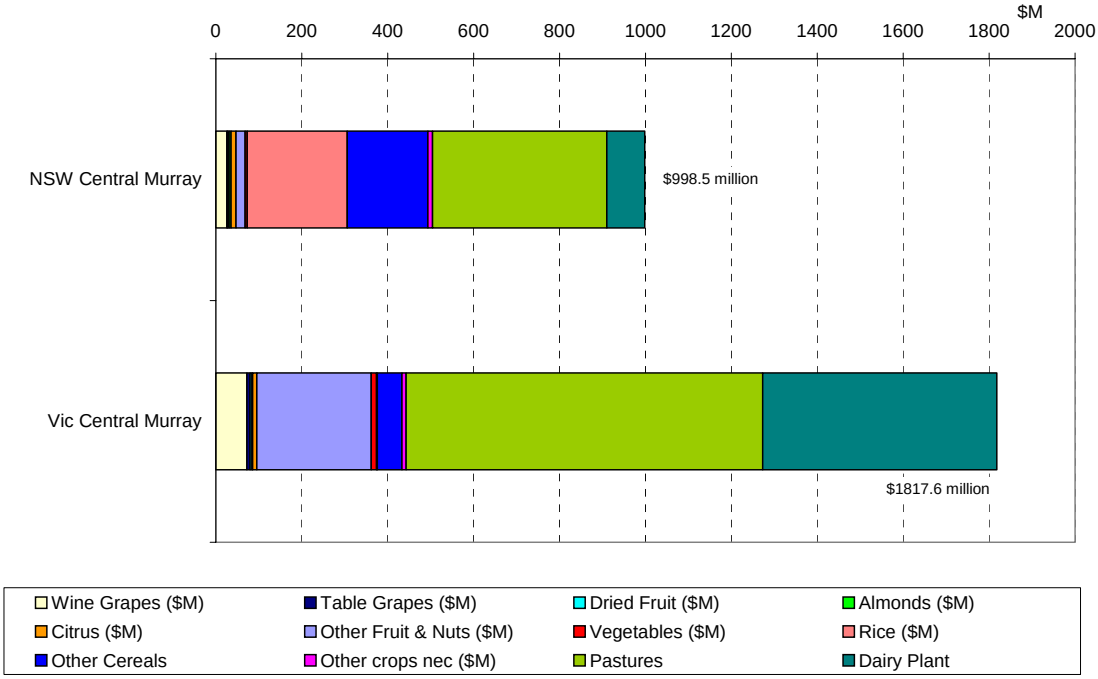
Figures 4.25, 4.26 and 4.27 illustrate capital stock estimates for irrigated agriculture in 2001 by state and by LGA. Key points include:

- the level of capital stock is much higher on the Victorian side of the border (approximately $1800 million in Victoria and $1000 million in NSW); and
- in NSW, capital stocks relate mainly to pasture, cereals and rice, whereas in Victoria dairy and pasture are the key components of capital stock for most shires. The exceptions are Shepparton where fruit is the main activity, and the sandy hills around Swan Hill where investment in horticulture, particularly in the Nyah, Woorinen and Tresco pumped irrigation districts, is apparent.

This is consistent with the local consensus, which suggested that over the last 10 years in particular, large-scale horticulture has rapidly expanded in the Swan Hill-Robinvale area. This move towards horticulture was often linked to infrastructure investment, particularly the Woorinen pipeline project just north

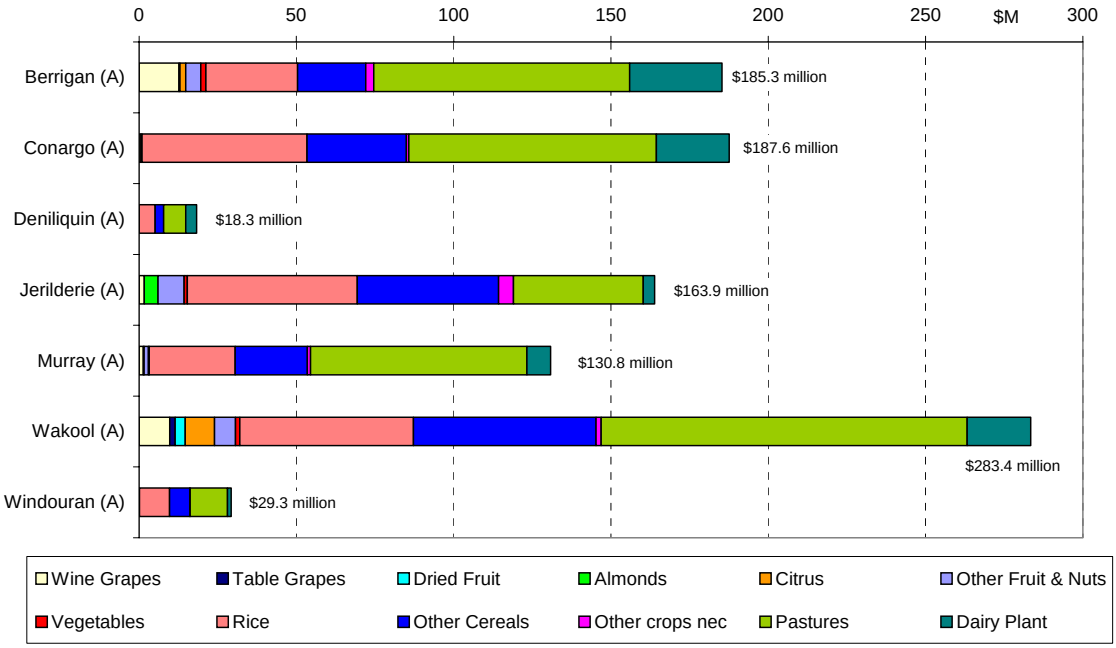
of Swan Hill and the pumped water districts in the region. The Swan Hill region is the second largest wine grape growing region in Victoria (Swan Hill Rural City Council Economic Development Unit 2002, p. 5).

FIGURE 4. 25 CAPITAL STOCK IN IRRIGATED AGRICULTURE—CENTRAL MURRAY 2001



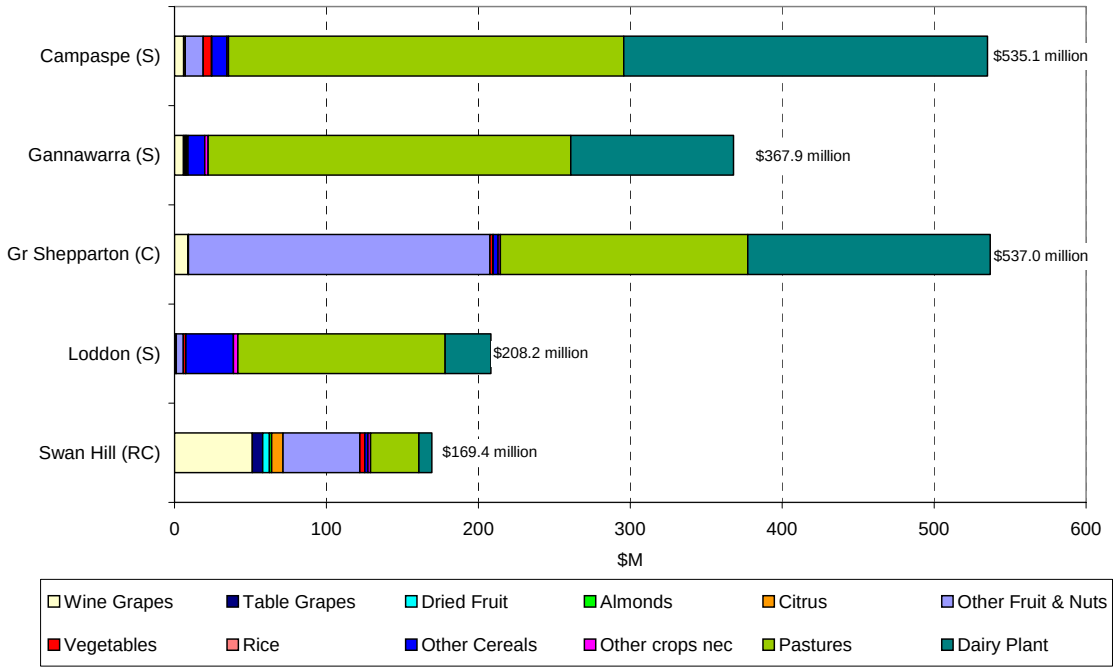
Source BTRE estimate based on ABS Agricultural Census 2001.

FIGURE 4. 26 CAPITAL STOCK IN IRRIGATED AGRICULTURE—NSW CENTRAL MURRAY 2001



Source BTRE estimate based on ABS Agricultural Census 2001.

FIGURE 4. 27 CAPITAL STOCK IN IRRIGATED AGRICULTURE—VICTORIAN CENTRAL MURRAY 2001



Source BTRE estimate based on ABS Agricultural Census 2001.

Table 4.7 and 4.8 give an indication of trends in capital stock from 1997 to 2001. In NSW, the growth in capital stock is the result of a large increase in capital associated with other cereals. As mentioned earlier, this growth is likely to be somewhat overstated due to overestimations of the irrigated hectares. In Victoria, the growth of wine grapes in Swan Hill is notable, as is the capital stock linked with fruit and nuts in Shepparton. However, interestingly, while pastures have displayed strong growth overall (though quite varied across shires), capital stock in dairy plants has fallen over the period. This is likely to be a result of the rationalisation of the dairy industry due to deregulation during the late 1990s. While many small soldier settlement dairy farms still exist in Victoria, the local view was that consolidation is occurring, mostly in regard to amalgamations of farms with less than 200 cows in order to achieve greater economies of scale. Bank lending practices are also influencing this trend, as they tend to operate on the view that dairy farms need at least 200 cows to be viable.

In contrast, dairy is expanding on the NSW side. Local observation suggests that a significant investment in rotary dairies has been occurring, in particular, reflecting higher numbers of cows per farm in that state. The local reasons given for this were the high price of farms and smaller size of farms in Victoria which was seen as pushing new entrants to NSW in order to get much-needed economies of scale.

In 1997 capital stock in irrigated agriculture in NSW Central Murray was around $800 million and in Victoria around $1600 million (see Figure 4.25, Tables 4.7 and 4.8). In other words, Victoria had double the capital stock of NSW. Conversely, from 1997 to 2001 the growth of capital stock in NSW exceeded that of Victoria. However, in dollar terms this amounted to a difference of only $24 million ($190 million compared to $166 million), at least some of which is likely to be due to over estimation through double-counting.

Montagues, an Australian fruit/citrus growing/packing company based in Melbourne, has recently begun developing a major site just north of Swan Hill on the NSW side of the river at Murray Downs. Montagues is investing $50 million in this staged development. Larger lot sizes with direct river access for irrigation was put forward as the major reason for choosing to locate the plant on the NSW side of the river.

TABLE 4. 7 CHANGES IN CAPITAL STOCK IN IRRIGATED AGRICULTURE BY CROP TYPE—NSW CENTRAL MURRAY 1997 TO 2001 ($M)

LGA	*Berrigan*	*Conargo*	*Deniliquin*	*Jerilderie*	*Murray*	*Wakool*	*Windouran*	*NSW Central Murray*
Wine Grapes	12.5	0.4	0.0	0.6	0.8	4.5	0.0	18.7
Table Grapes	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dried Fruit	0.0	0.0	0.0	0.0	0.0	-0.7	0.0	-0.7
Almonds	0.3	0.0	0.0	2.2	0.0	0.0	0.0	2.5
Citrus	0.0	0.0	0.0	0.0	0.2	0.3	0.0	0.5
Other Fruit & Nuts	2.8	0.0	0.0	8.3	1.4	1.2	0.0	13.7
Vegetables	0.5	-0.3	0.0	-2.0	0.3	-0.2	-0.2	-1.8
Rice	1.7	11.9	0.2	3.0	4.7	11.9	-2.7	30.7
Other Cereals	19.1	30.0	2.6	32.2	12.5	51.8	6.4	154.6
Other crops nec	-3.7	-4.2	-0.7	-6.9	-2.3	-4.8	-0.8	-23.4
Pastures	-4.2	7.4	0.0	-3.0	4.8	-5.7	-8.4	-9.2
Dairy Plant	-3.2	0.2	2.5	1.6	1.6	2.2	-0.3	4.5
Total	25.8	45.3	4.6	36.0	23.9	60.4	-6.0	190.0

Source BTRE estimate based on ABS Agricultural Census 2001.

TABLE 4. 8 CHANGES IN CAPITAL STOCK IN IRRIGATED AGRICULTURE BY CROP TYPE—VICTORIAN CENTRAL MURRAY 1997 TO 2001 ($M)

LGA	*Gannawarra*	*Swan Hill*	*Loddon*	*Shepparton*	*Campaspe*	*Victorian Central Murray*
Wine Grapes	3.3	28.1	-0.9	7.7	3.5	41.7
Table Grapes	0.0	-4.0	0.0	-0.1	0.0	-4.1
Dried Fruit	0.0	-2.9	0.0	0.0	0.0	-2.9
Almonds	0.0	0.3	0.2	0.0	0.0	0.5
Citrus	-0.9	-0.3	0.0	-0.2	0.9	-0.5
Other Fruit & Nuts	-0.7	16.4	4.5	44.5	5.5	70.2
Vegetables	0.5	0.4	0.3	0.9	2.4	4.5
Rice	1.0	-0.2	0.2	0.0	0.3	1.2
Other Cereals	5.8	0.0	9.7	2.5	5.1	23.1
Other crops nec	0.2	1.2	-0.8	-0.3	-0.4	-0.1
Pastures	21.3	-0.4	-3.0	25.4	28.6	71.9
Dairy Plant	-10.5	-2.6	-5.1	-1.8	-19.2	-39.1
Total	19.9	36.1	5.0	78.6	26.7	166.4

Source BTRE estimate based on ABS Agricultural Census 2001.

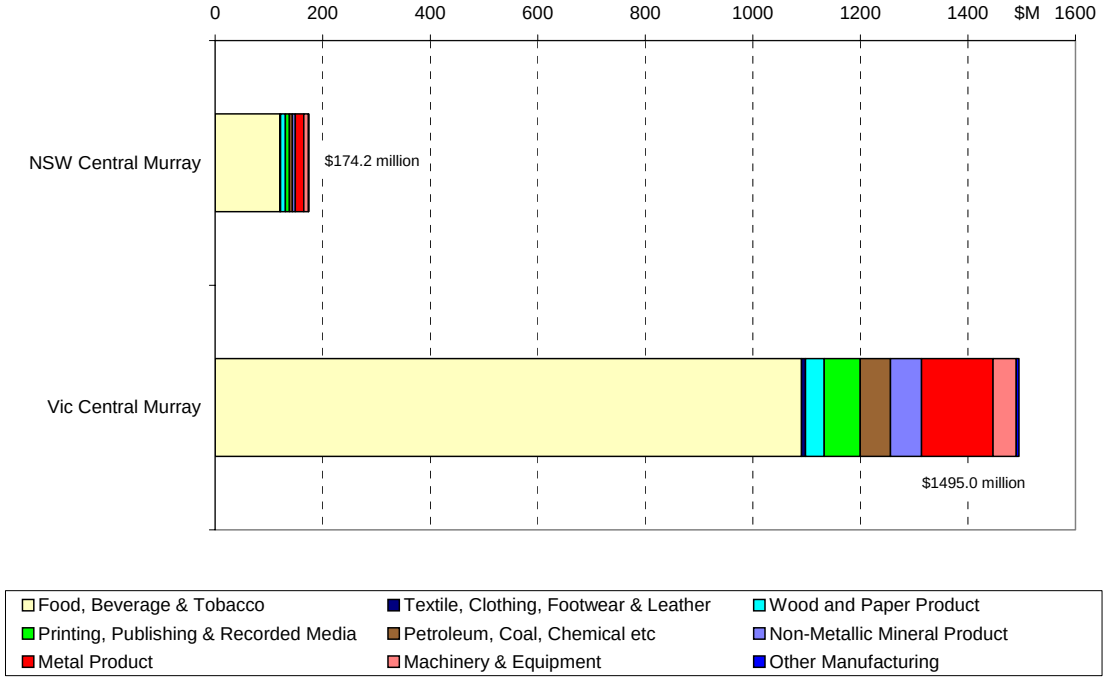
The overall conclusion to be drawn from the preceding discussion of patterns in irrigated agriculture is that while using only a little more irrigated hectares, the value of Victoria's irrigated agriculture is far larger than NSW and the existing on-farm capital stock is also far larger—this is indicative of investment being concentrated on the Victorian side.

Manufacturing

Estimates of capital stock in manufacturing industries have been obtained using the method described in Chapter 1 and Appendix I. Figures 4.28, 4.29 and 4.30 illustrate capital stock estimates for manufacturing in 2000–01 by state and by LGA. Key points include:

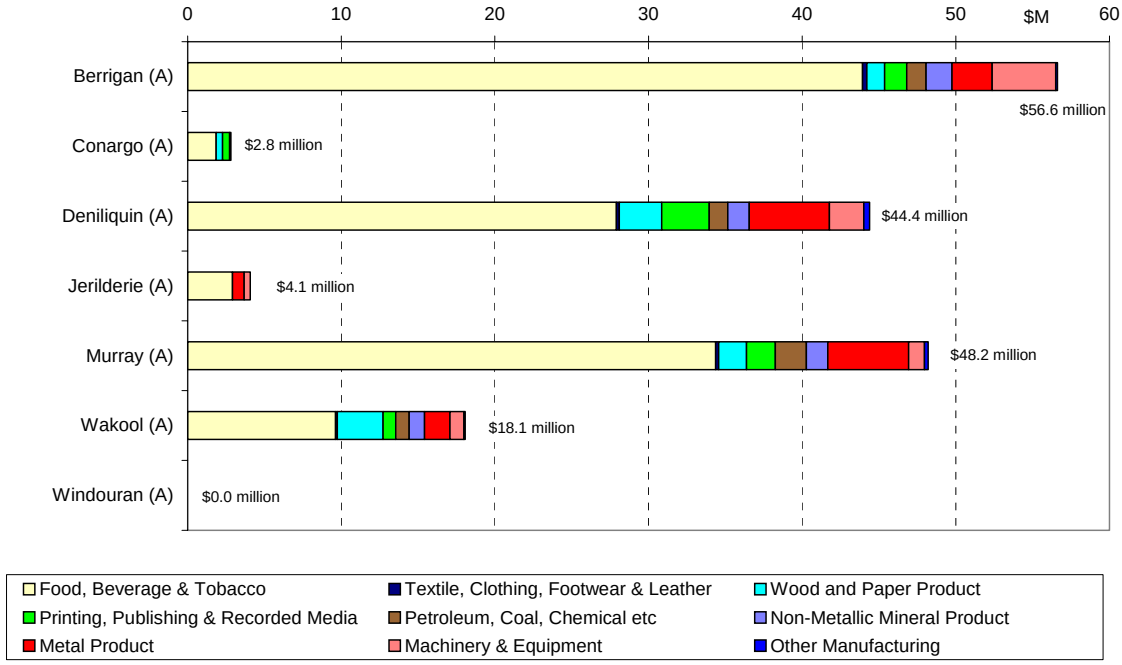
- consistent with the evidence presented so far, manufacturing capital stock in the Victorian Central Murray far exceeds NSW (approximately $1500 million in Victoria and less than $200 million in NSW);
- food processing (which builds on the irrigated agricultural base) is dominant in both regions;
- in NSW, the Berrigan, Murray and Deniliquin LGAs have the highest value of manufacturing capital stock; and
- Shepparton and Campaspe dominate capital stock in Victorian manufacturing.

