Water Trading in Northern Victoria
1991/92 - 2005/06
A Snapshot of Water Trading in Northern Victoria

This report provides comprehensive background information on Victoria’s water market, irrigation sectors and trade experience. The report is focused on the period from 1991/92, when permanent trade of entitlements began, to 2005/06. It is based on data collected from rural water authority annual reports and billing systems, and data collected by Victorian Government agencies.

This document was prepared as a ‘point-in-time’ report covering the period from 1991/92 to 2005/06. Developments since 2005/06, many of which have been significant, are not covered. Three developments since 2005/06 are of particular significance.

Firstly, the analysis and interpretation contained in this report applies to the period prior to the unbundling of water entitlements in northern Victoria on 1 July 2007.

Secondly, the release of Our Water Our Future: The Next Stage of the Government's Water Plan in June 2007 included the announcement of a $2 billion Food Bowl Modernisation Project that has potential to capture up to 450 billion litres of water annually. This significant new investment in modernising ageing and inefficient infrastructure will create a world class irrigation system that will make more water available by reducing system losses.

And thirdly, another central component of the Next Stage is the expansion Victoria’s Water Grid – a network of rivers, channels and pipes linking Victoria’s major water systems. Expanding the Victorian Water Grid will allow more water to be transferred between more water systems. This will maximise flexibility for water sharing across regions and between uses and also provides a valuable insurance option to secure water supplies for households and industries across the State. Connections between rural, regional and metropolitan water supplies provide for greater security of supply in the face of ongoing drought and the challenge of climate change.

During the analysis undertaken for this report, minor discrepancies were found between some of the different data sources. This occurred, in part, because each water authority has different data managements systems that have changed over time. For this reason, perfect accuracy cannot be guaranteed. However, the accuracy of the data is considered to be sufficiently high to identify trends in water trade across districts and river groupings during the period covered.

Because of the introduction of the Victorian Water Register on 1 July 2007, data collation will become more precise. The Victorian Water Register is a publicly available accounting system that will enable the volumes of water shares and allocations to be better tracked in light of seasonal determinations, usage and trade.

Population and income statistics provide useful information when considering broad social and economic trends in northern Victorian regions. The Australian Bureau of Statistics (ABS) Census data is the source of such information in this report. At the time of completion, Census data for 1991, 1996 and 2001 was available, however the complete set of information produced from the 2006 Census was not available.

October 2007
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<td>A, F&amp;F</td>
<td>Agriculture, Forestry and Fisheries</td>
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<td>Agriculture-Advancing Australia</td>
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<td>AAG</td>
<td>Australian Agribusiness Group</td>
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<td>AB</td>
<td>Absolute</td>
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<td>Australian Bureau of Agricultural and Resource Economics</td>
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<td>Agriculture</td>
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<td>Australian dollar</td>
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<td>Boort irrigation district</td>
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<td>Collector District</td>
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<td>CFA</td>
<td>Country Fire Authority</td>
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<td>CG</td>
<td>Central Goulburn irrigation district</td>
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<td>CGE</td>
<td>Computable General Equilibrium</td>
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<td>CMA</td>
<td>Catchment Management Authority</td>
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<td>Council of Australian Governments</td>
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<td>COLIB</td>
<td>Coliban Regional Water Authority</td>
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<td>DIIRD</td>
<td>Department of Innovation, Industry and Regional Development</td>
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<td>DNRE</td>
<td>Department of Natural Resources and Environment, Victoria (now DSE)</td>
</tr>
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<td>Department of Premier and Cabinet</td>
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<td>DPI</td>
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<td>DSE</td>
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<td>Department of Treasury and Finance</td>
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<td>FMIT</td>
<td>First Mildura Irrigation Trust</td>
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<td>FY</td>
<td>Financial year</td>
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<td>GDP</td>
<td>Gross Domestic Product</td>
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<td>GMW</td>
<td>Goulburn Murray Water</td>
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<td>Gou/Bro/Lod/Cam</td>
<td>Goulburn, Broken, Loddon and Campaspe rivers</td>
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<tr>
<td>GRP</td>
<td>Gross Regional Product</td>
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<tr>
<td>GVCP</td>
<td>Gross Value of Commodities Produced</td>
</tr>
<tr>
<td>ha</td>
<td>Hectare</td>
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<tr>
<td>KECO</td>
<td>Kerang Cohuna irrigation districts</td>
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<tr>
<td>km</td>
<td>Kilometre</td>
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<td>L-CIR</td>
<td>Loddon Campaspe Irrigation Region</td>
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<td>LMW</td>
<td>Lower Murray Water</td>
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<td>LWRDC</td>
<td>Land and Water Resources and Development Corporation</td>
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<td>Abbreviation</td>
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<tr>
<td>Mallee CMA</td>
<td>Mallee Catchment Management Authority</td>
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<td>MDBC</td>
<td>Murray-Darling Basin Commission</td>
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<tr>
<td>Merb</td>
<td>Merbein</td>
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<tr>
<td>Merb, Red C, Rob.</td>
<td>Merbein, Red Cliffs and Robinvale districts.</td>
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<tr>
<td>MIS</td>
<td>Managed Investment Scheme</td>
</tr>
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<td>Mitta</td>
<td>Mitta Mitta river</td>
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<tr>
<td>ML</td>
<td>Megalitre</td>
</tr>
<tr>
<td>mm</td>
<td>Millimetre</td>
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<td>Mur/Kiewa/Ovens/Mitta</td>
<td>Murray river (upstream of Nyah), Kiewa, Mitta-Mitta and Ovens-King rivers.</td>
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<td>MV</td>
<td>Murray Valley</td>
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<td>Not applicable</td>
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<td>NSW</td>
<td>New South Wales</td>
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<td>NWC</td>
<td>National Water Commission</td>
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<td>Ny</td>
<td>Nyah irrigation district</td>
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<td>PH</td>
<td>Pyramid Hill irrigation district</td>
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<td>PIRVic</td>
<td>Primary Industries Research Victoria</td>
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<tr>
<td>R/Cliffs</td>
<td>Redcliffs</td>
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<td>RCS</td>
<td>Regional Catchment Strategy</td>
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<td>RDV</td>
<td>Regional Development Victoria</td>
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<td>RO</td>
<td>Rochester irrigation district</td>
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<td>RV</td>
<td>Regional Victoria</td>
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<td>SH</td>
<td>Swan Hill</td>
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<td>SIR</td>
<td>Shepparton Irrigation Region</td>
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<tr>
<td>Southern MDB</td>
<td>Southern Murray Darling Basin</td>
</tr>
<tr>
<td>SP</td>
<td>Shepparton irrigation district</td>
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<td>SuIR</td>
<td>Sunraysia Irrigation Region</td>
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<tr>
<td>Thomson/Mac</td>
<td>Thomson and Macalister rivers</td>
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<tr>
<td>TimberCorp</td>
<td>Timbercorp Limited is Australia's leading agribusiness investment manager</td>
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<tr>
<td>Torrumbarry</td>
<td>Kerang-Cohuna, Swan Hill and Woorinen</td>
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<tr>
<td>Tyn</td>
<td>Tynder</td>
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<td>VWR</td>
<td>Victorian Water Register</td>
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<tr>
<td>WPM</td>
<td>Water Policy Model</td>
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<tr>
<td>WTP</td>
<td>Buyer’s ‘willingness to pay’</td>
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<tr>
<td>WTS</td>
<td>Seller’s ‘willingness to sell’</td>
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E.1 EXECUTIVE SUMMARY

Report aims and structure

Victoria’s Water Act 1989 provides the legislative framework for Victoria’s water market. There have been several reforms of the water market and the Act since 1989, including modifications to the structure of property rights. Temporary trading began in 1989 and in 1991/92 trade in entitlements began.

This Study draws together new and existing data to describe activity in Victoria’s water market since trade was enabled. The study:

- identifies the number and types of entitlements traded since the formation of the market;
- identifies trends in trade of permanent and temporary entitlements;
- identifies how irrigation sectors and districts have adjusted to the water market;
- analyses the economic impact of the market; and
- seeks to understand people’s perceptions of water trading.

Chapter 2 of this Report, Victoria’s Water Market, details the legislation and policies that have shaped the market. This section also describes the features of a ‘cap and trade’ market and the key characteristics of Victoria’s water market.

Chapter 3: Victoria’s Irrigated Agriculture Sector, provides an overview of Victoria’s agricultural sector and the irrigation regions that this Report focuses on.

Chapter 4: Victoria’s Trade Experience, provides an overview of trade in northern Victoria over the past 15 years and draws on a body of data and analysis to determine how trade has affected key districts and industry sectors.

Chapter 5: Economic Analysis, discusses the value creation process and the economic impact of the water market.

Chapter 6: Social Perceptions of Trade, documents a range of different perspectives on Victoria’s water market and considers the factors that influence these perceptions.