FIGURE 4. 28 CAPITAL STOCK IN MANUFACTURING—CENTRAL MURRAY 2000–01



Source BTRE estimates based on ABS estimates of Non-current Assets in Manufacturing subdivisions 1996-97 & 2000-01, industry employment data from the ABS 1996 & 2001 Censuses of Population and Housing.

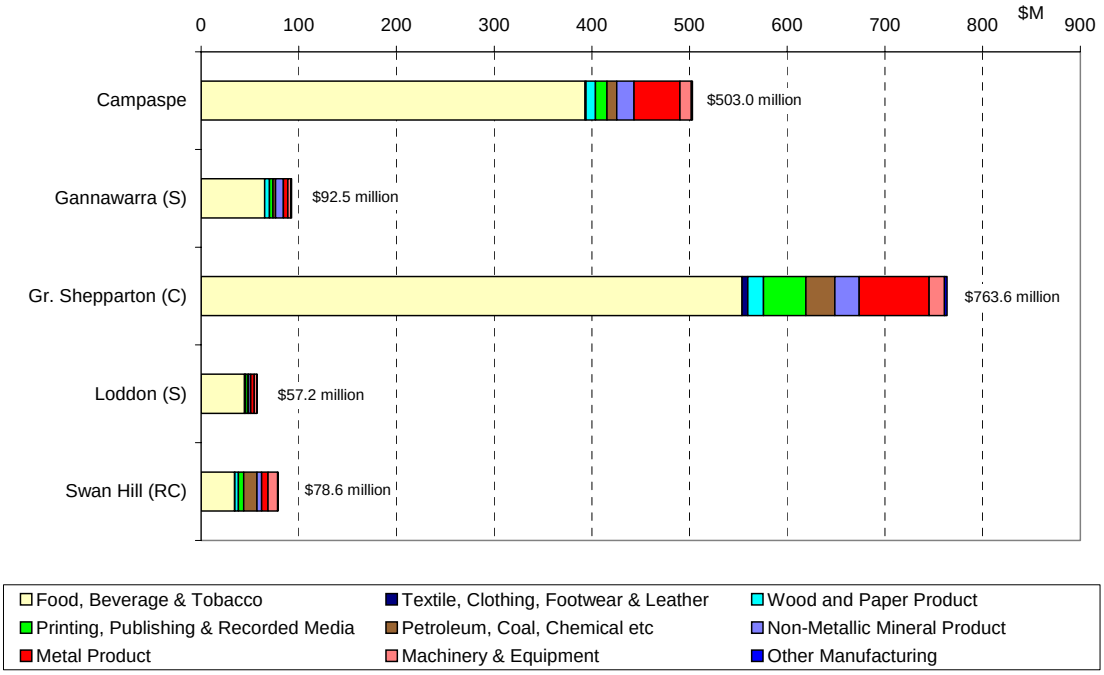
FIGURE 4. 29 CAPITAL STOCK IN MANUFACTURING—NSW CENTRAL MURRAY 2000–01



Note For confidentiality reasons any category with less than 3 people employed receives a value of either 0 or 3. As a result, a zero on these graphs does not necessarily mean an industry is not represented in a region.

Source BTRE estimates based on ABS estimates of Non-current Assets in Manufacturing subdivisions 1996-97 & 2000-01, industry employment data from the ABS 1996 & 2001 Censuses of Population and Housing.

FIGURE 4. 30 CAPITAL STOCK IN MANUFACTURING—VICTORIAN CENTRAL MURRAY 2000–01



Source BTRE estimates based on ABS estimates of Non-current Assets in Manufacturing subdivisions 1996-97 & 2000-01, industry employment data from the ABS 1996 & 2001 Censuses of Population and Housing.

Tables 4.9 and 4.10 provide an indication of trends or changes in capital stock in manufacturing from 1996–97 to 2000–01. In NSW, capital stock in manufacturing has grown over the period (by around $56 million), mainly driven by increases in the food and beverage category in the Berrigan and Murray SLAs. Based on these estimates Jerilderie and Windouran have declined in manufacturing capital stock, however, the declines are small and not significant given the limitations of the data. In Victoria, capital stock in manufacturing has grown dramatically over the period (by around $650 million), mainly driven by huge increases in the food and beverage category in the Shepparton and Campaspe LGAs. According to these estimates, all the Victorian Central Murray shires enjoyed growth in manufacturing capital stock over the period.

TABLE 4. 9 CHANGES IN CAPITAL STOCK IN MANUFACTURING—NSW CENTRAL MURRAY 1996–97 TO 2000–01 ($M)

	Berrigan	*Conargo*	*Deniliquin*	*Jerilderie*	*Murray*	*Wakool*	*Windouran*	*NSW Central Murray*
Food, Beverage & Tobacco	18.2	0.4	0.1	0.3	15.4	7.5	-0.5	41.2
Textile, Clothing, Footwear & Leather	0.1	0.0	0.2	0.0	0.2	0.1	-0.1	0.5
Wood and Paper Product	0.0	0.4	-1.7	-0.4	-1.1	2.1	0.0	-0.7
Printing, Publishing & Recorded Media	0.5	0.0	1.2	-0.5	-0.6	0.1	0.0	0.7
Petroleum, Coal, Chemical etc	1.3	0.0	0.7	0.0	1.5	0.0	0.0	3.4
Non-Metallic Mineral Product	0.0	0.0	1.4	0.0	1.4	0.2	0.0	3.0
Metal Product	0.8	0.0	2.4	0.8	1.0	0.8	0.0	5.8
Machinery & Equipment	1.5	0.0	0.5	-0.6	0.1	0.4	0.0	1.7
Other Manufacturing	0.0	0.0	0.1	-0.1	0.0	0.1	0.0	0.2
Total Manufacturing	22.2	0.8	4.8	-0.6	18.0	11.2	-0.6	55.9

Source BTRE estimates based on ABS estimates of Non-current Assets in Manufacturing subdivisions 1996-97 & 2000-01, industry employment data from the ABS 1996 & 2001 Censuses of Population and Housing.

TABLE 4. 10 CHANGES IN CAPITAL STOCK IN MANUFACTURING—VICTORIAN CENTRAL MURRAY 1996–97 TO 2000–01 ($M)

	Campaspe	*Gannawarra*	*Gr. Shepparton*	*Loddon*	*Swan Hill*	*Vic Central Murray*
Food, Beverage & Tobacco	188.4	19.1	301.1	16.3	13.7	538.7
Textile, Clothing, Footwear & Leather	-1.0	0.0	0.4	-0.1	0.1	-0.6
Wood and Paper Product	2.5	1.1	2.9	0.3	2.3	9.0
Printing, Publishing & Recorded Media	1.8	-0.8	8.2	0.9	-0.1	10.0
Petroleum, Coal, Chemical etc	8.3	1.5	2.0	-1.0	9.4	20.2
Non-Metallic Mineral Product	5.8	5.9	8.4	1.0	2.0	23.1
Metal Product	5.0	1.6	23.7	0.8	-0.8	30.3
Machinery & Equipment	3.9	1.0	8.7	1.6	3.6	18.8
Other Manufacturing	0.1	0.3	-0.1	0.0	0.2	0.5
Total Manufacturing	214.8	29.6	355.3	19.8	30.5	649.9

Source BTRE estimates based on ABS estimates of Non-current Assets in Manufacturing subdivisions 1996-97 & 2000-01, industry employment data from the ABS 1996 & 2001 Censuses of Population and Housing.

Other off-farm industries

There are many other off-farm industries which play a significant role in the Central Murray region (although these often rely on the region's agricultural and manufacturing base). The importance of the retail trade, accommodation, cafes and restaurants, education and other service sectors was illustrated in Figure 4.11. Information on these sectors is limited to the employment data described earlier. The value of the investment associated with these services and institutions was not available. Instead a brief qualitative description follows.

Tourism

Tourism cuts across many of these categories and is a significant contributor to the Central Murray economy. Most tourism activity stems from the Murray River and associated agriculture and irrigation. The parklands and reserves adjacent to the river are popular holiday destinations for Melburnians. Recreational activities include river cruising, houseboats, swimming, fishing etc. Echuca's proximity to Melbourne makes it an attractive destination. Tourist attractions include the Historic Port of Echuca and the famous paddle steamers.

The Echuca-Moama Tourism organisation plays an active role in promoting the region.

The food manufacturing sector has provided a tourism boost with factory sales outlets and factory tours increasing in popularity. SPC, Ardmona and Campbell's Soups all offer direct sales outlets with day bus tours from Melbourne.

Eco-tourism is said to be increasing in the region with environmental and recreational attractions such as the Barmah Forest and Wetlands. The forest is the world's largest River Red Gum forest and is situated on the Murray River with the world heritage listed wetlands. Redgum products and crafts (such as furniture) are also popular attractions and industries for the region (for example, Koondrook in the Gannawarra Shire).

Services and supporting institutions

The region has a number of towns that act as service centres. Shepparton is a fairly big regional centre with medical facilities, banks, retail outlets and other services. Further north, Echuca, Swan Hill and Deniliquin also contain a variety of services that serve surrounding communities.

Educational facilities, particularly for tertiary education, were raised as a shortfall in many of the field trip interviews. Facilities currently in the region include the:

- University of Melbourne Dookie College Campus, (Institute of Land and Food Resources) just east of Shepparton;
- Latrobe University Shepparton Campus;
- Victoria University of Technology at Echuca;
- Rural Medicine Program at the Shepparton Campus of Goulburn Valley Health;
- TAFE campuses in Swan Hill, Kerang, Echuca, Deniliquin and Finley.

Other supporting institutions include Rice Research Australia Pty Ltd near Jerilderie—a cooperative research institute involving SunRice which plays a key role in rice production research. The National Inland Saline Aquaculture Research Centre (NSW Fisheries) in Wakool is also being established. The Victorian Department of Natural Resources and Environment (DNRE) has a significant presence in the region including:

- the Institute of Sustainable Irrigated Agriculture at Tatura—a research establishment with 200 scientists and support staff;
- the Kyabram Dairy Centre—dairy research and extension programmes;
- DNRE Cobram—supports research for the horticulture, cropping and dairy industries.

FACTORS IMPACTING ON INVESTMENT

The source of investment in the Central Murray is a mix of both existing local enterprises and larger corporate organisations coming into the area. In the agriculture sector it is predominantly existing farmers expanding by, for example, buying more land or water, investing in more efficient water use (through lasering, automatic irrigation, recycling water) or diversifying out of grain into horticulture. Corporate interest in horticulture tends to be focused on the Sunraysia and Riverland areas. In the manufacturing sector, there is a strong corporate presence in food manufacturing on the Victorian side, as well as long established local and family businesses which have expanded to become similar in size and operation to the larger corporate companies. There is also a mix of both opening new greenfield sites and reinventing current irrigation sites. Most of the greenfields investors are looking for sites with direct river access for irrigation pumping.

Given these different sources of investment, it is reasonable to expect that there may be some differences in the factors driving investment decisions. This section explores the multitude of complex and interrelated factors that underlie decisions to invest. The primary source of information was interviews with various investors in the Central Murray region. Given the primacy of agriculture as the economic base of the region many of the factors relate to this sector.

During these interviews, it was made clear that water issues (including reliability and security of tenure) were the primary factor behind historical investment patterns and the major factor currently inhibiting investment in the region. History and government policies, local loyalties (community and culture) and infrastructure were also critical to explaining the investment pattern. These factors will now be examined in more detail along with a number of others.

Water (reliability and tenure)

Investment across the region has and continues to be most affected by uncertainties surrounding water reliability and tenure. This uncertainty stems from two main sources: the potential for reductions in the total water available for irrigation (as a result of the drought, the Cap, etc) and ambiguity over the specification of tenure of entitlements in the context of increased demands on governments to provide water for environmental purposes.

Other physical factors mentioned as affecting the overall availability of water and therefore contributing to uncertainty over future investment were the capacity of the Eildon Dam (on the Goulburn River) and more general concerns regarding climate change. The Eildon Dam is in need of repairs and cannot be filled above 65 per cent capacity. This is expected to be a significant pressure on

water supply and hence reliability in the Goulburn system over the next few years.

Related to the supply issue is the actual legal tenure of the water entitlements. As outlined in Chapter 2 this differs between NSW and Victoria. It was clear during the fieldwork that different types of investment were associated with the perceived overall water security (reliability and tenure) arrangements. The high value permanent plantings (such as dairy and horticulture) have been attracted to the Victorian system, which is generally perceived as being superior on both counts. Whereas the more annual, opportunistic croppers (such as rice and cereals) have been attracted to the less reliable but greater volumes offered by the NSW General Security water. As a result, most of the irrigators interviewed appeared to favour whichever system they had become attuned to in developing their business.

Consistent with anecdotal evidence, Victorians overall believed their system was supreme on both counts and the key to why investment was attracted to the Victorian side of the river. We note here that there are differences of view regarding the reality of the relative quality of the tenure in each state with some observers suggesting that Victorian tenure may, in fact, be less secure in law than NSW. However, these and other observers also concluded that the political reality was that the use of Ministerial discretion to reduce entitlements was much less likely in Victoria.

Surprisingly, very few NSW irrigators would choose to adopt the Victorian approach if given the opportunity. NSW irrigators were generally not willing to sacrifice the larger volumes of water they currently receive. In addition to this, very few of those interviewed expressed an interest in converting from NSW General Security to High Security water. The costs associated with this were perceived to be prohibitive and the benefits for investment were also uncertain. Many were fearful that given recent government interventions and the continuing uncertainty due to the Living Murray and NSW Water Sharing Plans, High Security entitlement converted at a substantial cost could still be subject to reductions. Instead, many suggested that the flexibility offered by the carryover provisions, and the capacity of General Security water to attract supplementary (ie. off-allocation) water gave irrigators greater benefits and similar reliability. There are only a few irrigators in the region with NSW High Security water, but there seemed to be some consensus that, especially in times of drought, NSW High Security water was the most reliable source. NSW High Security water is regarded as more secure even than Victorian water because it has priority and is so rare in the NSW system.

Naturally at present, the drought was foremost in people's minds and is preventing many from fulfilling investment plans. However, uncertainty about water supply was much more related to the water reform process of the last 10 years and the influence of the environmental movement. In this context,

irrigators are uncertain of the likely political response to this pressure. Watson (2003) notes the change in political fortunes and the potential for mistakes as a powerful but unsophisticated environmental lobby has usurped the influence of an unsophisticated pro-irrigation lobby.

There is a general feeling of 'change fatigue' among irrigators with the Murray-Darling Basin Agreement, 'the Cap', water trading, Land and Water Management Plans, salinity plans, Living Murray Initiative consultations, MIL privatisation, water sharing plans etc all affecting the business environment for irrigators. This attitude is much more evident on the NSW side of the border, as would be expected given the effective cuts to entitlements made by the application of 'the Cap', the extremely low allocation in 2002–03 and poor outlook for 2003–04 as a result of the drought (discussed in Chapter 2). The reality of cuts already made has reduced faith that the system will supply their nominal entitlement. The situation in Victoria is less pessimistic as for most, 'the system' has largely delivered (see Figure 2.7 and the reliability charts in Chapter 2). In NSW, disillusionment is more entrenched, and hangs heavy over investment plans, particularly of smaller farmers growing rice, cereals and pasture who are pessimistic about their future in the industry.

It should be noted that many of these same irrigators (especially in NSW) pride themselves as opportunity croppers and their ability to take advantage of cheap water when it is available. It is by no means certain that this group is willing to trade a reduced entitlement for more certain supply arrangements. However, it is a recurring theme that it is not so much that the changes themselves are the problem (although certainly this was sometimes said to be the case), but the uncertainty over processes and the environment of continual change. Irrigators claim that they are unable to plan investment with any degree of certainty regarding the amount of water they will receive.

While the introduction of water trading is generally seen as a significant positive influence on investment, irrigators across the region are also concerned about water being traded downstream out of their area and as a result there being less water available for irrigators in the Central Murray. They also fear a secondary effect on remaining irrigators, fewer of whom remain to meet delivery infrastructure costs. This concern was particularly strong in NSW where more annual low value crops are grown, which cannot afford to buy water at the prices that dairy and horticulture can.

Horticulturalists see the issues somewhat differently. Some horticulture crops take six or seven years after planting before an economic crop is produced. As a result, before investing in such a long-term industry, irrigators need to be reasonably confident of their water supply. Irrigators in these and other industries like dairy cannot afford to miss out on water as it may not only reduce production and cash flow needed to meet high overhead costs but may also put the investment itself at risk. It is for these reasons that high investment

horticulturalists have been attracted to the greater perceived reliability of Victorian water, or have arranged their businesses under the NSW system in ways that minimise water supply risks. This, in turn, has led to the flow-on industries associated with horticulture also locating close to suppliers in the Victorian Central Murray. The previous section described how most food processing and dairy manufacturing was located in Victoria.