Victoria’s Trade Experience

Structural adjustment in Victorian agriculture is not a new phenomenon. Over time, production is increasingly concentrated on larger farms. Less people are choosing to live in rural Victoria compared to urban centres and there is also a continuing increase in the role of off-farm income earned by farming families.

The relative ratio of water trade compared to total (irrigation) water use in Victoria is not large. Nonetheless, trade provides an important service for irrigators because it facilitates an adjustment of entitlement ownership which has:

- facilitated the development of a significant new irrigation region in Sunraysia;
- reallocated permanent and temporary water across Northern Victoria’s districts and industry sectors;
- allowed entitlements to move off less productive land; and
- improved risk management options for irrigators, especially during drought.
Sunraysia has imported the greatest volume of entitlements (116,063 ML or an additional 68% of its original entitlement) of all irrigation areas. The entitlements were sold from Goulburn-Murray Water’s (GMW’s) major irrigation districts, i.e. Torrumbarry (-39,245 ML, 10% of its original entitlement), Pyramid Boort (-31,738 ML, 13%), Central Goulburn (-20,533 ML, 5%) and Shepparton (-11,094 ML, 6%).

The main sellers of permanent water within GMW are the dairy (38%) and mixed farming (62%) sectors. Graziers are included in the mixed farming category. The dairy sector’s sale of permanent water is recent and began in the years directly following the 2002/03 drought.

Permanent trade has facilitated the movement of entitlement from salt-affected land. Trade allowed entitlement holders to realise the capital value of their water that was previously devalued because it was tied to less productive land. The liquidation of their water asset facilitated adjustment options for those involved.

Whilst GMW districts supplied most of the entitlement that was imported into Sunraysia, these districts also purchased significant volumes of temporary water. The main buyers of temporary water have been Central Goulburn, Torrumbarry, Rochester and Murray Valley, accounting for 97% of the purchases.

Sleeper licences on the following river groupings are the largest sellers of temporary water into GMW’s districts:

- Murray upstream of Nyah, the Kiewa, Ovens and Mitta Mitta rivers; and
- Goulburn, Broken, Loddon and Campaspe rivers.

The second main source of temporary water exports is Sunraysia. The third major source is from mixed farming, particularly in Pyramid Boort.

The overall area (ha) of irrigation within GMW has remained relatively constant. Between 1996/97 and 2003/04 the area of dairy fell by 6% and mixed farming grew by 4%. Horticulture grew in GMW by 33% (albeit from a low base) and in places like Boort, large scale Managed Investment Schemes (MIS) such as Olivecorp, have been established.

In the six years between 1997 and 2003, Sunraysia grew in irrigated area by almost 40%. This is mainly due to new developments on areas that were previously dry land farms adjacent to the Murray River. The area of developments adjacent to the Murray River grew by 75%. In comparison, growth on traditional irrigation districts in Sunraysia only grew by 5%.

**The combined effect of permanent and temporary trade**

To understand the impact of water trade on irrigated industries, we need to consider the combined impact of both permanent and temporary trade.

There is a misconception amongst some people that permanent trade is more reliable in terms of supply than temporary trade, but this is not the case.

Water purchased on the temporary market is more reliable in terms of supply than water allocated against an entitlement due to the fact that 1 ML of water purchased on the temporary market is guaranteed to be delivered, whereas in a dry or low allocation season, not every ML of entitlement will necessarily be delivered (depending on seasonal allocation).
Permanent and temporary water also differ in terms of exposure to price fluctuations. The price of temporary water moves up and down on the market depending on scarcity. On the other hand, the price of permanent water delivered to the entitlement holder is regulated through annual fees to a water authority.

Sectors such as horticulture that need to maintain watering every year to protect orchards will benefit from a relatively constant water supply at a guaranteed price. For this reason, the horticulture sector prefers operating on permanent water in regions that have experienced historically high reliability. Sectors such as grazing and mixed farming that do not have the same scale of capital investment have greater flexibility to change the crops and livestock they produce within a season. By capitalising on changes to commodity prices and the opportunity cost of traded water, mixed farmers and graziers can benefit from using temporary water.

Absolute trade is an indicator that has been developed to assist our understanding of the net effect of permanent and temporary trade. Absolute trade does not account for important implications of exposure to price risk; however it does enable us to consider the effects on production in regions and sectors. It also highlights that permanent and temporary trade should not be considered in isolation of each other.

For example, the two largest selling regions of entitlement (Torrumbarry and Pyramid Boort) sold 8% or less of their water in 2005/06 (after 15 years of trade) in absolute terms compared to their original 1991/92 entitlement base. The lower than anticipated absolute trade results occurred due to significant imports in seasonal allocations by both districts.

Approximately 40% of the sales in absolute water were from sleeper licences on river systems. The remaining was predominantly from GMW’s main irrigation districts, from the mixed farming and grazing industries and marginal farms seeking to exit the industry.

Within GMW, the dairy sector is the largest buyer of water in absolute terms. Despite a decade of prolonged low allocations and severe drought in 2002/03, dairy sector land area has remained relatively constant during this time. This is conceivably because the dairy industry has used trade to assist its management of low allocations.

Satellite images show that across the Shepparton Irrigation Region there has been a significant decline of water use as a consequence of shifting from perennial to annual pastures (a practice that resulted in a shorter watering season and less water requirements per hectare). Approximately 180,000 ha of perennial pasture was irrigated in the SIR in 1996/97, of which 28% or 50,000 ha disappeared by 2003/04.

Mixed farming is the largest exporter of water in absolute terms in GMW, exporting both permanent and temporary water.

Horticulture’s absolute trade results fluctuate depending on investment and climate cycles. The sector buys large volumes of permanent water to expand production and sells temporary water in non-drought years.

Horticulture has used trade to smooth water use across various climatic conditions and allocations. Had this sector not been able to access additional water on the market during low allocations, the long term cost to valuable perennial crops would have been significant.

Managed Investment Schemes (MIS) are thought to have played a role in encouraging the establishment of large horticulture private diversion businesses. The ongoing role of MIS is uncertain. The Australian Taxation Office is currently reviewing the eligibility of non-forest schemes and has flagged an intention to phase them out.
Trade effects on local economies

The net value created by trade is positive, but there may be local distributional impacts.

The distribution effects of water trade depend on whether the people who sell the water stay in the region and whether they invest outside the region. The effects will also depend on whether those purchasing temporary allocations are doing so to offset their sale of entitlements, or whether those irrigators selling entitlements are different to those who are purchasing allocations.

The overall trend across GMW’s main irrigation districts was a decline in the number of people employed in Agriculture, Forestry and Fishing (A,F&F) by 5% between 1996 - 2001. On the other hand, sectors such as manufacturing, wholesale trade and health services grew, with the total number of people employed across GMW increasing by 5%.

In Pyramid Boort, employment in A, F&F declined by 4% and overall local employment also decreased by 9%. Pyramid Boort also had the highest loss of population (by 2.4%) of any GMW district between 1991 and 2001. Pyramid Boort has the least diversified economy of any irrigation area.

In contrast, Central Goulburn had a decline in persons employed in A, F&F of 7% but the number of total persons employed increased by 6%. Similarly, Shepparton experienced a 5% decline in persons employed in A, F&F, but employment overall increased by 16%. The population also increased in Central Goulburn (5.6%) and Shepparton (2.7%) during this period.

During this period of adjustment, Pyramid Boort also experienced the combined largest rise in average household and individual income of any district between 1991 and 2001. Water trade allowed farmers on marginal properties to realise (sell) the capital value of their water entitlement that was previously tied to less productive land. Water trading provides opportunities to exit the industry, retire areas of less productive land and respond to the opportunity cost of traded water.

A trend of a shrinking agricultural sector relative to other parts of the economy is consistent with general long-term trends in Australia and other Westernised economies.

Water trade, wealth creation and risk management

Market activity is measured by both the volume of water traded and the number of trades executed. Victoria’s irrigators have participated in the water market since its inception, with the level of market activity increasing.

The market for temporary water reflects seasonal pressures; irrigators enter the market for temporary water to protect production in periods of stress. Dry seasons in 1994/95, 1997/98 and 2002/03 are associated with spikes in the volume of temporary water traded in Victoria.

The sale and purchase of entitlements are driven by irrigation trends – that is, structural adjustment towards more economically-efficient irrigated production. For irrigators wishing to expand their business, the water market makes it possible to source additional entitlements. Conversely, for struggling irrigators the market makes it possible to either exit the industry or to restructure in favour of different crop mixes.

Sunraysia Case Study

Until 1988/89 Sunraysia’s irrigation enterprises were constrained by fixed water allocations, with dry land grazing the dominant land use. The water market has made it possible for irrigators in Sunraysia to purchase water and increase production of water-dependent high-value crops.
Sunraysia’s irrigation sector has expanded significantly; in the six years from 1997 to 2003 the number of hectares irrigated in Sunraysia grew by nearly 40%.

Private diverters pump directly from the Murray River using privately-owned infrastructure that gives irrigators autonomy and the ability to use their entitlement as needed.

While employment in agriculture, forestry and fisheries (A,F&F) has generally declined across Australia and within neighbouring GMW (by 5%), employment in Sunraysia grew by 10.5% between 1991 and 2001. The average annual population growth rate between 1981 and 2001 was 2.3%, with Mildura the third fastest-growing town in Victoria after Bendigo and Wodonga.

**Drought Case Study**

Irrigated agriculture is exposed to climatic variability and natural fluctuations in the available water supply. Managing environmental pressures is crucial to the viability of Victoria’s agriculture sector. The market allows people to purchase water to start or finish off a crop when natural rainfall and/or existing allocations are inadequate.

Without an efficient water market, farmers with drought-sensitive crops are unable to purchase additional water, despite the fact that other irrigators might be willing to sell.

Market data suggests that as water availability falls, the volume of water purchased and the number of transactions in the market increase. In 2002/03 the volume of water available was 617,066 ML less than the volume available in the previous year. The number of temporary trade transactions increased in GMW by 81% and in LMW by 238% during 2002/03 compared to the following year.

An increase in prices during a drought reveals the increased value irrigators place on water during periods of scarcity. In mid-December 2006, when allocations on the Goulburn System were only 24%, the price of temporary water reached $950/ML. During less scarce times, water traded for $10/ML.

TERM-Water – a water-enhanced computable general equilibrium modelling framework for Australia that is able to assess the flow-on effects of changes in land, labour and capital as a consequence of trade – modelled impacts of the drought on Australia’s economy, regions and industries. TERM-Water model results have found that gains from water trading rise as water scarcity worsens. The results suggest that water trading is particularly valuable in times of drought.

The Water Policy Model (WPM) – a spatial equilibrium model that uses net social welfare as the objective and is used to understand the economic welfare implications of changing water use in the southern Murray Darling Basin – found that under drought conditions comparable to the 2002/03 drought, water trade created $29 million worth of farm gate value to irrigators in GMW’s main irrigation districts (excluding Torrumbarry).

Victoria’s water market is creating value for irrigators and reallocating water entitlements to higher-value users.

**Social consequences and perceptions of water trading**

The social impacts of trade vary for a range of reasons and can affect irrigation sectors and regions differently. There are however, observable groups of behaviour that provide insight into the factors that influence people’s trade experience.
Preliminary analysis using 1991, 1996 and 2001 ABS Census data was conducted to compare irrigation districts with a Regional Victoria (RV) average across a range of socio-economic indicators.

Between 1991 and 2001, the population of the irrigation districts rose at an average annual rate of 3% compared to a population growth rate of 0.5% for RV. The combined irrigation districts examined accounted for approximately 35% of the total population growth in RV between 1991 and 2001.

Overall, the unemployment rates among residents of the northern irrigation districts were well below the RV average and participation rates were considerably higher, indicating relatively strong local labour markets. The combined northern irrigation districts also had a higher proportion of persons in full-time work.

The average household and individual incomes of northern irrigation districts were higher than the RV average in 2001.

There is general support amongst irrigators and local communities for temporary trade; however different views are expressed about the social effects of permanent trade. The views vary depending on a range of factors, such as whether the region is a net buyer or seller of permanent water, the type of industry represented, the structure of the business, farm viability and so on.

Negative perceptions of trade include concerns about ‘water barons’; inequitable activisation (and profiting) of previously unused entitlements by ‘sleeper licences’; large volumes of water exported out of particular areas; higher infrastructure costs, ‘stranded assets’ etc.

Positive perceptions include the ability to restructure irrigation businesses, pay off debt, exit the industry with capital for alternative ventures, expand businesses and create significant new irrigation regions.

Current feelings in rural Victoria that water is fundamental to an area’s prosperity may be a legacy of a system that was established because irrigation development in many cases resulted in the settlement of entire new areas. The idea of moving water out of an area is considered by some as removing the reason for the area’s existence, even though the regional economy may have, in fact, diversified considerably.

Conclusions

The opening up of Victoria’s water trading system, which has coincided with one of the driest decades on record, has helped to lessen the burden of drought by providing a mechanism to manage this risk. The market has facilitated an efficient allocation of water in a way that government agencies could not do. Water trading enables wealth creation and risk management options for irrigators that were previously not available.

While the social perceptions of permanent trade vary and further work to understand localised impacts may be warranted on a case by case basis, the market is providing overall benefits that support policy assumptions underlying the development of water trade in Victoria. Water trading provides greater choice and is increasingly being used by irrigators across regions and sectors to improve their business management.
1. **INTRODUCTION**

1.1 **REPORT – PURPOSE**

Victoria’s 1989 *Water Act* created the legislative framework for a Victorian water market. Victoria’s water allocations were historically “attached” to blocks of land, with each landholding entitled to an annual allocation from the available supply. There have been several reforms of the water market and the Act since 1989, including modifications to the structure of property rights. Temporary trading began in 1989 and in 1991/92 trade in entitlements began. The trading rules were widened significantly in 1994. These changes included allowing trade for the first time out of irrigation districts, between supply systems and into the Sunraysia region. Although there are physical and legal restrictions on the volume of water that can be bought and sold, irrigators are otherwise able to buy and sell entitlements as they would buy or sell any other agricultural input.

This Study draws together new and existing data to describe activity in Victoria’s water market over the last 15 years, and also explores the impact of the market on regional communities and industries. The study:

- identifies the number and types of entitlements traded since the formation of the market;
- identifies trends in trade of permanent and temporary entitlements;
- identifies how irrigation sectors and districts have adjusted to the water market;
- analyses the economic impact of the market; and
- seeks to understand perceptions of water trading.

This Study was initiated in 2006 following recognition that a deeper understanding of the water market was required to inform policy and to respond to growing public interest in the market.

1.2 **REPORT STRUCTURE**

Chapter 2 of this Report, Victoria’s Water Market, details the legislation and policies that have shaped the market. This section also describes the features of a ‘cap and trade’ market and the key characteristics of Victoria’s water market.

Chapter 3: Victoria’s Irrigated Agriculture Sector, provides an overview of Victoria’s agricultural sector and the irrigation regions that this Report focuses on.

Chapter 4: Victoria’s Trade Experience, provides an overview of trade in northern Victoria over the past 15 years and draws on a body of data and analysis to determine how trade has affected key districts and industry sectors.

Chapter 5: Economic Analysis, discusses the value creation process and the economic impact of the water market.

Chapter 6: Social Perceptions of Trade, documents a range of different perspectives on Victoria’s water market and considers the factors that influence these perceptions.
2. **BACKGROUND: VICTORIA’S WATER MARKET**

2.1 **LEGISLATIVE AND POLICY FRAMEWORK**

Victoria’s 1989 *Water Act* created the legislative framework for a Victorian water market. Victoria’s water allocations were historically “attached” to blocks of land, with each landholding entitled to an annual allocation from the available supply. There have been several reforms of the water market and the Act since 1989, including modifications to the structure of property rights. Temporary trading began in 1989 and in 1991/92 trade in entitlements began. The trading rules were widened significantly in 1994. These changes included allowing trade for the first time out of irrigation districts, between supply systems and into the Sunraysia region. Although there are physical and legal restrictions on the volume of water that can be bought and sold, irrigators are otherwise able to buy and sell entitlements as they would buy or sell any other agricultural input.

In addition to State legislation, Victoria’s water market has been shaped by the Murray Darling Basin Agreement and Council of Australian Government (COAG) policies. The Murray-Darling Basin Agreement was signed in 1992. As the Basin extends through Queensland, New South Wales, Victoria and South Australia, the water supply of downstream states is dependent on the water management policies of upstream states. The Murray-Darling Basin Agreement stipulates the volume of water that Victoria is allocated from the Murray, which has an impact on the volume of water available for trade on the Murray System. In response to growing concern about the environmental health of the Murray Darling Basin, permanent extraction caps were introduced for New South Wales, Victoria and South Australia in 1997.

In 1994 COAG developed the Water Reform Framework, a national policy designed to achieve efficient and sustainable reform of Australia’s rural and urban water industries. In 1995 National Competition Policy was introduced, which made payments available to States and Territories for the successful implementation of reforms consistent with the COAG Framework.

In June 2004 the Murray-Darling Basin Ministerial Council established the Living Murray program, underpinned by an Intergovernmental Agreement. The Program’s ‘First Step’ allocated $500 million to recover water and to improve the health of the river system. The Program emphasised the role of water markets as a means of sourcing water for environmental flows. At the same time the COAG Framework was extended through an Intergovernmental Agreement - National Water Initiative (NWI). The NWI has nine key elements, the first two of which are:

- water access entitlements and planning framework; and
- water markets and trading.