It was also felt that corporate investors coming into the region would not invest in the absence of reliable water supplies. As a result, many corporates go to Victoria or as a second best alternative pump directly out of the river in NSW (for example, Montagues). River pumpers are believed to have greater control over the timing of their water entitlement. In contrast, existing irrigators in NSW, most of whom have annual cash crop enterprises, tend to be more willing to rely on temporary transfers and other less reliable water sources.

A particular source of uncertainty in recent years in NSW has been the water sharing plans. The water tenure provided by these plans is 10 years. There is a unanimous view among irrigators we spoke to that this time period was far too short for investors in longer-term, high investment industries, particularly given the delay or lag between the change and when businesses react. This is despite the view of the NSW Government that the plans actually give more legal security of tenure than either the existing NSW system or that of other states. However, irrigators are adamant that they need more certainty than this to invest in new irrigation ventures and see the 10-year plans as an indication that the Government is willing to reduce water entitlements for purposes other than to deal with natural shortfalls. Given the long-term nature of the horticulture and dairy industries it is difficult to foresee any positive change in current investment patterns if NSW implements the 10-year plans. As one interviewee remarked, horticulture works on a 20-year investment timeframe, making the proposed water sharing plans incompatible with horticultural investment.

Overall, the historical perception of a strong perpetual water right and water supply is being eroded and this has and will continue to have a negative impact on investment. There was a strong view that water and the reliability thought to come with it was the primary reason for the successful development of the region, particularly in Victoria, and that without that water reliability, the historical investment that has taken place would not have occurred. In other words, the strength of the investment growth enjoyed in the Victorian Central Murray is also being threatened by the uncertainty inherent in the current reform process.

Government agricultural and industry policies

A range of complex historical and political influences has been instrumental in shaping the current investment pattern in the Central Murray. A few of the major influences are now discussed. Current land use patterns are a reflection of historical policy and institutional arrangements on both sides of the border.

One powerful historical policy influence was the 'no permanent planting rule' which apparently existed in this part of NSW until the mid-late 1990s. This rule effectively prevented the development of horticulture in this part of NSW and may explain why investments of this nature have concentrated in Victoria. NSW Government policy has traditionally focused on the Central Murray area as a rice-growing region. Successive NSW governments have supported the development of rice in the region since the 1930s. As a result, there is a long tradition of rice research and development and other agronomic support for rice in NSW. At the same time, NSW policy supported and encouraged the Murrumbidgee Irrigation Area (MIA) as the focus of horticulture for the state.

Similar in approach, Victorian Government policy has been supportive of the dairy industry and the development of horticulture cooperatives (particularly fruit and citrus). The prevailing view expressed during interviews on both sides of the river was that the Victorian Government was more strategic in their planning and facilitation of investment while in NSW so-called 'red tape' (land tax, planning laws etc) discouraged potential investors. Examples given to support this view included:

- The establishment of Prime Development Zones in Victoria. These are areas identified by the State Government (through surveying and other scientific research) as most likely to see new investment in high-value irrigation development. After conducting the research, the government then promotes these areas to potential investors as areas with good soil, infrastructure, low salinity risk, access to water and proximity to services and markets. This removes some of the initial costs and risks for investors.
- In partnership with the Federal Government, the Victorian Government also took part in initiatives such as Loddon Murray 2000 in the mid-1990s. These programmes involved a variety of activities including: identifying areas as ideal for certain crops/fruits; assessing land suitable for irrigation investment; business planning; redevelopment grants; training and resettlement grants. For example, under these programmes the government undertook aerial surveying in conjunction with the Murray Valley Citrus Board to identify potential new citrus areas.

The Victorian Government system (rules, guidelines, processes etc) was generally perceived to be more transparent, accessible, coordinated, easily understood and responsive for investors. This was argued to be one reason behind their success in attracting corporate investment. This was not a unanimous view however, with some people commenting that the Victorian

system had more 'hoops to jump through'. Easily accessible information (such as soil type) was said to be lacking in NSW. There was also a strong feeling of state government neglect in many of the NSW interviews. The so-called 'political wilderness' of the NSW Central Murray and being so far from the centre of decision-making in Sydney were often raised as inhibiting investment. Mention was also made of a 'premier state' mentality in NSW, which arguably meant that it was not as aggressive in terms of attempting to attract investment. However, the NSW Government Regional Business Development Scheme in cooperation with the Murray Shire, recently played a significant role in attracting Victorian manufacturer, Byford Equipment, to Moama (NSW Department of State and Regional Development 2003, p. 3).

As a result of these historical and institutional influences, it is reasonable to see how agglomeration effects on both sides can take hold to reinforce the existing pattern of rice and annual crops in NSW and horticulture, dairy and manufacturing in Victoria. The power of history and perception and policies of governments have played a critical role in determining investment patterns in the Central Murray.

Community and culture

During the fieldwork interviews a consistent, though intuitively obvious, theme emerged which usually underpinned local investment expansion. It can be summed up in the answer to the question of 'Why do you invest in this region?' with one simple sentence 'because we live here'. The importance of local and state loyalties and community, family and cultural ties in influencing investment decisions cannot be underestimated. Combined with the tendency to be risk averse, by for example sticking with what you know, this often meant that local investors were not really looking to invest outside their local area. While it was not often made this explicit in answers to interview questions it became apparent that these factors were also having a significant impact on investment. Family farms, even large family corporate-sized enterprises, tend to reinvest in their own locality. Other cultural factors, such as the greater ethnic diversity in the Victorian part, were also mentioned (for example, the Italian influence in the growth of horticulture such as fruit and olives).

Infrastructure and location

Infrastructure (electricity, transport, telecommunications and natural gas) has also played a significant role in influencing investment patterns in the region. Areas lacking in infrastructure are obviously at a disadvantage when it comes to attracting investors. There are some differences in infrastructure that favour Victoria. However, more important is the fact that the shorter distance to Melbourne means that the transport infrastructure of the region is focused toward Melbourne, including the NSW infrastructure.

In general, NSW Central Murray is well connected to greater Victoria with road and rail. Both sides of the river were thought to have reasonable transport infrastructure (major interstate highways and a network of arterial roads, standard gauge rail to Sydney, Melbourne and Geelong, broad gauge rail links to other regional Victorian centres). The planned upgrade of the Goulburn Valley Highway including the Shepparton bypass will significantly reduce travel times to Melbourne. This was seen as a big plus for the region.

Three main factors were identified as advantaging areas of Victoria:

- The Central Murray region is considerably closer to Melbourne than Sydney. This proximity to Melbourne was considered to be a major advantage.
- Access to natural gas (cheap efficient energy) in Shepparton attracts downstream processing to that area. This was said to be a significant impediment for other areas in being able to attract manufacturing. The natural gas pipeline only extends as far as Shepparton and Echuca. Gas pipelines are a cheaper source of natural gas than industrial sized gas cylinders that can be used by manufacturers unable to access pipelines. Growers locate close to the processors in order to reduce transport costs. As a result, NSW growers can be disadvantaged by higher transport costs when getting their product to processors and markets.
- Bridges over the river have and continue to be a problem for both sides. However, this affects NSW to a greater degree because infrastructure and markets are all Melbourne focused. The bridges over the river at Swan Hill and Echuca were particularly mentioned as being old, narrow and in need of replacement, although we understand that the bridges at Koondrook, Cobram and Robinvale are in similar or worse condition. They are often partially closed and some machinery needs to be disassembled to get over. This acts as an incentive to locate on the Victorian side to avoid these problems.

There were also a number of infrastructure issues affecting the whole region: lack of access to 3-phase power; poor capacity of electricity networks; lack of a power link across river due to separate NSW and Victoria networks; no airport in the region; and B-Double trucks unable to access local roads.

Other factors

A number of other related factors were also raised as influencing investment decisions. These are listed briefly below. Some affect both sides of the border equally, others attract or discourage investment in either state.

- Investment by governments and water authorities in water delivery infrastructure (for example, the piped pumped systems around Swan Hill in Victoria) were seen to encourage on-farm investment in higher value crops such as horticulture and in more water efficient technology.

- Lower land prices and larger lot sizes were raised as one of the key factors in NSW's favour. This has been the major reason behind some recent investment decisions to locate north of the river (eg. Montague's, Byford's). It was also said that the NSW dairy industry took off when land for expansion in Victoria became scarce. The shortage of irrigated land for further expansion in Victoria also provides demand for NSW produce (eg. milk) from processors in Victoria. In other words, in some sectors NSW is becoming increasingly important to Victorian industry.
- Access to finance is obviously an important determinant of investment but there did not appear to be any substantial difference between the two states. Most potential investors access capital from traditional banks and those with adequate equity and capacity to repay loans did not appear to have any major difficulty obtaining finance for investment. However, there were a few farming enterprises, particularly in NSW, that felt access to finance was a problem.
- Physical factors such as soil type, climate and location naturally drive investment decisions at the local level but in general, there was not perceived to be a major difference in these factors either side of the border. Soil type in particular was seen as a major influence on investment and climatic factors are also important (eg. almonds need to be grown to the north in Victoria because of the risk of frost damage).
- The demands of export markets and large cooperatives are important in driving the timing and nature of investment decisions in horticulture and viticulture. For example, the demand for higher quality fruit provided an impetus for some farms to invest in water efficient technology such as drip systems, which give greater control over irrigation and improve fruit quality.
- Labour shortages were common throughout the region, particularly during harvest seasons. Skill shortages across most agriculture and trade sectors were raised as an issue, but not a major influence on investment.

SUMMARY

Together, the industry employment data, agricultural census data, capital stock estimates and qualitative evidence from fieldtrip interviews all point toward an investment picture that is dominated by the Victorian side of the Central Murray. The Victorian Central Murray has a larger population, strong population growth, and using only a few more irrigated hectares, the value of Victoria's irrigated agriculture is far larger than NSW. The existing on-farm capital stock is also far larger—this is indicative of investment being concentrated on the Victorian side. Manufacturing activity, which is predominantly food processing, is shown to be even more concentrated in Victoria. Other activities such as tourism, education and other services are also concentrated in Victoria.

The primary factors driving this observed investment pattern are water reliability and perceived security of tenure, government agricultural and industry policy, local loyalties (community and culture) and infrastructure and location. During the interviews, it was made clear that uncertainty over water (including reliability, overall supply and tenure) was the primary factor behind historical investment patterns and the major factor currently inhibiting investment in the region. The high value permanent plantings (such as dairy and horticulture) have been attracted to the reliability and security of tenure that the Victorian system is perceived to offer and the downstream industries have followed.

For NSW, a number of factors have contributed to some recent success in attracting investment. These include the ability to manage water reliability by using water allocation carryover provisions, the larger lot sizes and cheaper land prices in NSW. These factors are reflected in the fact that since 1997 the increase in capital stock associated with irrigated agriculture in NSW has been similar in size to that of Victoria.

CHAPTER 5 COMPARATIVE REGIONAL PERFORMANCE

This chapter provides regional comparisons of performance and investment patterns across the Sunraysia, Riverland and Central Murray regions.

POPULATION AND INCOME

With regard to the five regions in this study (Victorian Sunraysia, NSW Sunraysia, Victorian Central Murray, NSW Central Murray and the Riverland) Table 5.1 shows the populations, rates of growth and the estimated irrigation water use per head of population. Whilst the actual areas covered are similar for each region, the population varies considerably being notably higher in the Victorian Central Murray and very much lower in NSW Sunraysia. Growth of population also varies considerably with the Victorian regions having the most significant real and percentage gains. Only NSW Sunraysia has recorded a fall in population and, as discussed in Chapter 3, this is probably due to the 'sponge city' effect of Mildura.

Irrigation water use per head of population provides some insight into each region's ability to use water to support industry and employment. Whilst not all population in these regions is directly dependent on irrigated water, in Chapters 3 and 4 we deduced strong links between the manufacturing industry and irrigated agriculture in all regions. These two sectors comprise almost all the core (non-service) industry base for all regions. Consequently, irrigation water used per head is a relevant parameter for comparing these regions: albeit one to be used with care.

The key points from the parameter are the very high usage in the NSW Central Murray and the very low use in Victorian Sunraysia. Whilst both probably reflect some Victorian-based manufacturing using input from NSW agriculture, the size of the difference in the case of NSW Central Murray suggests that other factors are also important—particularly the occurrence of high water use and low labour input agriculture.

TABLE 5. 1 POPULATION STATISTICS BY REGION

Region	*Population 2001*	*Pop Growth 1991–2001 (number)*	*Pop growth 1991–2001 (rate)*	*Irrigation Water Use 2001 (ML/Head of Population)**	*Area km²*
NSW Central Murray	31 220	500	1.6%	78.7	26 187
Vic Central Murray	132 591	6232	4.7%	16.7	22 653
NSW Sunraysia	7 078	-184	-2.6%	10.0	26 273
Vic Sunraysia	49 283	5175	10.5%	3.7	22 082
Riverland	33 546	436	1.3%	8.2	20 952

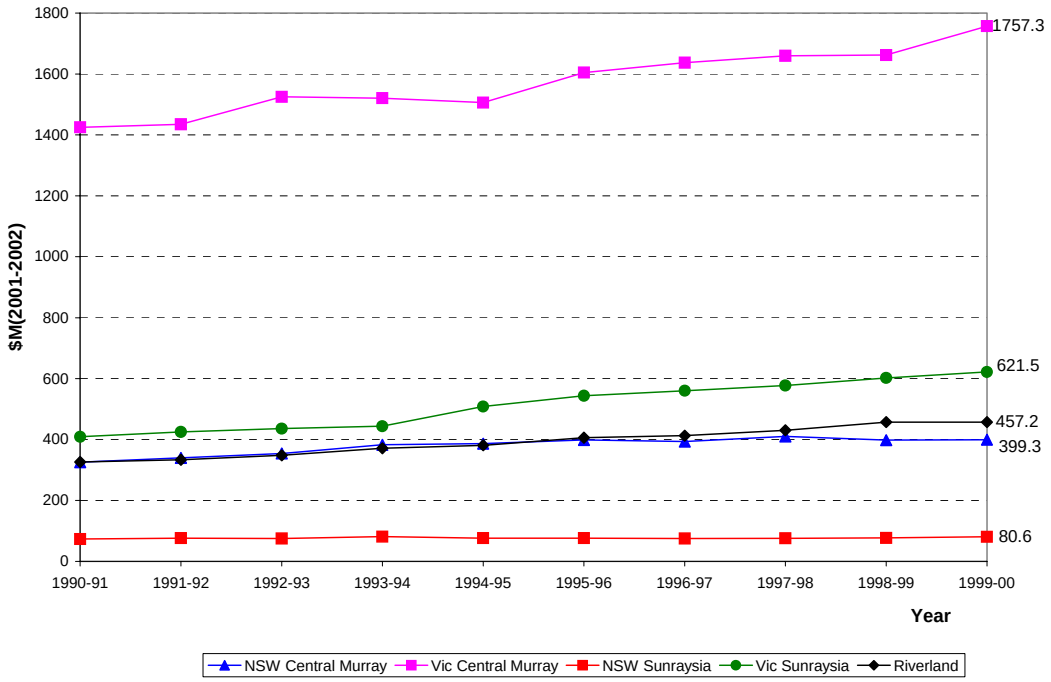
Source Based on ABS 2001 *Regional Population Growth*, Australia and New Zealand, 1991 to 2001 (Cat. 3218.0) Estimated Resident Population data. * BTRE estimate based on NLWRA 2001a and Agricultural Census 1997 and 2001.

Gross real taxable income (Figure 5.1) reinforces the relative sizes of the economies of the regions suggested by the population figures. However, Table 5.2 suggests that the economic growth patterns (as shown by real taxable income) and the population growth figures (Table 5.1) are very different. For example, the rate of growth of real taxable income in the Riverland (3.8 per cent) and combined Sunraysia (4.3 per cent) are similar even though population growth in the Riverland is very much lower. NSW Sunraysia has positive growth in real taxable income despite a falling population and the NSW and Victorian Central Murray have similar rates of economic growth despite their very different rates of population growth.

These trends are reflected in Figure 5.2 which shows a quite dramatic relative increase in the taxable income of individuals in the Riverland and a continuing trend of higher individual incomes of the (particularly NSW) Central Murray. Whilst these relative trends between the regions are important, it should be kept in mind that the differences in individual incomes between the regions are only about $2000—and all remain $8000 to $10 000 below the national average—that is 80 per cent or less.

Overall, the population and income data for the regions shows very high growth in the economies of the Riverland and Sunraysia, despite the lagging of NSW Sunraysia. Only in Victorian Sunraysia is this accompanied by a large increase in population. The Central Murray economies have grown less quickly and again only in Victoria has it been accompanied by a significant increase in population.

FIGURE 5. 1 GROSS REAL TAXABLE INCOME BY REGION—1990–91 TO 1999–00



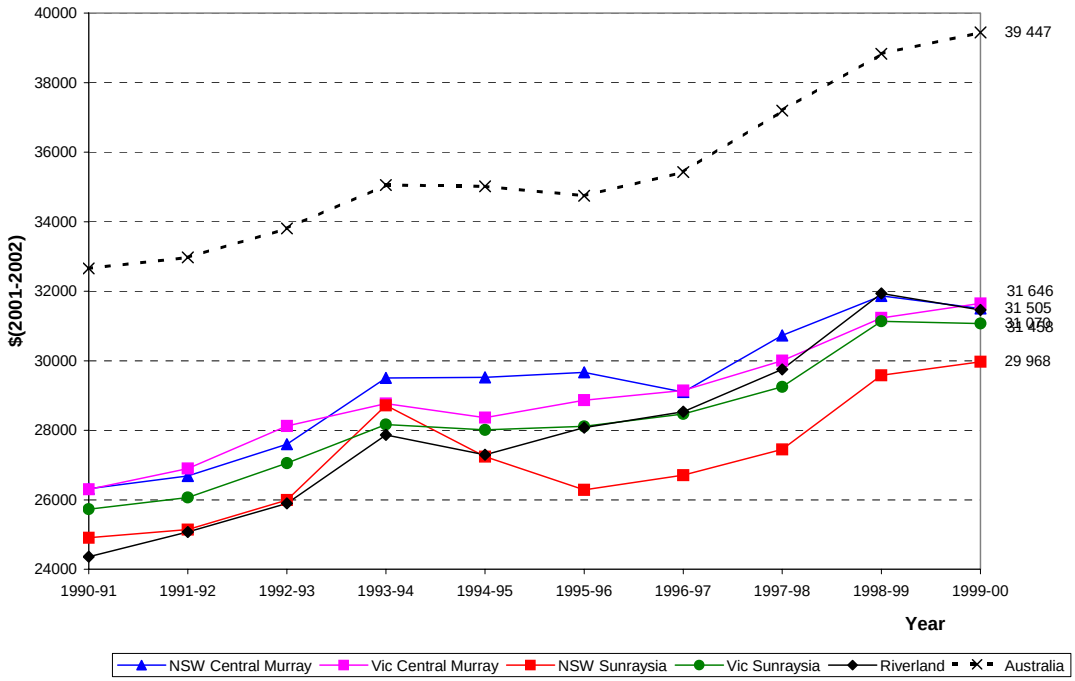
Source BTRE July 2003 estimates, based on Australian Taxation Office data.