The NWI aims to expand water trading and, in turn, improve the economic efficiency of water. Its other key goal is to achieve socially and environmentally sustainable water use. As with the Living Murray Program, the NWI emphasises the role of the market as a cost-effective method for purchasing water for environmental flows. The NWI is also designed to improve the monitoring, reporting and accounting of water use.


2.1.1 **PLANNED REFORMS**

*Our Water, Our Future* demonstrates the Victorian Government’s ongoing support for the Victorian water market and its planned investment in market reforms. Of particular significance
to the water market are planned rural reform initiatives that include unbundling, asset reconfiguration, and the creation of a Victorian Water Register. The Government will also establish an environmental water reserve which, for the first time, will create legally enforceable property rights for environmental water.

Unbundling is designed to improve the efficiency and flexibility of the Victorian trading system. It will modify the structure of existing property rights and separate the existing water entitlement into three elements: a water share (high and general security share), a delivery share and a water-use licence.

The high security share will represent the existing irrigator’s entitlement. The general security share is new (and tradeable) and represents an entitlement to receive sales water, i.e. irrigators will be able to sell their entitlement to receive sales water to other irrigators. Given that sales water is allocated after permanent water, this share has lower security of supply characteristics.

Unbundling also separates the transferable components of an entitlement (the water and delivery shares) from the non-transferable components (water-use licence).

2.1.2 **Asset reconfiguration and the Victorian Water Register**

Through *Our Water Our Future*, the Victorian Government committed to work with water authorities to review existing irrigation infrastructure needs and availability against future water demand. The Government will increase investment in infrastructure to reflect increased and anticipated water demands, and in other cases will decommission infrastructure. The reconfiguration of Victoria’s irrigation assets is designed to increase the efficiency of Victoria’s water supply system.

The Victorian Water Register (VWR) is designed to facilitate the transparent and accountable management of Victoria’s water resources. The VWR will be implemented in regulated northern Victorian systems by 1 July 2007. Data from the VWR will be reported annually in State Water Reports.

2.2 **Victoria’s Water Market: Market Mechanism**

2.2.1 **Cap and Trade Markets**

Water is a scarce resource in high demand. Competing demand for water gives rise to a complex allocation problem, which in Victoria has historically been resolved by linking water entitlements to land. Victoria’s water market is an allocation mechanism that not only accounts for the scarcity of water, but also creates economic value by allowing farmers to trade their entitlements. This form of market is known as a “cap and trade” market.

The term “cap” refers to a resource extraction limit (or, conversely, a pollution emission limit) that is divided into a number of property rights available within a market. A market’s “cap” will reflect policy objectives; this will often be an ecologically sustainable level of extraction or emission. In the case of Victoria’s water market, the ‘cap’ is the total volume of water allocated for irrigation purposes. In some districts this cap also accounts for allocations to the environment, urban water and recreation uses.

This capped volume is then divided into entitlements. The property rights that are bought and sold in a market must be well defined, legally recognised and enforceable (Haites, 2002). Two

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1 Victorian Government White Paper, *Our Water Our Future*, 2004, Chapter 4,
types of property rights are traded in Victoria’s water market – permanent water entitlements and seasonal allocations. The market facilitates participants selling their property right if the value from trade exceeds the value of the right to the participant. For other participants (buyers) the market makes it possible to purchase property rights if the economic benefit exceeds the market price. In this manner the market gives rise to an efficient allocation of property rights – that is, the market allocates property rights to the party that places the greatest value on them, and therefore maximises the economic gains from trade.

Rather than allocating water rights to landholdings, Victoria’s water market allows irrigators to reallocate entitlements to those irrigators who can maximise the economic value of water, subject to hydrology, environmental circumstances and trade constraints. This process not only increases the economic ‘productivity’ of water entitlements, but creates opportunities for farmers to benefit economically from the sale or purchase of entitlements.

### 2.2.2 Markets and Asymmetric Information

In order for allocation mechanisms to be efficient they must resolve the information asymmetry problems that are inherent in most trading environments. ‘Asymmetric information’ refers to the fact that parties to a transaction hold private information that affects the value of the transaction. Asymmetric information can cause problems both before and after the transaction is executed. ‘Adverse selection’ is a problem prior to the transaction and occurs when the seller of goods holds private information on the characteristics of the goods being sold. This is known as ‘quality uncertainty.’ Quality uncertainty can be so extreme that people will elect not to buy on the market, leading to market failure. A successful allocation mechanism therefore needs to ensure that property rights are well designed so that there is no uncertainty regarding the quality of goods being traded in a market. In the case of Victoria’s water market, all participants must be sure that entitlements are ‘high quality’ – that is, that they are legally recognised property rights. The exact nature of the entitlement must also be clear, and therefore must stipulate details such as the entitled volume of water and whether the entitlement is permanent or seasonal.

Moral hazard is a problem when the value of the good is affected by one party’s actions after the transaction has taken place. This is most often a problem when the good being sold is a form of contract, or stipulates a set of actions. In Victoria it is crucial that any institution designed to allocate water entitlements ensures that farmers extract only as much water as stipulated in their entitlements. Well-designed monitoring and compliance schemes can be used to reduce the risk of moral hazard.

Victoria’s cap and trade water market resolves several dimensions of the adverse selection and moral hazard problems. Water entitlements are legally recognised and well-defined property rights, and water authorities have responsibility for monitoring and enforcing individual compliance with water entitlements. However, due to trade constraints (Section 2.3.2), including transaction costs, entitlements will not necessarily be transferred to the irrigator who values them most highly. The water market therefore resolves adverse selection within the constraints of the market. Accurate metering is also important to provide information on water use to users and water authorities.
2.3 **Victoria's Water Market: Key Characteristics**

**2.3.1 Property Rights**

Two different types of property rights are traded in Victoria’s water market:

- water entitlements; including water rights and diversion licences. The trade of water entitlements is referred to as a ‘permanent trade’; and
- seasonal allocations made against a person’s entitlement. Trade of this allocation is referred to as ‘temporary trade’.

A permanent entitlement is an irrigator’s ongoing claim to a share of a water system and is usually expressed in megalitres (ML). Allocations against entitlements depend on how much water is available in the system for distribution after system losses and reserves for the following year have been accounted for. In the event that the total water supply is below the total quantity of water in the system, entitlement holders will receive a corresponding percentage of their individual entitlement. Thus, for example, in a dry season, if 50% of the district’s total entitlement is available for distribution, each farmer is allocated 50% of their permanent entitlement.

When an entitlement is sold in the market it is known as permanent trade and the corresponding quantity of water is diverted to the buyer until the entitlement is sold again. A diversion licence is equivalent to a permanent entitlement in an irrigation district, except it entitles the holder to pump water (using his or her own infrastructure) from a stream or river rather than have it delivered by the water authority via a network of man-made channels or pipes. Irrigators who pump water from rivers are known as private diverters.

Private diverters can operate on a regulated or unregulated river or stream. If an authority delivers the water down the river via the operation of a dam or weir it is known as a regulated river (the flows are managed by the water authority). Unregulated streams do not contain major upstream reservoirs and private diverters pump from the stream when water is available. Unregulated rivers comprise most of Victoria’s waterways but are the source of less than 10% of the water used by irrigators.

A seasonal/annual allocation is "announced" by the water authority periodically though the irrigation season, which typically runs for nine months from August to May. Allocations are made against entitlements and depend on how much water is available in the system for distribution after accounting for system losses and reserves for the following year. If irrigators do not wish to permanently sell their entitlement (but can get a better market price for water than they can earn using the water as an agricultural input) then the farmer can sell a seasonal allocation. This is known as temporary trade.

Sales water is additional water that is allocated seasonally when available. Sales water is made available if there is enough water to allocate 100% of people’s entitlement plus reserve for the following year and there is excess water available for distribution. Prior to the recent ten-year dry period, most Goulburn Murray Water (GMW) irrigation districts received sales water, meaning they were allocated 100% of their entitlement plus the option of an additional percentage of sales water. The volume of sales water allocated in a particular season depends on how much water is available in the system (accounting for an appropriate volume of water being set aside for the following season). For example, irrigators may be offered up to 150% of their entitlement in a particular season, i.e. 100% of their entitlement plus an additional 50% sales water.
2.3.2 CONSTRAINTS ON TRADE

Water markets create value through trade. It is important to recognise that Victoria’s water market is subject to constraints. This is partly due to the nature of the good being traded – water cannot be moved seamlessly throughout the State, and so in some cases trade between districts is not possible and in other cases it may be expensive. Infrastructure therefore has an important role to play as a facilitator of trade. The more physically mobile water is, and the more cheaply it can be moved, the greater the scope for an efficient allocation of water across the State.

Trading rules create Zones which are allowed to trade and back trade according to a complex range of rules that ensure the receiving system is able to deliver water.

In addition to physical constraints on trade there are also administrative and regulatory rules that further restrict trade or increase costs. These rules can be specific to particular water authorities and include, for example:

- barriers to market participation;
- the prohibition of some urban buyers from buying water entitlements from the rural water market;
- ownership of entitlements (after unbundling) by non-landholding buyers being limited to a maximum of 10% of water entitlements;
- restricted volume of permanent water traded between districts. Until 2006/07 trade was capped at 2% of a district’s entitlement, with the cap now fixed at 4%; and
- exit fees levied against irrigators (not applicable in Victoria)\(^2\) that no longer wish to receive water and sell their delivery share. This may create disincentives to exit the water market.

There are also features of the broader economy that may affect the efficiency of water allocation, such as tax incentives, government subsidies and grants which may influence the profitability of particular farm types, creating distorted incentives to buy and sell water.

2.3.3 TRADING PLATFORMS

Transactions in Victoria’s water market can be organised through brokers and/or through water exchanges such as Watermove which is owned by GMW. Watermove is a web-based trading platform that conducts temporary and permanent trade in Victoria. Traders may submit offers by mail, fax or online and the transactions occur weekly. A pool price for each trading zone is determined based on successful offers to buy and sell. Approximately 30% of all of northern Victoria’s temporary transactions are executed through Watermove, although the rate varies significantly across districts.

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\(^2\) Note that from 2007/08 termination fees will apply in Victoria. Termination fees will be a fee payable for surrender of a delivery share as part of unbundling reforms.
The natural supply of water is highly variable. This variability creates uncertainty for irrigators, making it difficult, for example, to anticipate crop yields and to plan investment. There are a range of instruments policy-makers can use to cushion irrigators against extreme variations in the water supply, including:

- **Physical Infrastructure, including dams and weirs**
  - Physical infrastructure makes it possible for authorities to manage the volume of water made available for distribution. Dams and weirs, for example, make it possible for water authorities to hold back surplus water for distribution during dry periods.

- **Property Rights**
  - It is essential that the property rights in a water market are sufficiently flexible to accommodate the variability of the water supply. For this reason entitlements do not guarantee irrigators a given volume of water – rather, they entitle irrigators to a particular claim on a district’s available supply in an average year.

- **The Water Market**
  - The water market makes it possible for irrigators to purchase and sell water entitlements, and therefore to manage the risks associated with a variable water supply.

Victoria’s infrastructure, the structure of property rights (entitlements) and the water market helps cushion irrigators against extreme and unpredictable fluctuations in water availability.

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**Figure 1 – Percentage of temporary trade through Watermove**

20% 29% 31% 34% 37% 35%
3. **VICTORIA’S IRRIGATED AGRICULTURE SECTOR**

Victoria had the highest Gross Value of Agricultural Commodities Produced in Australia at $8,711 million (2003/04) followed closely by New South Wales. In February 2006, the sector directly employed 74,600 persons or 3.0% of the total Victorian workforce (Department of Primary Industries 2006).

In absolute terms, real agricultural output has more than doubled over the four decades to 2003/04 and agricultural exports have almost tripled in value (real terms) since the mid-1970s. Agriculture has become increasingly export-oriented over the last two decades — around two-thirds of production is now exported (Department of Primary Industries 2006: 2).

A significant proportion of Victoria’s agriculture is produced in Victoria’s irrigation areas, located predominantly along the Murray, Goulburn and Loddon Campaspe systems. Irrigation also occurs south of the Great Dividing Range in the Macalister, Werribee and Bacchus Marsh districts and surrounding tributaries, although these areas are not considered in this report.

### 3.1 **VICTORIA’S NORTHERN IRRIGATION AREAS**

This Study focuses on North Victoria because the bulk of Victoria’s water trade activity occurs in this region. The high level of market activity can be attributed to the interconnectivity of the region’s delivery system, facilitating trade between a greater number of irrigators and regions than elsewhere in the State. The three main irrigation regions in northern Victoria are the Shepparton Irrigation Region, the Loddon-Campaspe Irrigation Region and the Sunraysia Irrigation Region.

<table>
<thead>
<tr>
<th>Irrigation Region</th>
<th>Rainfall Range mm</th>
<th>Land Area 1,000 ha</th>
<th>Area Irrigated 1,000 ha</th>
<th>Irrigation district</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shepparton</td>
<td>400 - 600</td>
<td>519</td>
<td>280</td>
<td>Murray Valley</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Shepparton</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Central Goulburn</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Rochester</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Private diverters on rivers</td>
</tr>
<tr>
<td>Loddon-Campaspe</td>
<td>373 – 445</td>
<td>714</td>
<td>333</td>
<td>Campaspe</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Torrumbarry</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Pyramid-Boort</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Private diverters on rivers</td>
</tr>
<tr>
<td>Sunraysia</td>
<td>200 - 400</td>
<td>N/A</td>
<td>43</td>
<td>Nyah</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Tresco</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Merbein</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Red Cliffs</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>First Mildura Irrigation Trust</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Robinvale</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Private diverters rivers</td>
</tr>
</tbody>
</table>

3 Based on water authority boundaries.
Table 2 highlights the different concentrations of land use type (or sector) in each irrigation region. Broadly speaking, Shepparton Irrigation Region is the major dairy area, Loddon Campaspe Irrigation Region is the main mixed farming area and Sunraysia Irrigation Region is the main horticulture area.

Table 2 – Irrigated land use summary within the Northern Victorian Irrigation Regions

<table>
<thead>
<tr>
<th>Irrigation Region</th>
<th>Dairy</th>
<th>Mixed</th>
<th>Grazing</th>
<th>Lifestyle</th>
<th>Horticulture</th>
<th>Cropping</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shepparton (SIR)</td>
<td>46</td>
<td>26</td>
<td>15</td>
<td>5</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Loddon-Campaspe (L-CIR)</td>
<td>22</td>
<td>37</td>
<td>30</td>
<td>1</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Sunraysia (SuIR)</td>
<td>-</td>
<td>13</td>
<td>-</td>
<td>-</td>
<td>82</td>
<td>5</td>
</tr>
</tbody>
</table>

Historically the River Murray, Goulburn and Campaspe systems are highly reliable. More recently the Goulburn and Campaspe systems have been less reliable than the Murray due to extended dry conditions. The allocation history for the three irrigation seasons to 2004/05 is shown in Table 3 (Goulburn-Murray Water 2006).

Table 3 - SIR allocation history (2002/03 – 2004/05)

<table>
<thead>
<tr>
<th>Irrigation Supply System</th>
<th>Allocation, %</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2002/03</td>
</tr>
<tr>
<td>River Murray</td>
<td>129</td>
</tr>
<tr>
<td>Goulburn</td>
<td>57</td>
</tr>
<tr>
<td>Campaspe</td>
<td>100</td>
</tr>
</tbody>
</table>

The following section briefly describes the key features of each irrigation region. Further information is available in Appendix C.

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Note: mixed farming includes vegetables.
3.2 SHEPPARTON IRRIGATION REGION

The Shepparton Irrigation Region (SIR) is located approximately 180 km north of Melbourne and comprises the Murray Valley, Shepparton, Central Goulburn, Rochester and Campaspe Irrigation Districts (Refer to Figure 2). It covers an area of approximately 519,240 ha, of which approximately 280,000 ha is irrigated (Goulburn Broken Catchment Management Authority 2002).

Towns within the SIR include Cobram, Numurkah, Nathalia, Strathmerton, Shepparton, Mooroopna, Tatura, Kyabram, Stanhope, Tongala, Rochester and Echuca.

The River Murray, Broken River, Broken Creek, Goulburn River and Campaspe River are the major tributaries flowing through the SIR. The average annual rainfall in the SIR varies from 600 mm in the east to 400 mm in the west (Bureau of Meteorology 2005). The majority of water for irrigation supply is provided by Lake Eildon on the Goulburn River with other storages on the Broken and Campaspe Rivers supplementing flows into the irrigation districts (Goulburn Broken Catchment Management Authority 2002). The Murray Valley Irrigation District is supplied by the River Murray diverted to the Yarrawonga Main Channel at Yarrawonga Weir (Goulburn Broken Catchment Management Authority 2002).

Key government stakeholders with responsibility for irrigation management in the SIR include the Goulburn Broken Catchment Management Authority (CMA), Goulburn-Murray Water

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5 The SIR extends from Yarrawonga Weir in the east to west of the Rochester Township and from Goulburn Weir in the south to the River Murray in the north. The SIR is bound by the East Goulburn Main Channel, the Campaspe River in the west, the Cattanach Canal and Waranga Western Main Channel in the south and the River Murray in the north.
(GMW), the Department of Sustainability and Environment (DSE), Environmental Protection Authority Victoria (EPA) and the Department of Primary Industries (DPI) (Victorian Government 2004). A summary of stakeholder responsibilities is provided in Appendix C.