TABLE 5. 2 ANNUAL RATE OF GROWTH OF GROSS REAL TAXABLE INCOME BY REGION—1990–91 TO 1999–00

Region	*Annualised Growth Rate 1990–91 to 1999–00*
NSW Central Murray	2.3%
Vic Central Murray	2.4%
NSW Sunraysia	1.1%
Vic Sunraysia	4.8%
Riverland	3.8%

Source BTRE estimates based on Australian Taxation Office data.

FIGURE 5. 2 MEAN REAL TAXABLE INCOME BY REGION—1990–91 TO 1999–00



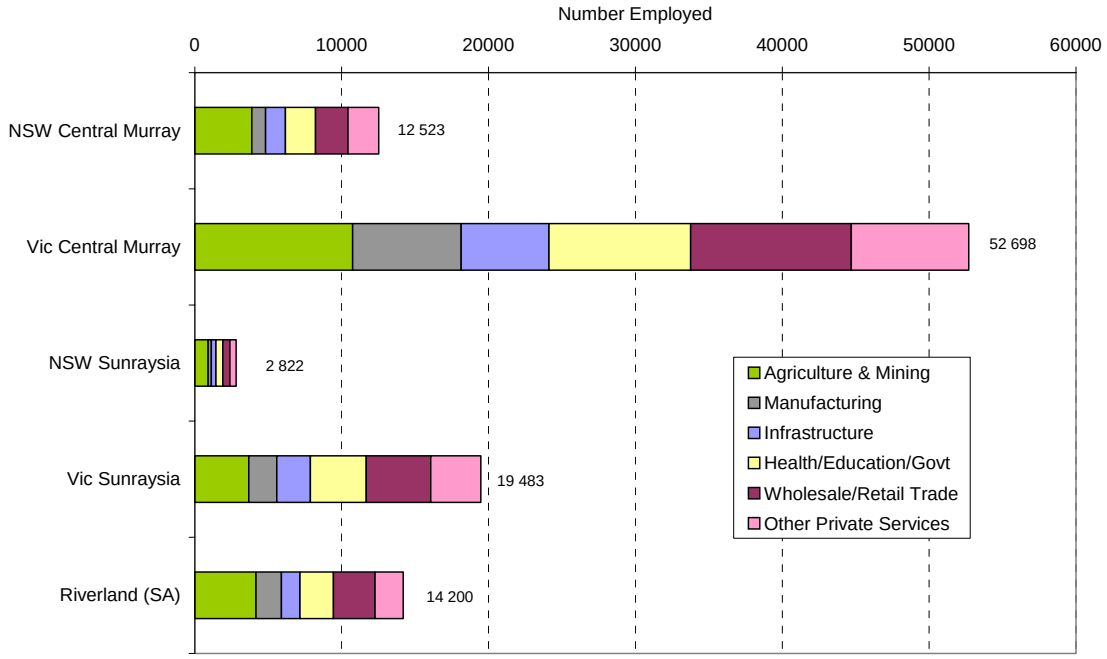
Source BTRE July 2003 estimates, based on Australian Taxation Office data.

EMPLOYMENT

Figure 5.3 provides a picture of the major sources of employment by industry for each region. All five regions contain a reasonably similar mix with agriculture forming the economic base with some manufacturing and services. The Victorian Central Murray dominates the image, illustrating its role as a major centre for manufacturing and services. In both Sunraysia and Central Murray, the Victorian side of the river has substantially more people employed.

Previous chapters have described the central role of agriculture in the regions under investigation. Figure 5.4 provides an insight into the different types of agriculture that regions have focused on. There is a clear distinction between the Central Murray which contains more broadacre agriculture (eg. dairy and grains, sheep, beef and cattle comprise around 80–90 per cent of agricultural employment) compared to the horticulture focus in Sunraysia and Riverland (where horticulture represents close to 80 per cent of agricultural employment in Sunraysia and 90 per cent in Riverland). This significance of horticulture in the west is reinforced by Figure 5.5, which provides a more detailed breakdown of horticultural employment across the regions. Interestingly, given the location of most food manufacturing (Figure 5.6), horticulture employment in Victorian Central Murray is less than Sunraysia and Riverland. Note also the significance of grape growing as an employer in all regions, but particularly Sunraysia and Riverland and the different mix of horticultural enterprises in Victorian Central Murray with pome (apple and pear) and stone fruit being important employers.

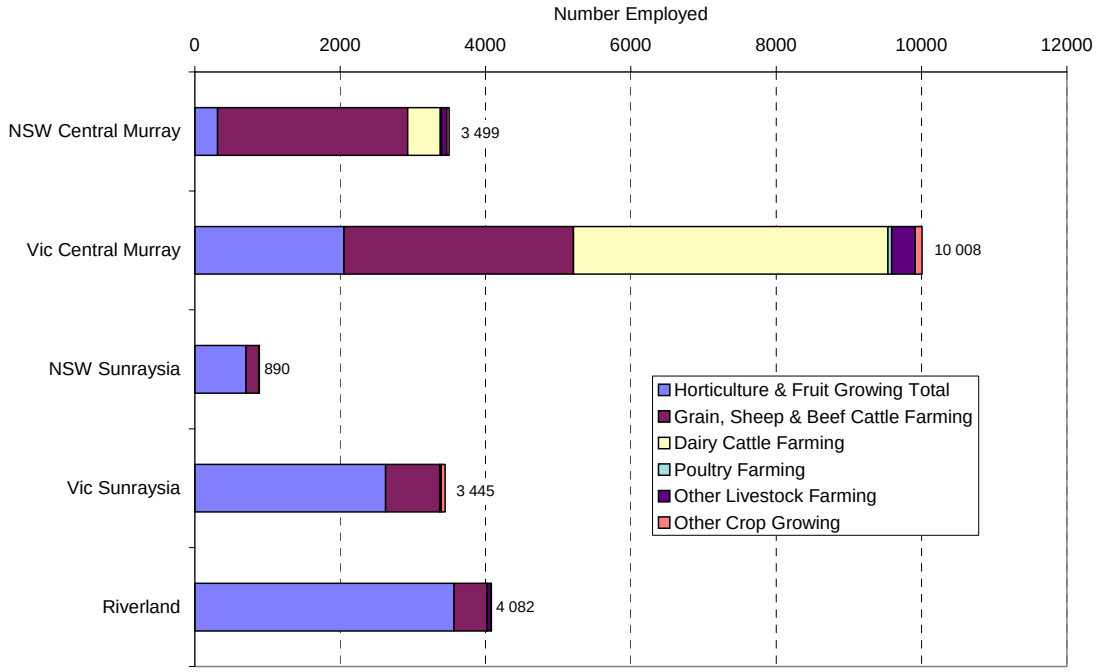
FIGURE 5. 3 EMPLOYMENT BY INDUSTRY SECTOR—BY REGION 2001



Note Infrastructure sector includes Construction, Communication, Transport, Electricity, Gas & Water. Other Private Services includes Accommodation, Cafes and Restaurants, Property and Business Services, Finance and Insurance, Cultural and Recreational Services and Personal and Other Services.

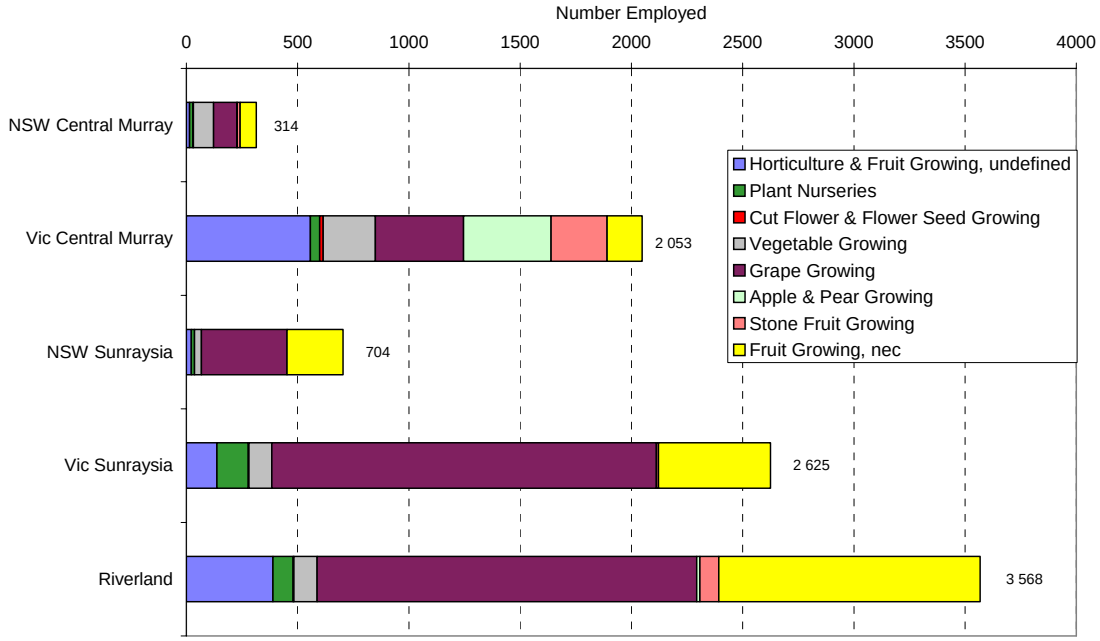
Source BTRE estimates based on ABS 2001 Census of Population and Housing (place of enumeration data, persons enumerated at home).

FIGURE 5. 4 AGRICULTURAL EMPLOYMENT—BY REGION 2001



Source ABS 2001 Census of Population and Housing (place of enumeration data).

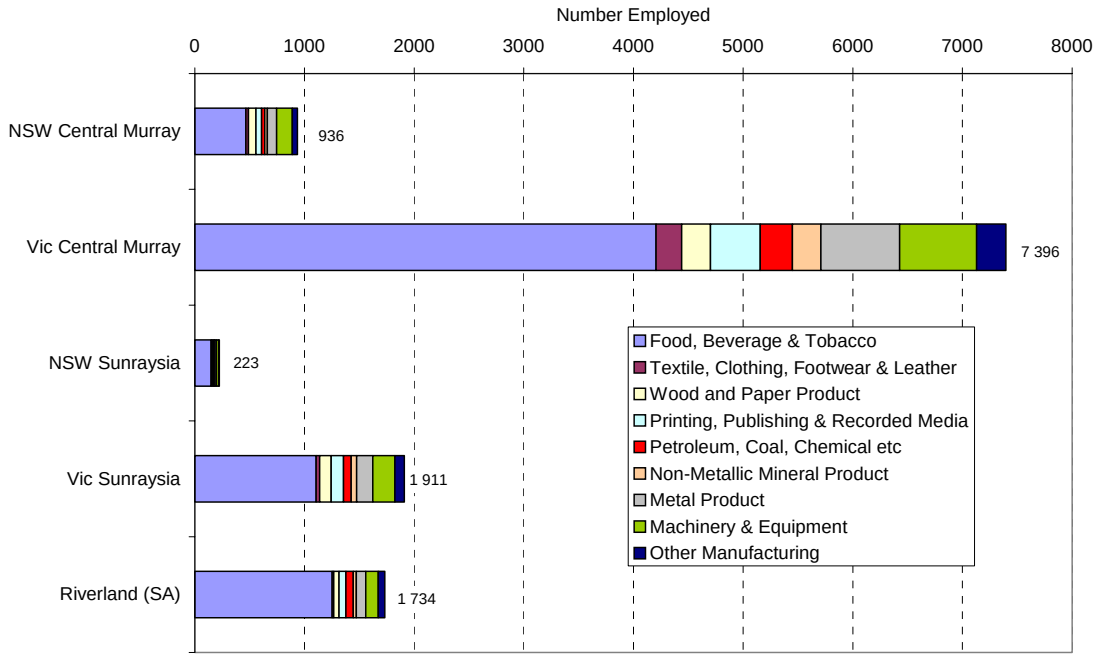
FIGURE 5. 5 HORTICULTURAL EMPLOYMENT—BY REGION 2001



Source ABS 2001 Census of Population and Housing (place of enumeration data).

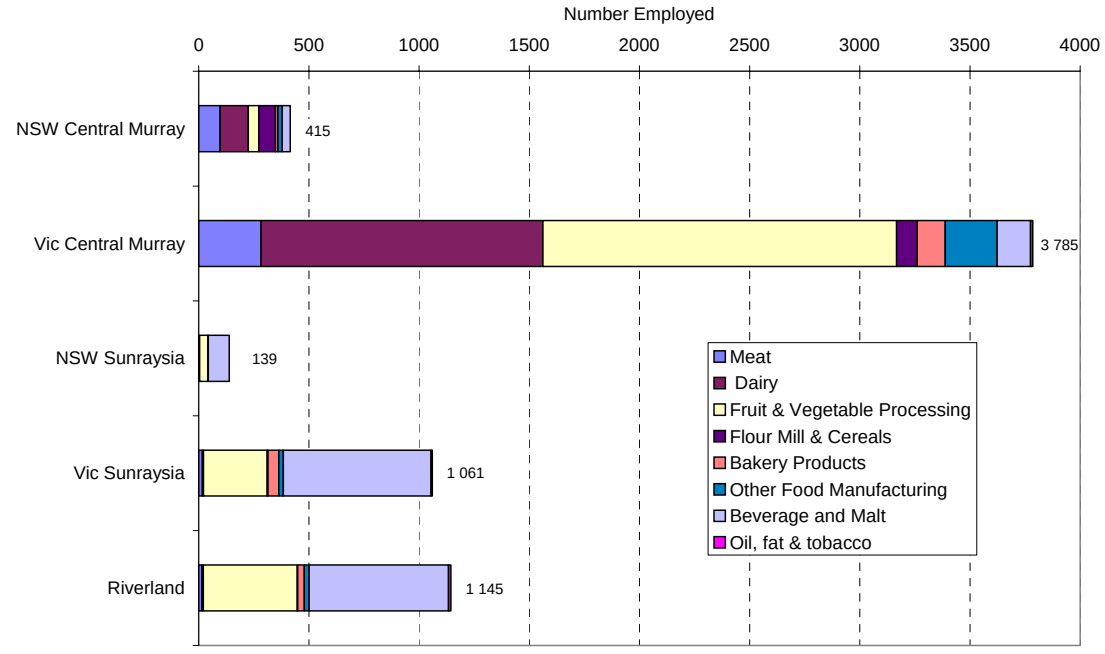
Manufacturing in the regions is intimately tied to the agricultural base with food and beverage manufacturing dominating employment (Figure 5.6). The Victorian Central Murray is the manufacturing hub with the main activities being dairy and fruit and vegetable processing (Figure 5.7). In contrast, manufacturing in Sunraysia and Riverland predominantly relates to wine processing (ie. beverages). The apparent discrepancies in the relative sizes of the agricultural horticultural industries and the corresponding manufacturing sectors reflect the focus in Sunraysia/Riverland on fresh product to the domestic and export trades where the Central Murray relies more on packaged and preserved products.

FIGURE 5. 6 MANUFACTURING EMPLOYMENT—BY REGION 2001



Source BTRE estimates based on ABS 2001 Census of Population and Housing (place of enumeration data, persons enumerated at home).

FIGURE 5. 7 FOOD MANUFACTURING EMPLOYMENT—BY REGION 2001



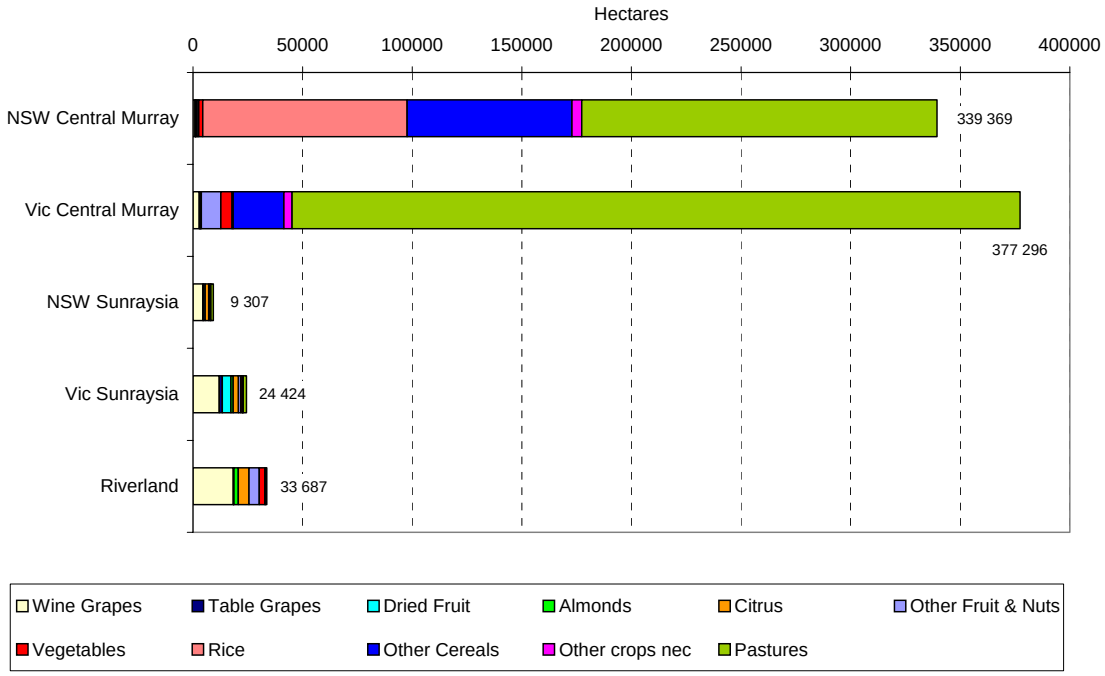
Source ABS 2001 Census of Population and Housing (place of enumeration data).