Figure 3 shows the current distribution of land use within the SIR. The dairy industry dominates land use in SIR (46%), followed by mixed farming\(^6\) (26%), grazing (15%), lifestyle (5%), horticulture (4%) and cropping (3%)\(^7\). A large version of this map is provided in Appendix C along with detailed land and water use data by district for GMW’s major irrigation districts.

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\(^6\) Mixed farming is a broad category that represents a property that has more than one enterprise type. It may include any combination of dairy, horticulture, cropping, grazing, intensive, lifestyle or other.

\(^7\) PIRVic data, 2003

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3.3 **LODDON-CAMPASPE IRRIGATION REGION**

The Loddon-Campaspe Irrigation Region (L-CIR) is located in north-central Victoria, approximately 250 km north-west of Melbourne and primarily comprises the Torrumbarry, Pyramid-Boort, Nyah and Tresco Irrigation Districts. A small area of the Shepparton Irrigation Region (SIR), namely the Rochester and Campaspe Irrigation Districts, also exist within the Region. Torrumbarry is the second largest system behind Central Goulburn in terms of entitlement.

The geographic centre of the Loddon-Campaspe Irrigation Region is located near Pyramid Hill (North Central Catchment Management Authority 2006). The Region covers 713,876 ha of land...
Towns within the Loddon-Campaspe Irrigation Region include Echuca, Cohuna, Swan Hill, Tyn Tynder, Kerang, Boort, Pyramid Hill, Serpentine and Rochester.

The Loddon-Campaspe Irrigation Region is located in an area characterised by its low rainfall, which varies from between 373 mm to 445 mm a year (North Central Catchment Management Authority 2006). The region contains relatively significant areas of saline-affected soil. Salinity Management Plans were developed for Kerang-Swan Hill, Tragowel Plains, Torrumbarry East of Loddon and Boort.

The River Murray, Campaspe River and Loddon River are the major tributaries flowing through the Loddon-Campaspe Irrigation Region. The reliability of Torrumbarry’s system, (apricot-coloured area) which is fed by the Murray River, is the same as the reliability of the Murray Valley Irrigation District. In recent years the Murray System has been more reliable than Goulburn System, which supplies Pyramid Boort (pink area) – see Figure 4.

Agriculture plays a major role in the Loddon-Campaspe Irrigation Region (Barr, N 2005: 17). Unlike SIR, which has the largest proportion of dairy farms, the land use by area in L-CIR is predominantly mixed farming.

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8. Irrigated area of the Nyah and Tresco Irrigation Districts is unknown.

9. Based on the irrigation property boundary.
Key government stakeholders with responsibility for irrigation management in L-CIR are North Central and Goulburn Broken Catchment Management Authorities, GMW, DSE, EPA and DPI. A summary of stakeholder responsibilities is provided in Appendix C.

Figure 5 shows the current distribution of land use within the Loddon-Campaspe Irrigation Region. Unlike SIR, the dominant industry is mixed farming (74%) which includes cropping, grazing and lifestyle, followed by dairy (22%) and horticulture (6%)\(^\text{10}\). A large version of this map is provided in Appendix C along with detailed land and water use data by district for GMW’s major irrigation districts.

![Figure 5 - Loddon Campaspe Region – land use map](image)

### 3.4 Sunraysia Irrigation Region

The Sunraysia Irrigation Region (SuIR) is located in north-west Victoria approximately 690 km north of Melbourne.

The Region comprises of the First Mildura Irrigation Trust, Merbein, Redcliffs and Robinvale Irrigation Districts, plus private diverters along the River Murray between Nyah West and the South Australian border (refer Figure 6). It extends west from the Nyah Township to the South Australian border, primarily centred in close proximity to the River Murray.

\(^{10}\) PIRVic data, 2003
Towns within the Sunraysia Irrigation Region include Mildura, Robinvale, Redcliffs and Merbein.

The average annual rainfall in the Sunraysia Irrigation Region varies from 400 mm in the east to 200 mm in the west (Bureau of Meteorology 2005). The River Murray (and its floodplain, tributaries and associated wetland systems) is the major tributary flowing through the Region.

The majority of water for irrigation is provided from Lake Hume on the River Murray near Albury-Wodonga; however other storages on the Broken, Goulburn and Campaspe Rivers supplement flow into the River Murray to supply the region.

Key government stakeholders with responsibility for irrigation management in SuIR are Mallee CMA, Lower Murray Water (LMW), First Mildura Irrigation Trust (FMIT), DSE, EPA and DPI. A summary of stakeholder responsibilities is provided in Appendix C.

Figure 7 shows the current distribution of land uses within the Sunraysia Irrigation Region. The majority of the land by area is horticulture. A large version of this map is provided in Appendix C.

Horticulture is the major irrigated land use in SuIR representing 82% of irrigated land. Grapevines represent 55% of horticultural plantings, while citrus (8%), nut trees (15%) and fruit trees (3%) make up the remainder. The area of cropping has reduced substantially in the last decade and now accounts for only 5% of the irrigated hectares. Vegetables (mixed farming\(^{11}\)) are fairly stable at 11% (SunRISE21 2007). In recent years nut trees (mainly almonds) have increased significantly (predominantly within the Managed Investment Scheme structure). Table 4 shows the spread of land use in Sunraysia.

\(^{11}\) It is worth noting that vegetables are categorised as mixed farming because they are not a perennial crop.
LONG TERM ADJUSTMENTS IN VICTORIA’S AGRICULTURE

Changes to Victoria’s irrigation districts and dry land areas occur due to a range of factors such as deregulation, changes in market preferences, technology, commodity prices etc. Structural adjustment in Victorian agriculture is not a new phenomenon.

ABARE has calculated there has been an average 3% per annum decline in the terms of trade of Australian grain growers over the 15 years to 1998/99 (Knopke, P, O’Donnell, V & Shepherd, A 2000). By 1987, the real price for wheat was half the price received in 1981 (Barr, N 2005: 10).
In the grain producing areas of the Wimmera and Mallee, the number of farms fell by almost half during the period 1961 to 2001, and in many cropping Statistical Local Areas (SLAs) population fell by over 40% in the 40 years to 2001 (Barr, N 2005).

Over time, production is increasingly concentrated on larger farms. Less people are choosing to live in rural Victoria compared to urban centres and there is also a continuing increase in the role of off-farm income earned by farming families.

...in the 1950s there were 35 Victorians for every farm establishment in Victoria. By 2001 this ratio had risen to 150. By using ABS population projections and extrapolating the existing rate of decline in the number of farm establishments, we have calculated this ratio may well pass 350 by 2031 (Barr, N 2005: 25).

In the non-irrigation areas of north-east Victoria, beef production has replaced dairy farming as the predominant agricultural industry. In 1961 dairy farms outnumbered beef farms three to one but in the last 15 years this ratio reversed (Barr, N 2005: 75). The wool industry has experienced similar changes:

It was once said that Australia rode on the sheep's back...The shift out of wool production in response to low prices for wool has been significant. In one lifetime this 'old world' of the wool industry has disappeared. Australian wool production halved between 1990 and 2003 and many have moved into prime lamb production and cropping (Forth, G 2000).
4. VICTORIA’S TRADE EXPERIENCE

Since 1991/92 when entitlements became permanently tradeable, there has been a reallocation of entitlements across northern Victoria. Figure 8 shows that compared to the total volume of water used in the Victorian irrigation system, trade is relatively small. Nonetheless, irrigators are increasingly entering the market to manage farms in a way that maximises value creation. In seeking out the greatest value, trading also helps farmers manage business and environmental risk.

This section explores Victoria’s key trading trends over the last 15 years and the way different sectors and regions have participated.

The reallocation of entitlements is driven by individuals seeking wealth. Trade has facilitated an adjustment in entitlement ownership, which has:

- facilitated the development of a significant new irrigation region in Sunraysia;
- reallocated permanent and temporary entitlements across districts and industry sectors in northern Victoria;
- allowed entitlements to move off less productive land; and
- improved risk management options for irrigators.

4.1 PERMANENT TRADE

There has been a significant transfer of entitlements from GMW downstream to Sunraysia to facilitate the development of new horticulture along the Murray River. Horticulture in Boort has also purchased entitlement. Sunraysia has imported the greatest volume of entitlement
(116,063 ML or an additional 68% of its original\(^{12}\) entitlement) of all irrigation areas. The entitlement was sold from GMW’s major irrigation districts, i.e. Torrumbarry (-39,245 ML, 10%), Pyramid Boort (-31,738 ML, 13%), Central Goulburn (-20,533 ML, 5%) and Shepparton (-11,094 ML, 6%).

| Accumulated Permanent trade, ML & % of 1991 Water Right (Estimated), 1991/92 to 2005/06 |
| ML | -1,091 | 172 | 4,444 | -30,383 | -1,059 | -5,818 | 20,355 | -20,000 | 168 | 589 | 104 | 604 |
| % | -60% | -40% | -20% | 0% | 20% | 40% | 60% | 80% | 100% | 120% |

Figure 9 - Cumulative permanent trade in Victoria, 1991/91 – 2005/06

The main sellers of permanent water within GMW are the dairy (38%) and mixed farming (62%) sectors (Primary Industries Research Victoria 2006). Graziers are included in the mixed farming category. The dairy sector’s sale of permanent water is recent and began in the years directly following the 2002/03 drought.

Some permanent trade has allowed entitlement holders to realise the capital value of their water that was previously devalued because it was tied to less productive land. The liquidation of their water asset facilitated adjustment options for those involved.

Some 45,000 ha of less productive saline C & D class soils\(^{13}\) were mapped between 1987–2005 in the areas of Boort (West of Loddon), Kerang-Swan Hill, Torrumbarry (East of Loddon), Tragowel Plains (Pyramid Hill) and Campaspe West.\(^{14}\) C & D class soils are generally viewed as unproductive for the purposes of irrigation.

\(^{12}\) Original entitlements for the current irrigation district boundaries are not available. Estimated entitlement in 1991 (prior to trading) has been calculated by adding or subtracting historical trades from 2001 entitlements that were published in *The Value of Water*, DSE, 2001.

\(^{13}\) Appendix C provides a table outlining soil salinity classes A – D and their respective productivity ratings.

\(^{14}\) Data source: PIRVic (from EM38 2005/06 Annual Report).
4.2 **TEMPORARY TRADE**

GMW districts supplied most of the entitlement that was imported into Sunraysia, however GMW districts also purchased significant volumes of temporary water. Sleeper licences\(^{15}\) on the following river groupings are the largest sellers of temporary water into GMW’s districts:

- Murray upstream of Nyah, the Kiewa, Ovens and Mitta Mitta rivers (Mur/Kiewa/Ovens/Mitta); and
- Goulburn, Broken, Loddon and Campaspe rivers (Gou/Bro/Lod/Cam).

The value of the temporary water now traded can be estimated at approximately $9 million, based on a simplistic calculation of multiplying 70% of the volume of net temporary trade by diverters on the Mur/Kiewa/Ovens/Mitta and Gou/Bro/Lod/Cam rivers by an average trade price\(^{16}\) on each system. 70% of the temporary export volumes are used because not all temporary sales can be attributed to sleeper licences (some of what is traded would have been used prior to trading).

Prior to trading in 1991/92, excess licence capacity was not utilised by river diverters and GMW reallocated the water as *sales water* (which incurred a minimal volumetric charge) to other entitlement holders. The dairy industry was the main beneficiary of sales water with an average dairy farm operating on 100% allocation and often another 100% of sales water (in a normal climatic year).

The recent dry conditions led to a significant reduction in availability of sales water. The implication of this is that some restructuring may have occurred in the dairy industry as it adjusts to the need to purchase water that was previously available (at no charge) through sales water.

The second main source of temporary water exports is horticulture in Sunraysia. In the horticulture industry, water is a vital factor of production and it is relatively inexpensive compared to other input costs. One possible explanation for horticulture’s sale of temporary allocations is that the industry purchases permanent entitlements to meet future plantation needs. While crops are immature and require less water, the excess is sold on the temporary market. Another theory is that businesses purchase excess permanent entitlement to ensure security of supply during low allocations. Any excess allocation is sold back to GMW on a seasonal basis unless required during drought conditions.

The traditional irrigation districts within Sunraysia have also contributed to temporary sales, possibly to capitalise on the opportunity cost of traded water.

The third major source of temporary water is from mixed farming, particularly in Pyramid Boort. The main buyers of temporary water are Central Goulburn, Torrumbarry, Rochester and Murray Valley, accounting for 97% of the purchases.

\(^{15}\) Sleeper licence is a term used to describe private diverters who hold a licence volume to extract more water than they traditionally required (excess capacity). Trading has enabled these irrigators to capitalise on the value of their excess capacity. Prior to trading, the excess capacity was not utilised.

\(^{16}\) Based on using an average value of $60/ML for Goulburn System rivers and $50/ML for Murray System rivers. This average does not account for premium prices received during water scarcity.
THE NET EFFECT OF PERMANENT AND TEMPORARY TRADE

To understand the production effects on irrigation sectors and regions we need to consider the combined impact of both net permanent and net temporary trade.

There is a misconception amongst some people that permanent water is more reliable in terms of supply than temporary water, but this is not the case.

Water purchased on the temporary market is more reliable in terms of supply than water allocated against an entitlement due to the fact that 1 ML of water purchased on the temporary market is guaranteed to be delivered, whereas in a dry or low allocation season, not every ML of entitlement will necessarily be delivered (depending on seasonal allocation).

Permanent and temporary water also differ in terms of exposure to price fluctuations. The price of temporary water moves up and down on the market depending on scarcity, and in recent years it has fluctuated between $10/ML – $950/ML.17

On the other hand, permanent water that is not purchased on the market, requires the entitlement holder to pay annual fees to a water authority to meet administration, infrastructure

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17 Drought events highlight this point. In a normal year (~100% allocation) temporary water on the Greater Goulburn system (zone 1A & 1B) trades on Watermove at an average price of ~$60/ML. In December 2006 when the allocation was 24%, temporary prices spiked at $950/ML. While the peak price is relatively high, the temporary trade price during other times in the season is considerably lower.
refurbishment and maintenance costs. Most of these fees are fixed each season regardless of the allocation.¹⁸

The difference between temporary and permanent water in terms of exposure to price fluctuations is an important consideration for irrigators. Sectors such as horticulture that need to maintain watering every year to protect orchards will benefit from a relatively constant water supply at a guaranteed price. For this reason, the horticulture sector prefers operating on permanent water in regions with historically high reliability. Sectors such as grazing and mixed farming that do not have the same scale of capital investment have greater flexibility to change the crops and livestock they produce within a season. By capitalising on changes to commodity prices and the opportunity cost of traded water, mixed farmers and graziers can benefit from using temporary water.

### 4.4 Absolute Trade – a New Indicator to Measure Net Trade

A valid question to ask when it comes to water trade is ‘what is the net effect of water trade, permanent and temporary, on a region or sector?’

*Absolute trade* is an indicator that has been developed to assist our understanding of the net effect of permanent and temporary trade. Absolute trade does not account for important implications of exposure to price risk; however it does enable us to consider the effects on production in regions and sectors as a consequence of water trade. It also highlights that permanent and temporary trade should not be considered in isolation of each other.

Absolute trade demonstrates the net effect of trade for any year on a region or sector. It provides a valuable tool to consider the effect of net trade over time and any trends in terms of water movement into or out of a region or sector.

To calculate absolute trade, an annual account for each district was developed recording net permanent trade in the year it occurs. The net permanent trade is then carried forward each year because a 100 ML exported in Year One is 100 ML exported in perpetuity. The annual net permanent trade results are adjusted by their seasonal allocation and then added to the annual net temporary trade result to provide an absolute trade result for each season.

Central Goulburn provides a useful example of how absolute trade is calculated. Central Goulburn has traded -20,533 ML net of permanent water in northern Victoria from 1991/92 to 2005/06 (note that all 20,533 ML was not sold in 2005/06, but that it is the net accumulated volume over time). Consider the overall impact of water trade in Central Goulburn in 2005/06 for example. Allocations were 100% and so the permanent water that was exported from the region (net accumulated permanent trade) was -20,533 ML. Net temporary trade for 2005/06 was 26,510 ML. The sum of the net permanent trade (-20,533) and net temporary trade (26,510) produced the annual absolute trade result of 5,977 ML, indicating that in 2005/06 Central Goulburn purchased more water than it traded out of the region. Comparing this 5,977 ML in 2005/06 with previous annual absolute trade results of 39,549 ML (2001/02), 34,113 ML (2002/03), 17,416 ML (2003/04) and -5,255 ML (2004/05), a picture begins to emerge of water use in Central Goulburn over time. In-depth analysis into these results would require consideration of allocations in each year, commodity prices, climate and other relevant factors.

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¹⁸ Most irrigators that generally operate using permanent water will also hold corresponding Delivery Shares. Delivery Shares are used as a basis for determining a significant proportion of the annual fixed tariff.
A working example of how absolute trade is calculated is provided in Appendix A along with the annual absolute trade summaries for each district/area.

### 4.4.1 Absolute Trade by Region

Table 5 shows absolute trade results by district in 2005/06 and as a proportion of original entitlement. The results show that in 2005/06, Sunraysia was a large importer of permanent water and water in absolute terms, resulting in 54% more water available to Sunraysia in 2005/06 than would have been available without trade based on original entitlements. Rochester followed with 15% more water available to the district.

The largest relative exporters of absolute water were the river diverters, FMIT and Shepparton with these districts exporting and therefore reducing available water by between 10 and 12% based on original entitlements. Torrumbarry and Pyramid-Boort which have exported the highest volumes of permanent trade operated in 2005/06 with 8% and 5% less water available compared to original entitlements due to purchases of temporary water.