HECTARES IRRIGATED AND VALUE OF PRODUCTION

Figure 5.8 reinforces the nature of activities carried out across the region—broadacre pasture and cereals in Central Murray and intensive horticulture in Sunraysia and Riverland. Horticulture is a more intensive activity using far less hectares, but as Figure 5.10 shows the value of production associated with those hectares is proportionally much larger. In Victorian Central Murray, the value of production is proportional to hectares due to the high value nature of milk production (from the irrigated pasture), whereas in NSW Central Murray the value of production associated with rice and other cereals is significantly less.

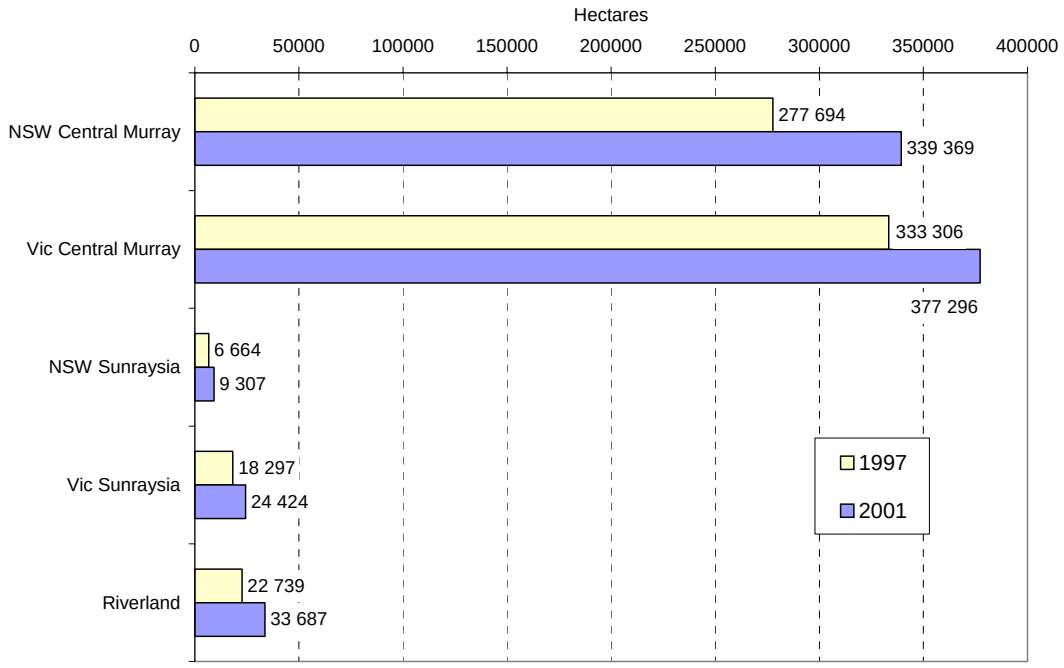
All regions have enjoyed growth in both the area irrigated and the value of production during 1997 to 2001 (Figures 5.9, 5.10 and 5.11). In particular, the Victorian Central Murray and Riverland areas have benefited from the largest increases in value of production (approximately $400 million and $300 million respectively). For the Riverland, this is due to the growth of wine grape production and for Victorian Central Murray milk and other agriculture (including dryland) have been the main drivers.

FIGURE 5. 8 AREA OF IRRIGATED AGRICULTURE BY CROP TYPE—BY REGION 2001



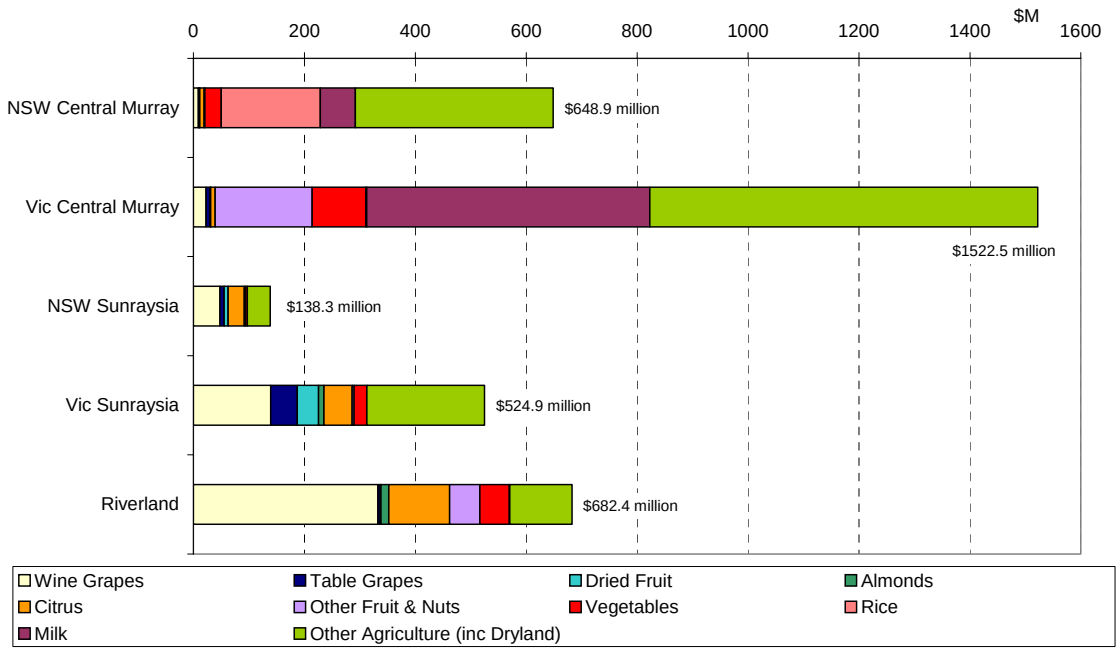
Source Based on ABS Agricultural Census 2001.

FIGURE 5. 9 AREA OF IRRIGATED AGRICULTURE—BY REGION 1997 & 2001



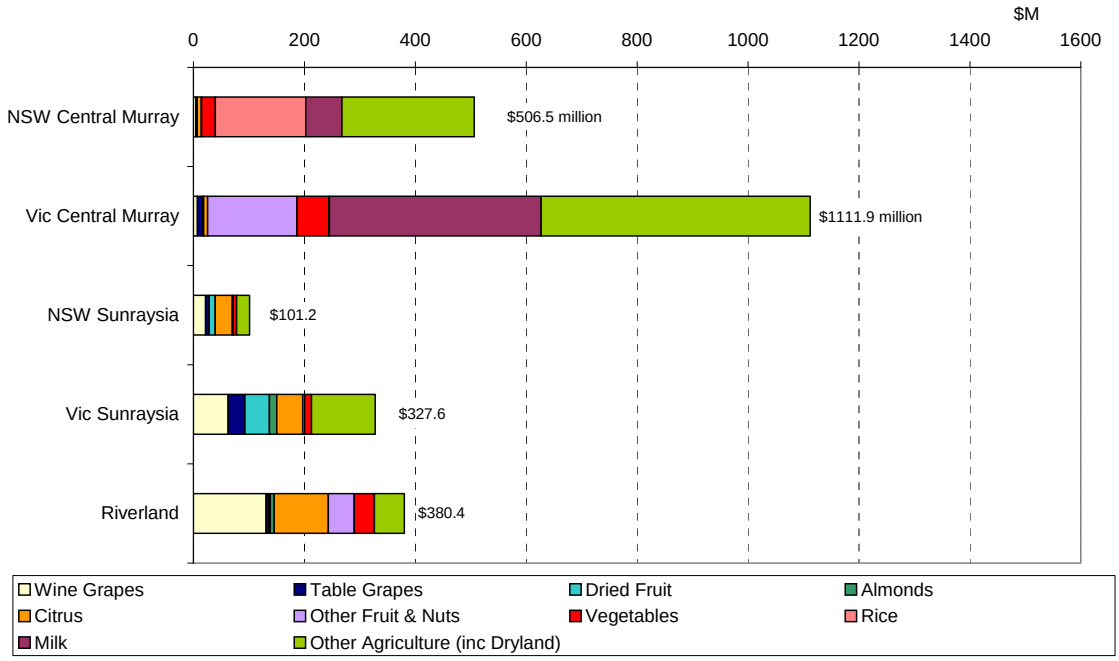
Source Based on ABS Agricultural Census 2001.

FIGURE 5.10 VALUE OF AGRICULTURAL PRODUCTION BY INDUSTRY—BY REGION 2001



Source Based on ABS Agricultural Census 2001.

FIGURE 5.11 VALUE OF AGRICULTURAL PRODUCTION BY INDUSTRY—BY REGION 1997



Source Based on ABS Agricultural Census 2001.

CAPITAL STOCK

As discussed in earlier chapters, capital stock is the key indicator we have chosen to provide an insight into investment in the regions being studied. Data on investment is scarce and the term itself is somewhat elusive to define and measure. This report therefore focuses on capital stock as the ongoing result of the investment. This section presents estimates of capital stock in both irrigated agriculture and manufacturing for each region. Unfortunately data limitations mean that different methodologies are used to calculate these estimates and the estimates are based on different valuation methods (for more detail on this issue see Appendix I). As a result, we have chosen not to add the two figures. It is also important to reiterate that while irrigated agriculture and agricultural produce manufacturing form the core economic base of these regions, other activities such as health, education, government, tourism and other services also play a significant role in regional investment. As such, the estimates presented here are underestimates or partial indicators of total investment. They should be used to indicate broad orders of magnitude, general directions and relative investment patterns.

Irrigated agriculture

Table 5.3 and Figure 5.12 present estimates of capital stock in irrigated agriculture for 2001. Capital stock in the Central Murray region, particularly the

Victorian side, is substantially larger than Sunraysia and Riverland. However, on a capital stock to water use basis, the investment dollars per megalitre of water in Sunraysia and Riverland are far larger (around $3000 a megalitre compared to less than $1000 a megalitre). This is a reflection of the different agriculture types in the regions—the high value horticulture focus of Sunraysia and Riverland. Also of note is the difference between Victoria and NSW within the Central Murray—Victoria's capital stock per megalitre of water is double that of NSW indicating the influence of high value irrigated dairy.

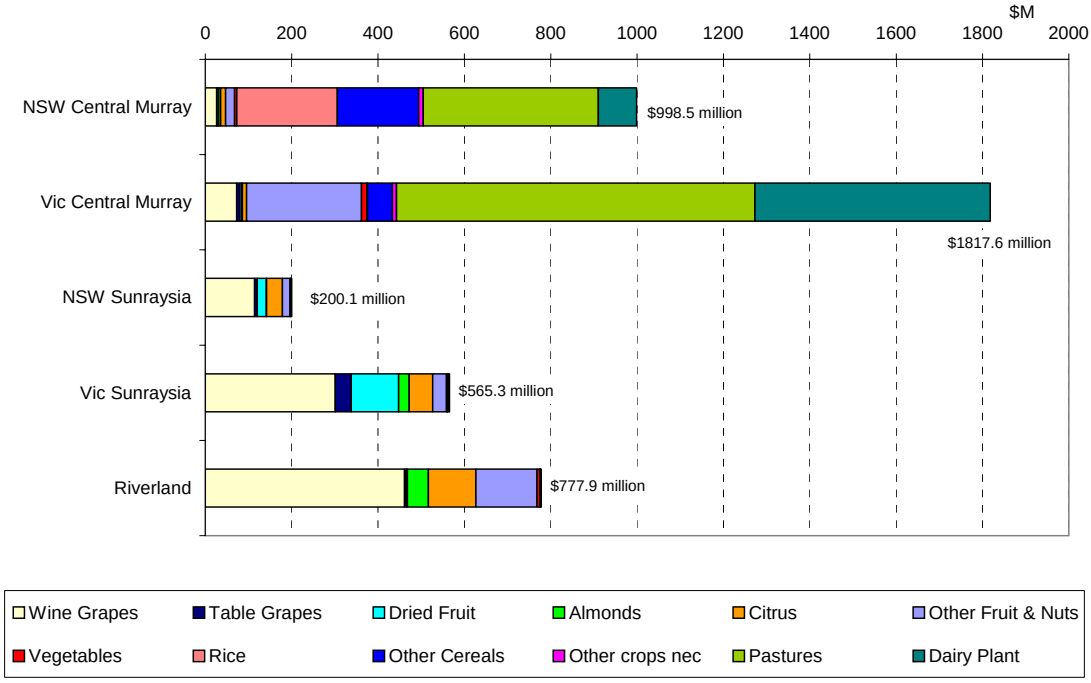
Table 5.4 and Figure 5.13 illustrate changes in capital stock from 1996–97 to 2000–01. All regions have enjoyed growth in capital stock during the period. In particular, the Riverland has experienced an increase in capital stock of around $261 million, significantly above other regions. This growth is being driven almost solely by wine grapes. The largest existing industries are driving capital stock investment in each region in recent years. For example, pasture and fruit in Victorian Central Murray and wine grapes in Sunraysia and Riverland. The same pattern does not apply to investment in regions. Despite the Central Murray having a larger share of existing investment, recent investment has been greater in Riverland and Sunraysia (approximately $470 million) than the Central Murray (approximately $360 million).

TABLE 5. 3 CAPITAL STOCK IN IRRIGATED AGRICULTURE BY CROP TYPE—BY REGION 2001 ($M)

Agriculture	*NSW Central Murray*	*Vic Central Murray*	*NSW Sunraysia*	*Vic Sunraysia*	*Riverland*
Wine Grapes	26	73	114	301	461
Table Grapes	2	7	6	37	3
Dried Fruit	3	4	21	110	4
Almonds	5	2	1	24	49
Citrus	11	9	37	54	110
Other Fruit & Nuts	21	266	18	32	142
Vegetables	5	13	1	2	6
Rice	233	1	0	0	0
Other Cereals	188	58	0	0	0
Other crops nec	11	9	0	1	1
Pastures	405	830	3	4	1
Dairy Plant	89	545	0	0	1
Total	*999*	*1818*	*200*	*565*	*778*
Water use (ML)	2 455 603	2 217 828	70 619	182 796	274 785
Capital Stock ($)/ML	407	820	2833	3092	2831

Source BTRE estimates based on ABS Agricultural Census 1997 and 2001 and NLWRA 2001a.

FIGURE 5.12 CAPITAL STOCK IN IRRIGATED AGRICULTURE—BY REGION BY TYPE 2001



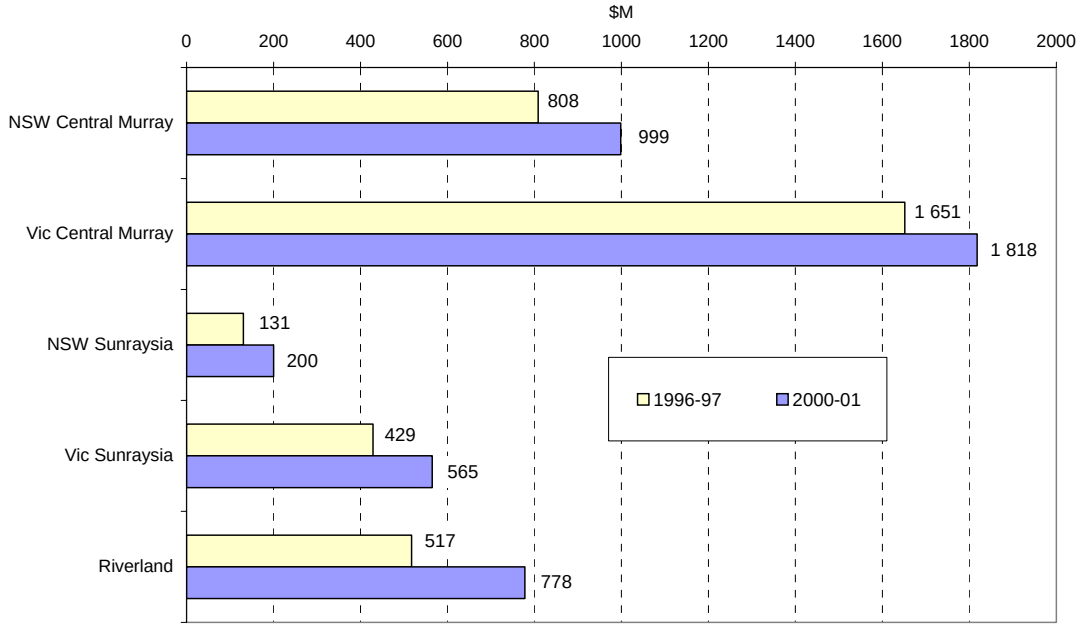
Source BTRE estimates based on ABS Agricultural Census 1997 and 2001.

TABLE 5. 4 CHANGES IN CAPITAL STOCK IN IRRIGATED AGRICULTURE BY CROP TYPE—BY REGION 1997 TO 2001 ($M)

Region	*NSW Central Murray*	*Vic Central Murray*	*NSW Sunraysia*	*Vic Sunraysia*	*Riverland*
Wine Grapes	19	42	73	133	214
Table Grapes	0	-4	0	12	-1
Dried Fruit	-1	-3	-12	-27	-2
Almonds	2	0	1	2	15
Citrus	0	0	-1	-3	3
Other Fruit & Nuts	14	70	9	17	30
Vegetables	-2	5	0	0	3
Rice	31	1	0	0	0
Other Cereals	155	23	-1	0	0
Other crops nec	-23	0	0	0	0
Pastures	-9	72	0	2	-1
Dairy Plant	5	-39	0	-1	-1
Total	190	166	69	136	261

Source BTRE estimate based on ABS Agricultural Census 1997 and 2001.

FIGURE 5.13 CAPITAL STOCK IN IRRIGATED AGRICULTURE—BY REGION, 1997 & 2001



Source BTRE estimates based on ABS Agricultural Census 1997 and 2001.

Manufacturing

Table 5.5 and Figure 5.14 present estimates of capital stock in manufacturing for 2001. Capital stock in the Victorian Central Murray far exceeds that of the other regions (approximately $1495 million). However, on a capital stock to water use basis, the investment dollars per megalitre of water in Sunraysia and Riverland are far larger ($1397 a megalitre in Riverland and $1703 a megalitre in Sunraysia compared to $674 a megalitre). Together, NSW and Victorian Sunraysia are similar in terms of $/megalitre to the Riverland, however, the stronger focus on manufacturing in Mildura is also clearly demonstrated. Consistent with the agricultural capital stock to water use, Victorian Central Murray's manufacturing capital stock per megalitre of water is almost ten times the size of its NSW counterpart.

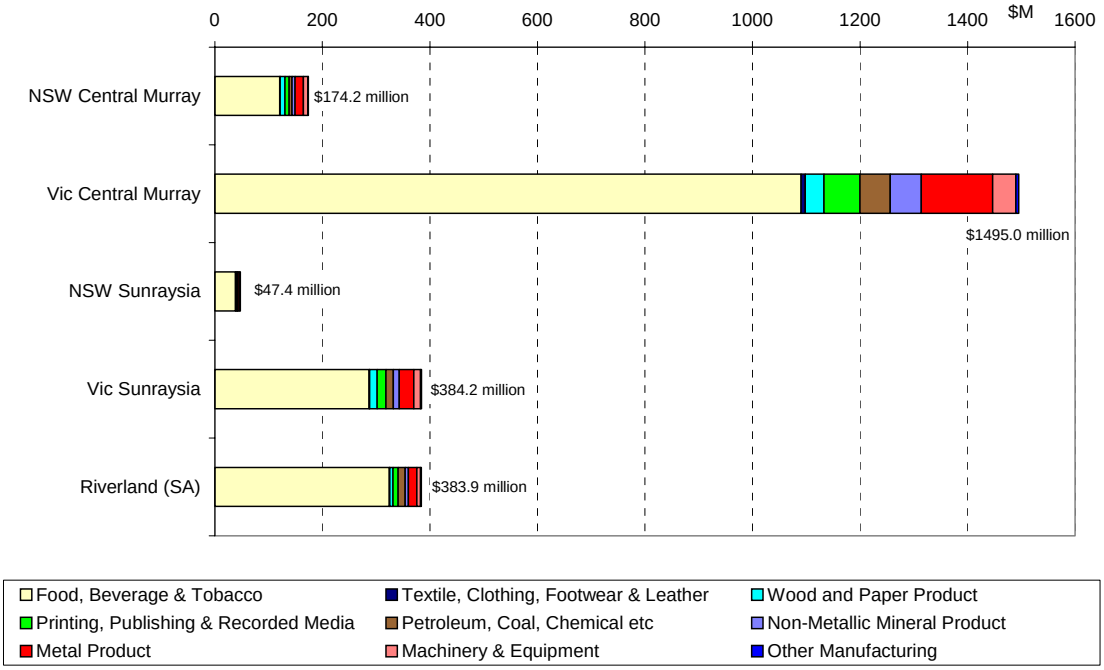
Food and beverage manufacturing employs the bulk of capital stock in all regions. However, for the Victorian Central Murray, food manufacturing, particularly dairy and fruit products, is a regional specialty. The manufacturing activities have located close to the dairy farmers and fruit growers. The region has then taken advantage of its proximity to suppliers and markets (eg. Melbourne) and agglomeration effects have reinforced the position of Victorian Central Murray (eg. Shepparton) as a regional hub for food processing.

TABLE 5. 5 CAPITAL STOCK IN MANUFACTURING BY TYPE—BY REGION 2000–01 ($M)

Manufacturing	*NSW Central Murray*	*Vic Central Murray*	*NSW Sunraysia*	*Vic Sunraysia*	*Total Sunraysia*	*Riverland*
Food, Beverage & Tobacco	121	1090	38	287	*325*	325
Textile, Clothing, Footwear & Leather	1	8	0	1	*1*	1
Wood and Paper Product	9	35	1	14	*15*	6
Printing, Publishing & Recorded Media	8	67	2	17	*18*	9
Petroleum, Coal, Chemical etc	5	57	1	14	*14*	13
Non-Metallic Mineral Product	5	58	1	11	*12*	6
Metal Product	16	133	3	27	*30*	16
Machinery & Equipment	9	43	1	12	*13*	7
Other Manufacturing	1	5	0	2	*2*	1
Total	*174*	*1495*	*47*	*384*	*432*	*384*
Water use (ML)	2 455 603	2 217 828	70 619	182 796	*253 416*	274 785
Capital Stock ($)/ML	71	674	671	2102	*1703*	1397

Source BTRE estimates based on ABS Agricultural Census 1997 and 2001, ABS Non-current Assets in Manufacturing subdivisions 1996-97 & 2000-01, industry employment data from the ABS 1996 & 2001 Censuses of Population and Housing and NLWRA 2001a.

FIGURE 5. 14 CAPITAL STOCK IN MANUFACTURING—BY REGION BY TYPE 2000–01



Source BTRE estimates based on ABS estimates of Non-current Assets in Manufacturing subdivisions 1996-97 & 2000-01, industry employment data from the ABS 1996 & 2001 Censuses of Population and Housing.

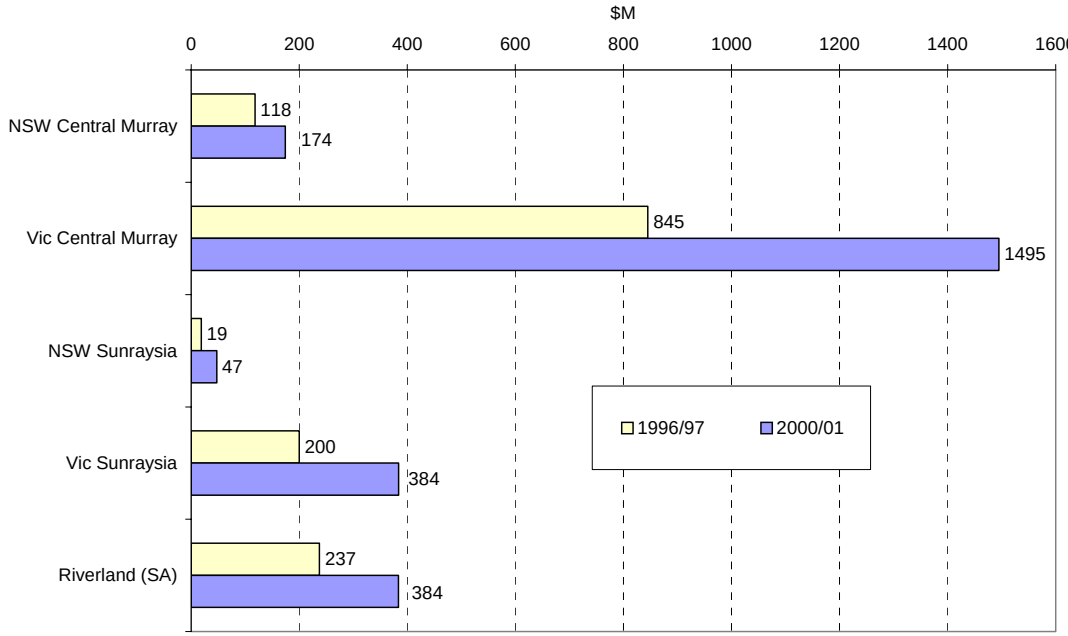
Table 5.6 and Figure 5.15 illustrate changes in manufacturing capital stock from 1996–97 to 2000–01. All regions have enjoyed growth in manufacturing capital stock during the period. The Victorian Central Murray has continued to strengthen its position with quite spectacular growth during the period (an increase of around $650 million). This is consistent with fieldwork discussions, which suggested that the dairy and fruit manufacturing sectors had enjoyed considerable growth in recent years. Capital stock investment in wineries and juice processors in the Riverland (approximately $147 million) and Sunraysia (approximately $213 million) has also been significant in recent years.

TABLE 5. 6 CHANGES IN CAPITAL STOCK IN MANUFACTURING—1996–97 TO 2000–01 ($M)

	NSW Central Murray	*Vic Central Murray*	*NSW Sunraysia*	*Vic Sunraysia*	*Riverland (SA)*
Food, Beverage & Tobacco	41	539	25	147	129
Textile, Clothing, Footwear & Leather	0	-1	0	0	0
Wood and Paper Product	-1	9	0	8	-1
Printing, Publishing & Recorded Media	1	10	0	-1	-2
Petroleum, Coal, Chemical etc	3	20	0	6	9
Non-Metallic Mineral Product	3	23	0	4	1
Metal Product	6	30	2	15	9
Machinery & Equipment	2	19	1	5	1
Other Manufacturing	0	0	0	0	0
Total Manufacturing	56	650	29	184	147

Source BTRE estimates based on ABS estimates of Non-current Assets in Manufacturing subdivisions 1996-97 & 2000-01, industry employment data from the ABS 1996 & 2001 Censuses of Population and Housing.

FIGURE 5. 15 CAPITAL STOCK IN MANUFACTURING—BY REGION 1996–97 & 2000–01



Source BTRE estimates based on ABS estimates of Non-current Assets in Manufacturing subdivisions 1996-97 & 2000-01, industry employment data from the ABS 1996 & 2001 Censuses of Population and Housing.

CHAPTER 6 KEY FACTORS IMPACTING ON INVESTMENT: DISCUSSION AND CONCLUSIONS

INVESTMENT, GROWTH AND COMMUNITIES

Table 6.1 puts some figures around what is understood by regional development practitioners in the regions. There are strong links between investment in agriculture and manufacturing, employment and growth for each of the regions as a whole. There is a concordance of results within regions: those regions where horticulture has become established and hence where investment in irrigated agriculture per megalitre of water used is highest (Sunraysia, the Riverland and some parts of Victorian Central Murray) are also the regions with:

- the best performing overall economies (highest populations, the highest real gross taxable incomes and growth rates and the most people employed in almost every sector of the economy); and
- the highest production and lowest water use (the highest value of agricultural production, lower overall water use; high and growing manufacturing investment; the greatest population, production and investment per megalitre of water used).

The overall pattern of these figures emphasises the importance of investment in irrigation industries to the overall well being of the communities they support. The attitudes and outlook of the communities that we spoke to confirm the differences shown by the statistics. The Riverland and Sunraysia communities give the impression of strong, outwardly looking communities ready to face any difficulties. By contrast, communities in the broadacre regions seem subdued and struggling with changing economic circumstances. Observing these communities, it is difficult to avoid noting an association between strong economies and strong communities.

SUMMARY OF REGIONAL INVESTMENT COMPARISONS

An overview of the key statistics in the regions studied is at Table 6.1.

- Central Murray (Victoria and NSW) has a larger share of existing agricultural capital stock ($2816 million in 2001 compared to $1543 million in

Sunraysia and Riverland). However, recent investment (since 1996–97) has been greater in Riverland and Sunraysia (approximately $470 million) than the Central Murray (approximately $360 million).

- The key industries driving investment in irrigated agriculture are pasture, dairy and fruit in Victorian Central Murray (plus rice and other cereals in NSW Central Murray) and wine grapes in Sunraysia and Riverland.
- Manufacturing capital stock is concentrated in the Victorian Central Murray (approximately $1 495 million in 2001). Recent growth has reinforced this trend with an increase of around $650 million during 1996–97 to 2000–01.
- On the basis of dollars of capital stock to amount of water used, irrigated agricultural investment in Sunraysia and Riverland is far higher (around $3000/ML compared to less than $1000/ML in Central Murray) in 2001. This is a reflection of the different agriculture types in the regions—the high value horticulture focus of Sunraysia and Riverland.
- Similarly, manufacturing capital stock to amount of water used in Sunraysia and Riverland is far larger ($1397/ML in Riverland and $1703/ML in Sunraysia compared to $674/ML in Victorian Central Murray).
- The key industry driving investment in manufacturing is food and beverages, which builds on the irrigated agricultural base of the regions. For Central Murray, this is predominantly fruit and dairy processing and for Sunraysia and Riverland, wine and juice processing are the main activities.

TABLE 6. 1 SUMMARY OF PERFORMANCE BY REGION

	NSW Central Murray	*Vic Central Murray*	*NSW Sunraysia*	*Vic Sunraysia*	*Riverland*
Population (persons, 2001)	31 220	132 591	7 078	49 283	33 546
Population growth 1991–2001 (persons)	500	6232	-184	5175	436
Population growth 1991–2001	1.6%	4.7%	-2.6%	10.5%	1.3%
Area (km^2)	26 187	22 652	26 273	22 082	20 952
Irrigated area 2001 (km^2)	3 394	3 774	93	244	337
Gross real taxable income ($M, 1999–00 in 2001–02 $)	399.3	1757.3	80.6	621.5	457.2
Unemployment rate (2001–02)	3.9%	5.5%	9.0%	7.7%	6.7%
Agricultural/mining employment (persons, 2001)	3 877	10 747	904	3 677	4 168
Manufacturing employment (persons, 2001)	936	7 396	223	1 911	1 734
Infrastructure employment (persons, 2001)	1 361	5 970	310	2 288	1 269
Health/education/gov't employment (persons, 2001)	2 048	9 646	467	3 804	2 270
Wholesale/retail trade employment (persons, 2001)	2 203	10 941	482	4 384	2 827

Other private services employment (persons, 2001)	2 099	7 998	436	3 419	1 932
Total employment (persons, 2001)	12 524	52 698	2 822	19 483	14 200
Irrigation water use (ML, 2001)	2 455 603	2 217 828	70 619	182 796	274 785
Irrigation water use per person (ML/person, 2001)	78.7	16.7	10.0	3.7	8.2
Agricultural value of production ($M, 2001)	648.85	1522.45	138.29	524.92	682.36
Change in agricultural VoP ($M, 1996–2001)	142.32	410.54	37.08	197.29	301.96
Agricultural capital stock ($, 2001)	999	1818	200	565	778
Agricultural capital stock per water used ($/ML, 2001)	407	820	2833	3092	2831
Change in agricultural capital stock ($M, 1997–2001)	190	166	69	136	261
Manufacturing capital stock ($M, 2001)	174	1 495	47	384	384
Manufacturing capital stock per water used ($/ML, 2001)	71	674	671	2102	1397
Change in manufacturing capital stock ($M, 1997–2001)	56	650	29	184	147

Source Various—see Chapters 2, 3, 4 and 5.

KEY FACTORS IMPACTING ON INVESTMENT

While there are many factors impacting on investment decisions (see Chapters 3 and 4) the following appear to be the key factors in the regions studied.

Water reliability and tenure

In broadacre agriculture in the Central Murray, the relatively high investment dairy industry is heavily concentrated on the Victorian side, whilst NSW, which largely operates on General Security water, is characterised by opportunistic cropping and grazing with relatively low fixed costs and investment. Investors in Central Murray are clear that security of tenure and reliability of supply are the most important factors determining the location of industry.

The evidence in Sunraysia and the Riverland is more equivocal. When asked, few individual investors in these regions said they weighed up interstate differences in reliability of supply and sovereign risk when making investment decisions, although many said that it would be important in the future. However, our analysis suggests that these factors have already shaped investment and that, in fact, it may be the most important factor of all.

The high investment horticultural industries (grapes, citrus, almonds, fruit trees etc) with high proportions of fixed costs, long lead times and income streams,

are concentrated in regions of high water supply reliability. These industries are almost entirely located in Victoria, South Australia or NSW Sunraysia. In Victoria, the perception of lenders and regional investors in these industries (especially in Sunraysia, but also in Central Murray) is that the reliability of supply and quality of tenure is the best available. In South Australia, at least until very recently[16], producers held the view that 'the Cap' provided a guarantee of supply to that state that, in turn guaranteed the integrity of individual allocations. In NSW Sunraysia, irrigators with High Security water entitlements claim them to be more secure than those in other states because of their relative scarcity.

Leaving aside any state biases, these perceptions based on historical experience are strongly correlated to the existence and continuing investment of high-value industries that demand the best available water reliability.

Similarly, the investment and trading patterns within states outlined in earlier chapters show the strong links between uncertainty and investment. In Victorian and South Australian high investment horticultural areas the trend has been that growers hold more than enough water entitlement to cover their needs, selling off any excess and Sales Water on the temporary market. That is, they use the system to gain certainty beyond that nominally provided by the system. On the other hand, where industry investment is relatively lower (for example, dairy and other broadacre industries in Victorian Central Murray) it is at least partially reliant on less reliable Sales Water allocations. In other words, these industries have built their businesses to incorporate a lower level of certainty in the face of their lower overall investment and water prices.

There is no doubt that the development history under previous government policies, community and cultural ties and agglomeration effects all play a part in maintaining the investment pattern. However, the evidence indicates that whilst differences in the reliability of supply of water has been the main issue impacting on investment patterns in the past, it has now been joined by security of tenure as a key factor in shaping current investment.

Introduction of water trading

This has been a most important spur to investment between regions in recent years. The ability to purchase water from other regions on a permanent basis has led to the establishment of developments in the Riverland, Sunraysia and western Central Murray. The location of these new developments is now more a function of agronomic and economic conditions and much less dependent on historic accidents or administrative intent. Conversely, temporary trading has allowed opportunistic users to access additional supplies. In both cases, the

[16] See Chapter 2, Current situation across States.

existence of temporary trading has given irrigators greater strategic control of a major productive input and led to increased investment and returns from a limited water supply.

The extent of the impact of trading can be gauged from the amount of water traded. For example, as noted, the CSIRO (2000) reported that the first two years of the Pilot Interstate Water Trading Project resulted in the permanent transfer of 8.7 GL into South Australia for high-value uses in mostly new or expanding ventures. Chapter 2 also showed permanent trade out of Goulburn-Murray Water (in 2001–02 10.6 GL of the net 11.7 GL traded going to Sunraysia) and into First Mildura Irrigation Trust (in 2001–02 162 ML of total 184 ML permanently traded was into FMIT). These show the transfer of permanent water to Sunraysia and the Riverland and away from the Central Murray. It is no accident that this trend corresponds with the observed trends in investment. Of course trade in water on a permanent basis also reduces the investment prospects in the region selling the water.

Development history and government policies

The momentum built up by historic investment patterns is a key factor in all regions. In the NSW Central Murray, the effects of the establishment of irrigation systems and the 'no permanent planting rule' that effectively excluded the establishment of horticulture will continue to be felt long after the policy change. Similarly, the historical development of dairying in the Victorian Central Murray has created an investment legacy. On a more positive side, the history of vines and fruit in Sunraysia and the Riverland have assisted the recent expansion of these industries in response to market signals. Linked to this is the tendency for smaller investors to gain confidence by following the lead of larger companies and corporates. An example referred to in this report is the expectation that the Montague's development in the NSW Central Murray will encourage further horticultural development in NSW.

Investment is also hindered by the sheer complexity of the different state water supply arrangements, which are overlayed with Basin-wide and national policies and priorities. The actual mechanisms are based in the long histories of state and irrigation area administration and good information for people outside each system is not easy to obtain although recent publications by the MDBC have begun to address this at a state level (MDBC 1999b, MDBC 2002a, MDBC 2002d, MDBC 2003h, MDBC 2003j). A glimpse of the complexity is shown in Chapter 2, which outlines the arrangements relating to water supply.

To properly assess specific situations, often the state supply arrangements need to be overlayed with an understanding of the rules and accepted practice in specific irrigation areas. Alongside water supply arrangements, there is a similarly complex array of drainage arrangements, which vary across areas, other administrative systems that address salinity and other water quality

issues. Investors face a huge task in properly informing their decisions. In the face of this complexity, it would be expected that investors generally stay with the systems they know and understand.

Community and culture

People in all regions expressed a preference to invest where they lived rather than somewhere else. This response reflects an amalgam of local and state loyalties, community, family and cultural ties and presumably self-interest in promoting the region in which they live. In addition, it shows adversity to risk, especially in the face of incomplete knowledge of the opportunities in other areas. If this reaction underlies much of the spatial behaviour of regionally based private investors, then it also explains why history and the earlier government policies retain their influence on current investment. 'Sticking to what you know' is an important factor in minimising risk, especially in a policy environment that is facing continual change. It will also mean that policy changes may take a long time to result in changed investment patterns.

Land use constraints attached to land title

This is a very important issue in NSW Sunraysia where the intersection of Western Lands Lease and the risk of native title claims has until very recently effectively precluded increased development in most of NSW Sunraysia. However, in other regions, land tenure is not an issue.

Other factors

A great number of other factors influencing investment have been identified and their impacts in the regions are outlined in Chapters 3 and 4. Differences in all these factors play important roles in the location and extent of industry development and investment patterns. They include:

- physical factors (water infrastructure, other infrastructure, soils and climate, location, land prices and availability of larger lot sizes);
- human factors (labour availability, local knowledge, social capital, demographics, serendipity, the presence of urban and lifestyle investors);
- industry factors (agglomeration effects, contracts and guarantees, existing marketing set ups, processors' sourcing strategies); and
- general economic conditions and context (overall market conditions, access to finance, government charges and intervention strategies).

THE IMPORTANCE OF UNCERTAINTY

The major factors driving investment throughout our examination of this project have exhibited the same underlying themes outlined in the literature quoted in Chapter 1. Investment is reliant on the expected magnitude of returns to the investor, the timing of costs and returns and the risks to them and the capital itself. The interplay of the basic factors of costs and benefits, time and uncertainty underpin any investment decision. Most investment is the result of decisions made on the basis of explicit or implicit analyses of costs and benefits by investors and lenders.

Return to capital is the driver of investment. It can be calculated in a reasonably straightforward manner taking into account the timing of costs and returns, interest rates and the likelihood of prices, events and outcomes—if they are known. The key question is how certain can we be of the future.

It is the uncertainties in the calculations that create difficulty and demand higher returns in compensation. The intuitively uncontroversial proposition that the more uncertain the outcome, the higher the return on capital needs to be to justify an investment is supported by the economic literature (see Dixit and Pindyck 1994). The longer the period between the investment and the return, the more uncertain the predictions. Uncertainty therefore raises the hurdle for investment.

It is no wonder then that we find investors in irrigation focussed on risk. In all regions we found that dealing with uncertainty pervades the thinking of investors and shapes the amount and distribution of their investments. Below are a few examples of the strategies adopted to combat risk in marketing and more often in water supply arrangements.

In marketing and general risk management:

- the historic popularity of co-operatives reflects a desire to reduce uncertainty in marketing;
- the leader/follower model of investment quoted by regional producers where risk-taking entrepreneurs have been a necessary pre-requisite to more general development;
- the popularity of sales contracts in the horticultural (especially the wine grape) and dairy industries—minimising the marketing risk to growers;
- the clear preference for freehold land title; and
- processor sourcing of inputs from different irrigation districts—spreading the risk of failure in any one district.

In relation to the water supply, we observed particular sensitivity to the issue and a wide range of strategies designed to reduce risk:

- In Sunraysia and the Riverland many irrigators own water entitlements beyond their immediate needs as a hedge against a reduction in

allocations—recuperating only some of the associated costs through temporary trading;

- The clear preference of irrigators for their own region as an investment location. Most also showed a preference for the crops and even the water supply system that they had become accustomed to. These are strategies designed to reduce the risk involved in dealing with the less well known;
- Irrigators in NSW Sunraysia (Western Murray Irrigation) exclusively hold High Security water, unlike the rest of NSW. They continue to hold this despite it being surplus to current requirements—selling only to the temporary trade;
- In contrast, irrigators holding General Security water in NSW Central Murray manage the riskiness in supply by engaging in opportunistic, low capital agriculture which allows them to minimise their outlays (and losses) in times of low supply and make the best use of additional water in times of plenty;
- The almost universal preference by irrigators with high overheads for the Victorian or South Australian supply systems over those of NSW. To quote one irrigator operating from the Murray on the NSW side because of the availability of land 'I would love to access my water through the Victorian system—after all it is the same water'.

Our discussions with irrigators, observations of strategies along with the patterns of growth and investment described by the data presented in this report, convince us that uncertainty is the underlying driver of investment in irrigated agriculture on which the communities in all the regions visited depend.

Investment and growth with continuing uncertainty

If uncertainty regarding supply of water is a sensitive issue for investment in the long term, then for most irrigators current circumstances are extreme. The drought placed pressure on supplies to all Central Murray producers last season and the low levels of the major storages threaten an even worse result in the coming year.

As poor as the short-term outlook is, and as severe as the impacts might be, most producers we spoke to tended to be philosophical about shortages due to natural occurrences such as drought. Such occurrences are obviously unwelcome but are regarded as a natural hazard to be managed, with few lasting implications for the long-term outlook or investment decisions. This is because the risks can be assessed on the basis of historical weather patterns and the physical supply processes are well understood.

In contrast, the risks from changes in government policy (sovereign risk) cannot be assessed in these terms. Neither the extent of transfers to environmental uses

nor processes by which they will be obtained are easily assessable and it is to be expected that producers will take a pessimistic view. Most irrigators express serious concern about the ability of the various supply systems to meet their requirements in the long term in the face of increasing demands for water from other (particularly environmental) users. In NSW, the effective reduction due to 'the Cap' has caused some to question the security of tenure of their entitlement. The cut to what was (rightly or wrongly) regarded as a legal entitlement has severely undermined confidence. As we have noted, South Australian producers we spoke to were confident that their entitlements were secure under the Murray-Darling Basin Agreement. However, the recent 35 per cent cut to allocation is likely to have shaken that confidence. In Victoria, producers are aware of the pressure on the Victorian Government for competition reforms in the water industry and fear that they will be adversely affected.

Irrigators in all states argue that the current lack of certainty associated with current systems is already having a dampening effect on their investment and will continue to have impacts into the future. The Living Murray Initiative and other environmental demands are seen as the likely driver of negative change in the long term. Whilst the possibility of up to 1500 gigalitres being withdrawn from irrigation uses figures highly in the forward planning of many irrigators, many are more concerned that this initiative is just one more step in an ongoing process that continuously reduces their water use. They argue that having complied with demands for more efficient water use, salinity management plans etc, they will be asked to make even more cuts under the Living Murray Initiative with no guarantee that they can count on the new lower levels into the future. It is this ongoing uncertainty that may stifle investment in the future.

Although mechanisms for obtaining the water have not been settled, most irrigators fear that they will lose out. Given the continuation of intra and interstate trade, we would expect that regardless of the mechanism chosen, in the short to medium term, the cuts in water use will occur in the rice, dairy and pasture-based regions of the Central Murray rather than in horticulture. This is because the gross margins in horticulture are much higher and it is more likely that the immediate profit maximising (loss minimising) decisions in these industries will favour buying entitlement to maintain levels of production.

To suggest that reductions in water supply will simply result in a reduction in water applied to broadacre industries is too simplistic, ignoring as it does the impact on investment. We can see two ways that investment will be affected.

Firstly, the increased costs will be factored into long-term investment calculations. In these decisions, overall profitability (including allowances for risk) rather than gross margins are the over-riding consideration. Hence, whilst the short-term reaction in established horticulture-based enterprises may be to

buy water entitlement to maintain production of existing operations, a secondary reaction may be to decrease their levels of investment for the future.

The second impact is that of uncertainty. If there is increasing uncertainty as a result of an expectation of continuing cuts into the future, as noted above we would expect lower levels of investment than otherwise would have occurred. As the extent of uncertainty increases with the length of the investment horizon, the impact will be much larger in the industries with long lead times for returns. That is, the effects will be greatest on those same horticultural industries that support the communities of Sunraysia, the Riverland and the Victorian Central Murray. Conversely, those industries with shorter time frames, already adapted to opportunistically taking advantage of changes in supply, will be relatively favoured by increased uncertainty. Increases in uncertainty will therefore tend to favour the development of low investment broadacre cropping and grazing enterprises typical of the NSW Central Murray.

CONCLUSIONS AND POLICY IMPLICATIONS

This report has quantified the investment patterns across five regions drawing on the Murray River. It has shown that the investment patterns and consequently the well being of communities has been shaped by the water administration policies of the state governments involved and that uncertainty is the key underlying factor governing investment decision-making. As discussed above, continuing uncertainty in the irrigation industry favours those industries that are the least productive in terms of water use and provide the poorest economic base for building and supporting strong regional communities.

If the goal of water policy includes the development of efficient regional industries and sustainable communities, the policy question that flows from the analysis is 'how can the levels of uncertainty in the supply of water to irrigators be reduced?'

The establishment of a consistent approach that secures the access rights of irrigators and others will not only reduce the uncertainty associated with sovereign risk in its own right, but also allow improvements to water trading that will allow industry to build on the efficiencies gained through the development of intrastate trading in the 1990s.

The core risk concern of irrigators we spoke to is the continuing demands made for environmental purposes which from their point of view are often made on a seemingly random basis. The establishment of a national regime of water rights would reduce uncertainty from this source by giving water entitlements similar status as land or other property. Two advantages would flow from this for irrigators: they can have confidence that their investments will not be at risk from arbitrary cuts in water supplies and reductions will be compensated for at

market value. In addition, it would ensure irrigators and the general community can have greater confidence that the benefits of such changes will be balanced against the real costs of diverting water from current uses.

Discussing key factors in investment, Dixit & Pindyck (1994) comment:

> 'reduction or elimination of unnecessary uncertainty may be the best kind of public policy to stimulate investment … the uncertainty generated by the very process of a lengthy policy debate on alternatives may be a serious deterrent to investment … policy uncertainty can have a major negative effect on investment' (p. 14); and
>
> 'policy uncertainty can have a powerful deterrent effect on immediate investment. If governments wish to stimulate investment, perhaps the worst thing they can do is to spend a long time discussing the right way to do so' (pp. 19–20).

It is likely that investment is already being dampened by the current water debate—the longer the delay, the more that investment in these regions will be affected.

The introduction of secure, nationally consistent water rights and market-based systems for the management of water for environmental and other purposes is a difficult and complex task. However the regional development benefits of its introduction are potentially substantial.

APPENDIX I METHODOLOGY

BOUNDARY ISSUES

TABLE I. 1 ASGC CLASSIFICATIONS 1997 AND 2001

			2001 Classification	*1997 Classification*
40210	SA	Murray	Berri & Barmera (DC) - Barmera	Barmera (DC)
40420	SA	Murray	Berri & Barmera (DC) - Berri	Berri (DC)
43791	SA	Murray	Loxton Waikerie (DC) - East	Loxton (DC), Brown's Well (DC)
48120	SA	Murray	Loxton Waikerie (DC) - West	Waikerie (DC)
45460	SA	Murray	Renmark Paringa (DC) - Paringa	Paringa (DC)
46650	SA	Murray	Renmark Paringa (DC) - Renmark	Renmark (DC)
49039	SA	Murray	Unincorp Riverland	Unincorp Riverland

In SA, there has been considerable change to the ASGC between 1997 and 2001. However, most of the change seems to be only in terms of nomenclature, rather than actual boundary changes. The 1997 figures were estimated for the 2001 boundaries as per Table I.1. Note that comparison of the ASGC maps indicates close matching.

OVERVIEW OF VALUATION METHODOLOGIES

The capital stock in irrigated agriculture has been estimated from Agricultural Census data (AgStats) on areas under irrigation (Ha) and regional estimates of the replacement value of on-farm works and equipment in each industry. This involved applying a per hectare figure for capital stock to the number of hectares from the Agricultural Census. This method is similar to that used by Young (2000). Estimates of per hectare values were sought from local operators and the literature. In general, these estimates did not include a cost of land element. Capital stock included, for example, farm machinery, equipment, irrigation pumps and pipes, trellises, perennial plants, laser-levelling etc. For the dairy industry, a further amount was added on a per farm basis to account for the investment in milking shed plants (eg. dairies).

Estimates of capital stock in manufacturing industries were made given the reliance of manufacturing on irrigated agriculture in the regions being studied. Estimates of capital stock in manufacturing industries have been obtained by apportioning Australian data on non-current assets for two-digit manufacturing ANZSIC classes (ABS Cat. 8225.0 *Manufacturing Australia* data cube) on the basis of the number of employed persons in that industry in each region (from the ABS 2001 *Census of Population and Housing*).

DETAIL OF METHODOLOGY FOR CALCULATIONS OF AREAS OF AGRICULTURAL ACTIVITIES AND CAPITAL STOCK LEVELS

General

- The underlying base data are the "Irrigation" databases from the Agricultural Censuses in 1997 and 2001 (ABS 2002a) as reported in AgStats. In general, this source was preferred to the data by "Crop" type because of its ability to distinguish between irrigated and dryland areas of some cereal and orchard crops. We note however, that for some crops where it would be expected that the two totals would coincide exactly, for rice for example, there are differing estimates. Presumably this reflects differing responses to similar questions on the Census returns.
- The range of activities reflects the main activities in the regions considered. The category of "Other Fruits and Nuts" includes significant quantities of stone and pome fruit in some areas. In the absence of specific area data, it was not considered there was much to be gained by trying to estimate these individually. On the other hand, citrus and almonds were estimated separately due to their size and reported recent growth respectively.
- The area of orchards by crop type is not collected in the Agricultural Census. Rather, it quotes the number of trees. Therefore to estimate citrus and almonds an estimation of the average number of trees per hectare was made. These estimates were based on figures drawn from a number of sources (NSW Agriculture 2003, MVCMB 2003, Timbercorp 2003, AAGA c. 2000, DPI 2002) as well as estimates from the industry within the regions.
- The methodology for calculating capital stock involved applying a per hectare figure for capital stock to the number of hectares from the Agricultural Census. This method was developed independently by the BTRE but is similar to the approach used by Young 2000.
- In estimating the levels of capital stock in specific activities, estimates of per hectare costs were sought from regional operators and the literature.
- In general these estimates did not include a cost of land element. We have followed this practice in our estimates of capital stock on the basis that, from a regional point of view, the total land stock does not change with a change in activity. This is consistent with using the data to investigate capital stock

trends where one irrigation activity is substituted for another. However where a new area is developed for an activity the cost of establishing the basic irrigation infrastructure itself (pumps, channels/pipes, basic fixed farm infrastructure) should be added to the estimates. Unfortunately the available data is not available for us to calculate this in detail.

- We have simply applied the currently estimated values to both the 1997 and 2001 data. This means that the figures represent the current (2003) value of the capital stock at that time and of change over the period.

The following specific methods were used for each activity:

Grapes

Areas calculated by apportioning total grape area (Irrigation) on the basis of production quantities for dried fruit, table grapes and wine grapes in each of the SLAs. These production figures were drawn from the Agricultural Census by crop data base. Irrigation capital stock calculated on the basis of:

- $25 000 per Hectare for wine grapes. This figure reflects a generally held 'rule of thumb' quoted by a range of local industry people across the regions and the figure of $24 808 used in the Deakin study (SMEC 2001); and
- $27 500 for table grapes and dried fruit which reflects local estimates of around $30 000 and the published Deakin study figure of $26 808.

Almonds

- The area of almonds grown was not sought in the 2001 Agricultural Census but, consistent with other fruit and nut data, data was obtained regarding the number of trees. Areal irrigation data was only obtained for the broad category of "Fruit (inc nuts)".
- The importance for current investment of the almond industry suggested that estimation of the areas and capital stock should be undertaken.
- In order to develop an estimate of the area of almonds, an estimate of the number of trees per hectare was needed. Our estimate drew on a number of prominent sources, recognising that different farmers, regions and practices will plant at different densities. The sources used: Timbercorp (2003), AAGA (c. 2000), DPI (2002) suggested figures of 290 (approximate average from Australian tree and hectare totals), 256 and 280 ('commonly used' rates) and 250 (based on 'usual' 6m x 6m grid pattern) trees per Hectare respectively. In the light of these sources we have used an estimate of 250 trees to the Hectare.
- Irrigation capital stock was calculated on the basis of $25 000 per Hectare. This capital stock reflects a 'rule of thumb' regional estimate of $25 000 and figures of $10–15 000 quoted by DPI (2002). We believe the disparity here is

likely to (at least in part) reflect different irrigation systems. A Primary Industries South Australia study for 1998 (Pocock 1999) which analysed establishment costs in some detail, projected a cumulative cash flow deficit (without interest) of almost $36 000 by year four. This analysis includes a land acquisition figure of $12 500. If this figure is taken away, the estimate is around $24 000/Ha in 1998. Given the age of this estimate, we believe a figure of $25 000 is appropriate for current use.

Citrus

- The area of citrus grown was not sought in the 2001 Agricultural Census, but consistent with other fruit and nut crops, data was obtained regarding the number of trees. Areal irrigation data was only obtained for the broad category of "Fruit (inc nuts)".
- The size of the citrus industry suggested the importance of estimation of the areas and capital stock involved for this industry.
- Area calculated from the number of trees at the rate of 500/Ha. In order to develop an estimate of the area of citrus, an estimate of the number of trees per hectare was needed. Our estimate drew on a number of prominent sources and regional operators, recognising that different farmers, regions and practices will plant at different densities. The sources used—NSW Agriculture (2003) and MVCMB (2003)—provided a range of estimates (range of 222–666) and 500 respectively. In the light of these we have used an estimate of 500 trees to the Hectare.
- Capital stock was calculated on the basis of $22 500 per Hectare. This capital stock reflects a 'rule of thumb' regional estimates of $25 000 and $20 000 from regional sources and a figure of $22 740 used in the Deakin study (SMEC 2001). It should be noted however, that citrus establishment takes considerable time and a commercial return is not expected for up to six years. The figures above do not take this into account and therefore are likely to underestimate the real level of investment in citrus.

Other fruit and nuts

- The area of this category was calculated as a residual of the Total Fruit & Nuts (irrigated) figure less the calculated values for citrus and almonds (above).
- Capital stock was calculated on the basis of $30 000 per Hectare. This represents an average of quoted estimates for own farms and industry norms provided by producers, particularly in the pome and stone fruit industries that make up the largest proportion of this category.

Vegetables

- Area taken from "Irrigation" reporting data area of the Agricultural Census.
- The capital stock value of $2500/Ha was based on regional estimates for flood/furrow irrigated land suitable for rice, other cereals and pasture. Unfortunately, we have not been able to source figures on the extent of either laser levelling or other irrigation systems that would represent additional capital stock. To the extent that these systems are in place our estimate may undervalue the capital stock.

Rice

- Area calculated for 2001 from "Irrigation" reporting data area of the Agricultural Census. For 1997, the data was taken from the "Crop" reporting data area of the Agricultural Census. Note here that there are some differences in the 2001 Agricultural Census area where both are reported. Most differences are small; the exception being Conargo where the "Irrigation" estimate exceeds the "Crop" estimate by 1979 Ha.
- The capital stock value of $2500/Ha was based on regional estimates for flood/furrow irrigated land suitable for rice, other cereals and pasture. Unfortunately, we have not been able to source figures on the extent of either laser levelling or other irrigation systems that would represent additional capital stock. To the extent that these systems are in place our estimate may undervalue the capital stock.

Other cereals

- Area calculated from Irrigation reporting in the "Irrigation" tables of the Agricultural Census. The figure for 2001 was obtained directly from the tables. The 1997 value was calculated from the Cereals value less the calculated value for rice (above). Note that the 1997 value for Swan Hill Central of -39 Ha was adjusted to zero.
- The capital stock value of $2500/Ha was based on regional estimates for flood/furrow irrigated land suitable for rice, other cereals and pasture. Unfortunately, we have not been able to source figures on the extent of either laser levelling or other irrigation systems that would represent additional capital stock. To the extent that these systems are in place our estimate may undervalue the capital stock.

Other crops

- Area calculated from Irrigation reporting in Agricultural Census.
- The capital stock value of $2500/Ha was based on regional estimates for flood/furrow irrigated land suitable for rice, other cereals and pasture. Unfortunately, we have not been able to source figures on the extent of

either laser levelling or other irrigation systems that would represent additional capital stock. To the extent that these systems are in place our estimate may undervalue the capital stock.

Pastures

- Area calculated from Irrigation reporting in Agricultural Census.
- The general capital stock value of $2500/Ha was based on regional estimates for flood/furrow irrigated land suitable for rice, other cereals and pasture. Unfortunately, we have not been able to source figures on the extent of either laser levelling or other irrigation systems that would represent additional capital stock. To the extent that these systems are in place our estimate may undervalue the capital stock.

Dairy plant

- It was pointed out by dairy farmers that dairies had a very high investment in fixed plant—milking precincts, machines etc. This was especially so when contrasted with other livestock industries where investment levels in plant are almost minimal. Estimates of the replacement value of this plant varied from around $500 000 to $6-700 000 for a new rotary dairy. In particular, it was noted that the more expensive rotary dairies were more prevalent in NSW where new dairies were being built on larger areas. This trend is confirmed by the Agricultural Census figures for the mid to lower Murray region in NSW (average herd size of 248 in 2001) compared to Victoria (195) and SA (148).
- In the light of the above, but noting that many of the dairies are relatively old, we have an additional capital stock figure of $300 000 for each Victorian and South Australian dairies and $500 000 on NSW dairies.

Other on-farm assets

- The estimates above focus specifically on on-farm assets associated with specific irrigated industries. Given that no allowance has been made for stock, machinery and vehicles, houses, farm buildings, pumps etc the amounts will clearly underestimate the value of capital stock in on-farm infrastructure and no attempt has been made to value human or social capital. This is for a number of reasons. Firstly, the information to hand does not provide a basis for estimating these parameters, secondly mobile assets (in particular vehicles and machinery) are often used for off-farm/non-irrigation purposes and many of the fixed assets (eg. houses) are not strictly income producing. Although these omissions are likely to undervalue the on-farm capital stock, we do not believe their absence significantly undermines the usefulness of the figures for inter-regional comparisons.

Dryland and other industries

- These have not been included as the intention is to gain insight into the comparative investment in irrigation infrastructure.

METHODOLOGY FOR CALCULATIONS OF VALUE OF PRODUCTION

- The value of production figures were taken from the ABS Agricultural Census figures (ABS 2002a). These figures are calculated by the ABS on the basis of current prices in the year of collection.
- We have not sought to adjust these for inflation although the CPI for the period increased by 13 per cent and the farm based GDP by 64 per cent from 1997 to 2001.
- Specifically, the "Wine Grapes", "Table Grapes", "Dried Fruit", "Almonds", "Citrus", "Vegetables", "Rice" and "Milk" categories were simply drawn from the ABS's AgStats database.
- "Other Fruit and Nuts" was calculated from the value of "Total orchard fruit incl nuts" less the citrus and almond values.
- The "Other Agriculture (inc dryland)" was calculated as "Total Agriculture" less all the identified categories above.

METHODOLOGY FOR CALCULATIONS OF MANUFACTURING CAPITAL STOCK

- Estimates of capital stock in manufacturing industries have been obtained by applying Australian estimates of non-current assets for two-digit manufacturing ANZSIC classes (derived from the ABS/Space Time Research Pty Ltd. business performance data) on the basis of the number of employees in that industry in each region (from the ABS 1996 and 2001 *Census of Population and Housing* industry of employment data).
- The ABS estimates of non-current assets in manufacturing are for 1996–97 and 2000–01 (the most recent year available). While these do not align exactly with the ABS 1996 and 2001 Census timings it was decided that for the purposes of this research the differences would be minor. Given that interstate disparities would most likely reflect inter-capital differences and the likelihood of relatively consistent ratios immediately across borders, the Australian Average was also used in the calculations.

COMPARABILITY OF CAPITAL STOCK ESTIMATES

- The capital stock estimates for irrigated agriculture are calculated using an estimate of the current value of commonly occurring infrastructure for that industry. As such, the estimates are a replacement cost valuation of the capital stock.

- The capital stock valuation for manufacturing capital stock is an employment based top down allocation of the national total, which is derived from a survey of manufacturing industry (ABS 2002b). This data is provided directly by managers and accountants, presumably from company records. As such, it is likely that these estimates are substantially based on historical cost accounting methods—although we cannot be certain of this.
- Both historical cost and replacement cost are legitimate methods of valuing assets, they have different characteristics and can be expected to give different results. For this reason, although we have presented both figures, they should be treated carefully—we do not believe it appropriate, for example, to add the figures.

CALCULATION OF WATER USE

- Water use was calculated by applying common expectations of water use for different crop types to the area known to be under that crop type in 1997 and 2001.
- The values in column 2 of Table I.2 were used. These reflected the values gained during our fieldwork (column 4) and estimates found in the Australian Natural Resources Atlas (NLWRA 2001a).

TABLE I. 2 ESTIMATES OF WATER USE PER HECTARE—VARIOUS CROPS

	Estimate for Calculations (ML/Ha)	*ANRA* (ML/Ha*	*BTRE Fieldwork Estimates (ML/Ha)*
Wine Grapes	7.5	7.53	7
Table Grapes	6		6
Dried Fruit	6		6
Almonds	13		13
Citrus	10	9.9	10
Other Fruit & Nuts	9		9
Vegetables	5.5	5.5	-
Rice	13	13.3	12
Other Cereals	3	2.8	3
Other crops nec	3		3
Pastures	6	5.8	6.5

Source ANRA: Australian Natural Resources Atlas (NLWRA 2001a) and BTRE fieldwork estimates.

APPENDIX II IRRIGATION TYPES

The following brief description of irrigation methods draws on a variety of sources to provide a quick reference guide for readers on some of the terminology involved in irrigated agriculture.

Irrigation is the artificial application of water to land for the purpose of agricultural production. The type of irrigation system employed on farms varies depending on a range of factors including soil type, topography of the land, availability of power sources, availability and source of water, the period of time when the system was installed, the size of the area being irrigated, on-farm water storage capacity and labour/financial resources (http://www.nre.vic.gov.au/).

Irrigation involves a variety of irrigation methods and equipment (see Table II.1). They can be summarised as follows:

- flood, some with laser land forming, especially for pastures and rice production;
- furrows, the predominant method for horticultural and field crops, and, particularly in the older schemes, for vines and tree crops;
- sprinklers: various types of overhead sprinkler systems, depending on the crops; particularly for tree crops and vines, but also include centre pivot systems used for growing fodder crops, lucerne, vegetables, etc.; systems can be fixed or portable, though the latter can involve considerable labour input; increasing use of under-tree and micro-sprinklers resulting in much greater water use efficiencies;
- trickle/drip hoses: even more efficient, due to much more direct application of water; and
- sub-surface drip systems.

The MDBC report that other things being equal, flood and furrow methods are relatively inefficient, both in terms of application and crop water use. The area irrigated in this way is declining in real figures and as a proportion of the total area with the adoption of newer and more efficient methods. Because of the considerable capital investment, irrigation methods and equipment cannot be easily changed, except perhaps in replacing flood or furrow irrigation with more sophisticated systems. Whilst there is no doubt that the newer systems

generally result in more efficient water use, a word of caution is necessary. Efficiency depends on many factors including soil type, crop and the management skills of the irrigator (MDBC 2003a).

TABLE II. 1 TYPES OF IRRIGATION SYSTEMS

Irrigation system	*Description*
Furrow systems	This system comprises a series of small, shallow channels used to guide water down a slope across a paddock. Furrows are generally straight, but may also be curved to follow the contour of the land, especially on steeply sloping land. Row crops are typically grown on the ridge or bed between the furrows.
Flood or border check systems	These systems divide the paddock into bays separated by parallel ridges/border checks. Water flows down the paddock's slope as a sheet guided by ridges. On steeply sloping lands, ridges are more closely spaced and may be curved to follow the contour of the land. Border systems are suited to orchards and vineyards, and for pastures and grain crops.
Level basin systems	These systems differ from traditional border check or flood systems in that slope of the land is level and area's ends are closed. Water is applied at high volumes to achieve an even, rapid ponding of the desired application depth within basins.
Centre-pivot sprinkler systems	A self-propelled system in which a single pipeline supported by a row of mobile towers is suspended 2 to 4 meters above ground. Water is pumped into the central pipe and as the towers rotate slowly around the pivot point, a large circular area is irrigated. Sprinkler nozzles mounted on or suspended from the pipeline distribute water under pressure as the pipeline rotates.
Hand move sprinkler systems	A series of lightweight pipeline sections that are moved manually for successive irrigations. Lateral pipelines are connected to a mainline, which may be portable or buried. Handmove systems are often used for small, irregular areas. Handmove systems are not suited to tall-growing field crops due to difficulty in repositioning laterals. Labor requirements are higher than for all other sprinklers.
Solid set / fixed sprinkler systems	A stationary sprinkler system. Water-supply pipelines are generally fixed (usually below the soil surface) and sprinkler nozzles are elevated above the surface. Solid-set systems are commonly used in orchards and vineyards for frost protection and crop cooling. Solid-set systems are also widely used on turf and in landscaping.
Travelling gun sprinkler systems	A large sprinkler mounted on a wheel or trailer, fed by a flexible rubber hose. The sprinkler is self-propelled while applying water, travelling in a lane guided by a cable. The system requires high operating pressures.
Side-roll wheel-move systems	Large-diameter wheels mounted on a pipeline, enabling the line to be rolled as a unit to successive positions across the field. Crop type is an important consideration for this system since the pipeline is roughly 1 metre above the ground.
Linear or lateral-move systems	Similar to centre-pivot systems, except that the lateral line and towers move in a continuous straight path across a rectangular field. Water may be supplied by a flexible hose or pressurised from a concrete-lined ditch along the field's edge.
Low-flow irrigation systems (including drip and trickle)	These systems use small-diameter tubes placed above or below the soil's surface. Frequent, slow applications of water are applied to the soil through small holes or emitters. The emitters are supplied by a network of main, submain, and lateral lines. Water is dispensed directly to the root zone, avoiding runoff or deep percolation and minimising evaporation. These systems are generally used in orchards, vineyards, or high-valued vegetable crops.

Source DNRE 2003.

APPENDIX III GLOSSARY OF WATER TERMS

This table defines some of the terms used in discussing the administration of water in South Australia, New South Wales and Victoria, particularly in regard to general terms used across jurisdictions.

TABLE III. 1 GLOSSARY OF WATER TERMS

Term	*Definition*
Announced or seasonal allocation	The percentage of water entitlement declared available for diversion from a regulation in a irrigation season
Annual allocation	The annual volume of water available for diversion from a regulated stream by an entitlement holder
Bulk entitlement	A perpetual entitlement to water granted to water authorities by the Crown of Victoria under the Water Act 1989
Carryover	An unused entitlement from one season that can be used in the next year. Carryover of retail entitlement is allowed in NSW but not in SA or Victoria
Channel capacity	The maximum rate at which water can be delivered through a river reach or an artificial channel
Diversion	The movement of water from a river system by means of pumping or gravity channels
Diversion licence	A type of water entitlement—specified licences issued for a specified annual volume and diversion rate.
Domestic and stock	Domestic and stock entitlements are issued for that particular purpose, and are often not tradeable
Dozer allocation	An allocation that is not fully utilised
General Security entitlement	A water entitlement where the user's yearly allocation varies according to the amount of water available, after allowing for fixed commitments such as High Security commitments, environmental provisions and expected losses during the year
Gigalitre	One thousand million litres, or one thousand megalitres
Gravity districts	Districts which use gravity to divert the flow of water from the river
High Security entitlement	An entitlement which does not vary from year to year and is expected to be available in all but the worst droughts
Irrigation	Supplying land or crops with water by means of streams, channels or pipes
Megalitre	One million litres, approximately the volume of an Olympic-sized swimming pool

Off-allocation	When unregulated tributary inflows or spills are sufficient to supply irrigation needs and downstream obligations
Permanent transfer	The transfer of water entitlements on a permanent basis; the right to permanent transfers allows irrigators to make long-term adjustments to their enterprise and enables new operators to enter the industry
Private diverters	Licensed to operate privately owned pumps or diversion channels; includes river pumpers and diverters
Regulated streams/waterways	Streams where users are supplied by releases from a storage. A water licence for a regulated stream specifies a base water entitlement defining the licence holder's share of the resources from a stream
Reliability	The probability that a water entitlement will be fully available for use in a given season
Riparian	Of, inhabiting or situated on the bank and floodplain of a river
Sales Water	In Victoria, water that may be purchased by an irrigator in addition to the basic Water Right or diversion licence. Access to Sales Water is announced each season as a performance of Water Right, depending on the available resource. In effect, a lower reliability entitlement attached to Water Rights or licences
Sleeper allocation	An allocation that does not have a history of water usage
Temporary transfer	Water entitlements transferred on an annual basis
Unregulated streams	Stream that are not controlled or regulated by releases from major storages
Utilisation	The amount of water available for diversion that is actually diverted
Water entitlement	The legal right of a user to access a specified amount of water in a given period – expressed in a variety of ways, including access right, High Security, General Security, water right, licence, sales entitlements, holding allocation, taking allocation
Water right	In Victoria, a high reliability entitlement to water, held by individuals in irrigation districts
Water system	The dams, regulated waterways, pumps, channels and pipelines that store water and deliver it to consumers

Source Based on MDBC 2003i; MDBC 2003h, Hassall & Associates, 2002.

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ABBREVIATIONS

$M	$ million
ABA	Australian Bankers Association
ABARE	Australian Bureau of Agricultural and Resource Economics
ABS	Australian Bureau of Statistics
ACC	Area Consultative Committee
ANZSIC	Australia New Zealand Standard Industrial Classification
ASGC	Australian Standard Geographical Classification
BTRE	Bureau of Transport and Regional Economics
CIT	Central Irrigation Trust
COAG	Council of Australian Governments
DLWC	NSW Department of Land and Water Conservation
DNRE	Victorian Department of Natural Resources and Environment
DWLBC	SA Department of Water, Land and Biodiversity Conservation
EPAC	Economic Planning Advisory Council
FMIT	First Mildura Irrigation Trust
GBCMA	Goulburn Broken Catchment Management Authority
GMW	Goulburn-Murray Water
GL	gigalitre
Ha	hectares
km	kilometres
km^2	square kilometres
LGA	Local Government Area
Ltd	Limited
MDB	Murray-Darling Basin
MDBC	Murray-Darling Basin Commission
MDBMC	Murray-Darling Basin Ministerial Council
MIA	Murrumbidgee Irrigation Area
MIL	Murray Irrigation Limited
ML	megalitre
NCC	National Competition Council
NLWRA	National Land and Water Resource Audit
NSW	New South Wales
RMCWMB	River Murray Catchment Water Management Board
SA	South Australia
SLA	Statistical Local Area

SME	Small-medium enterprises
SMEC	Snowy Mountains Engineering Corporation Ltd.
SMEDB	Sunraysia-Mallee Economic Development Board
SRWA	Sunraysia Rural Water Authority
VIC	Victoria
WAP	Water allocation plan
WMI	Western Murray Irrigation
WSP	Water sharing plan