<table>
<thead>
<tr>
<th>District</th>
<th>Change in water available due to net accumulated permanent trade 1991/92 – 2005/06 ML</th>
<th>Net temporary trade 2005/06 ML</th>
<th>Absolute trade in 2005/06 ML</th>
<th>Estimated entitlement at 1991/92 ML</th>
<th>Absolute trade as a % of entitlement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sunraysia River Murray</td>
<td>116,063</td>
<td>-24,683</td>
<td>91,380</td>
<td>170,713</td>
<td>54%</td>
</tr>
<tr>
<td>Merb, Red C, Rob.</td>
<td>-1,091</td>
<td>-4,441</td>
<td>-5,532</td>
<td>114,645</td>
<td>-5%</td>
</tr>
<tr>
<td>FMIT</td>
<td>-3,950</td>
<td>-4,542</td>
<td>-8,492</td>
<td>72,749</td>
<td>-12%</td>
</tr>
<tr>
<td>Nyah &amp; Tresco</td>
<td>172</td>
<td>-1,873</td>
<td>-1,701</td>
<td>18,332</td>
<td>-9%</td>
</tr>
<tr>
<td>Mur/Kiewa/Ovens/Mitta</td>
<td>-7,346</td>
<td>-9,156</td>
<td>-16,502</td>
<td>162,167</td>
<td>-10%</td>
</tr>
<tr>
<td>Torrumbarry</td>
<td>-56,512</td>
<td>25,982</td>
<td>-30,530</td>
<td>377,594</td>
<td>-8%</td>
</tr>
<tr>
<td>Murray Valley</td>
<td>-2,388</td>
<td>5,539</td>
<td>3,151</td>
<td>58,993</td>
<td>5%</td>
</tr>
<tr>
<td>Pyramid-Boort</td>
<td>-31,738</td>
<td>19,557</td>
<td>-12,181</td>
<td>243,390</td>
<td>-5%</td>
</tr>
<tr>
<td>Rochester</td>
<td>-1,684</td>
<td>28,684</td>
<td>27,000</td>
<td>179,758</td>
<td>15%</td>
</tr>
<tr>
<td>Central Goulburn</td>
<td>-20,533</td>
<td>26,510</td>
<td>5,977</td>
<td>386,184</td>
<td>2%</td>
</tr>
<tr>
<td>Shepparton</td>
<td>-11,094</td>
<td>-7,865</td>
<td>-18,959</td>
<td>182,461</td>
<td>-10%</td>
</tr>
<tr>
<td>Gou/Bro/Lod/Cam</td>
<td>-5,107</td>
<td>-13,976</td>
<td>-19,083</td>
<td>163,756</td>
<td>-12%</td>
</tr>
<tr>
<td>Campaspe district</td>
<td>-170</td>
<td>1,903</td>
<td>1,733</td>
<td>19,592</td>
<td>9%</td>
</tr>
</tbody>
</table>

(Source: DSE)

It is important to note that absolute trade can change significantly between seasons in line with the complex factors that influence an irrigator’s annual trade decisions. For instance, in 2003/04 when Pyramid Boort sold significant volumes of permanent and temporary water, its absolute trade result was –39,404 ML or -16% of its entitlement. In 2005/06 following a strong year of temporary trade imports, Pyramid Boort’s absolute trade result was -12,181 ML or -5% of its entitlement base.

The net permanent trade figures are adjusted to account for seasonal allocations.

The absolute trade figures are adjusted to account for seasonal allocations.
In a six-year period, the area of irrigated agriculture increased in Sunraysia by nearly 40% (SunRISE21 2007). This growth coincided with the most significant import of water in absolute terms in northern Victoria.

Approximately 40% of the sales in absolute water are from sleeper licences on river systems, the remaining was predominantly from GMW’s main irrigation districts, from the mixed farming and grazing industries and marginal farms seeking to exit the industry.

### 4.5 TRADE AND INDUSTRY SECTOR CHANGE

Despite significant transfers of permanent and temporary water across northern Victoria, the overall area (ha) of irrigation within GMW has remained relatively constant.

Table 6 shows the change in different industry sector sizes between 1996/97 and 2003/04 within GMW. The area of dairy production fell by 6%, horticulture grew significantly by 33% (albeit from a low base), and mixed farming grew by 4% (albeit from a large base).

Table 6 - Change in sector size (ha) between 1996/97 and 2003/04 (GMW)

<table>
<thead>
<tr>
<th>Land Classification</th>
<th>Total districts area, 1996/97 ha</th>
<th>Total districts area adjusted, 2003/04 ha</th>
<th>% change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dairy Production</td>
<td>270,685</td>
<td>253,900</td>
<td>-6%</td>
</tr>
<tr>
<td>Horticulture</td>
<td>16,973</td>
<td>22,516</td>
<td>33%</td>
</tr>
<tr>
<td>Mixed Farming (inc. grazing, cropping &amp; lifestyle)</td>
<td>409,570</td>
<td>427,308</td>
<td>4%</td>
</tr>
<tr>
<td>Total</td>
<td>702,860</td>
<td>703,725</td>
<td>0%</td>
</tr>
</tbody>
</table>

(Source: DPI, 2006)

![Figure 11 - Change in sector size (ha) between 1996/97 and 2003/04 (GMW)](source:DPI, 2006)
Mixed farming grew by 17,738 ha and the dairy area declined by 16,785 ha. The almost equal area decline in dairy and growth in mixed farming may be attributable (to some extent) to data classification problems between the two years. Regardless of whether this observation is due to actual change or a data aberration, the overall message is that except for horticulture, the area of irrigated agriculture in GMW’s districts has been relatively stable.

Appendix C provides further details of land use change by sector and district.

### 4.5.1 DAIRY ADJUSTMENTS

The dairy industry has experienced a decade of prolonged low allocations and severe drought in 2002/03. The land area has remained relatively constant during this time, possibly because the dairy industry has used trade to assist its management of low allocations. Table 7 shows that the dairy sector is a significant importer of absolute water.

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<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual Permanent Net Trade</td>
<td>1,878</td>
<td>768</td>
<td>-463</td>
<td>-733</td>
<td>1,019</td>
<td>-10,312</td>
<td>-12,736</td>
</tr>
<tr>
<td>Cumulative Permanent</td>
<td>1,878</td>
<td>2,646</td>
<td>2,183</td>
<td>1,450</td>
<td>2,469</td>
<td>-7,843</td>
<td>-20,579</td>
</tr>
<tr>
<td>Cumulative Permanent</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>adjusted for allocation</td>
<td>1,792</td>
<td>2,610</td>
<td>1,930</td>
<td>674</td>
<td>1,002</td>
<td>-7,843</td>
<td>-20,313</td>
</tr>
<tr>
<td>Annual Temporary Net Trade</td>
<td>38,984</td>
<td>58,488</td>
<td>57,241</td>
<td>83,430</td>
<td>56,829</td>
<td>85,459</td>
<td>87,257</td>
</tr>
<tr>
<td>Absolute Trade</td>
<td>40,776</td>
<td>61,098</td>
<td>59,171</td>
<td>84,104</td>
<td>57,831</td>
<td>77,616</td>
<td>66,944</td>
</tr>
</tbody>
</table>

For the seven years between 1998/99 and 2004/05, 97% of the temporary water bought in GMW was by the dairy industry. The purchase of temporary water by the dairy industry reflects a need to substitute temporary water for allocations in low allocation years and to partially substitute allocation that was previously available as sales water.

There was a sale of permanent water in the two years following the 2002/03 drought, which may reflect a need by the industry to raise capital and service growing debt. ABARE data shows that Victoria’s dairy farms faced increased debt following the drought due to reduced production and significant income reductions because of a coinciding fall in milk prices (Appendix D has further information).

Another possible explanation stems from the fact that delivery shares rather than entitlement held are now the basis GMW uses to calculate fees for ongoing delivery or for terminating the obligation to pay such fees. In the two years that dairy farmers sold permanent water (2003/04 and 2004/05), there was a window of opportunity to reduce delivery shares by selling entitlements. There may have been an incentive for farmers to reduce holdings of entitlements to minimise future exit costs.

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22 The values used to calculate absolute trade (which is based on PIRVic sample data) represent approximately 70% of actual trades and are likely to underestimate actual traded volumes.
It is unknown whether irrigators who sell permanent water also buy temporary water (swap), or whether some dairy farmers are selling permanent water (to manage debt or exit the industry) and others are expanding or supplementing allocations with temporary water.

Figure 12 shows that in the last seven years, water use fluctuated in line with allocations. Except for the years 2001/02, the dairy industry has used less water and as a consequence it has adjusted its irrigation management practices accordingly. Measurements by PIRVic from satellite images show that across the Shepparton Irrigation Region, (districts: Shepparton, Rochester, Central Goulburn and Murray Valley) there has been a significant decline of water use as a consequence of shifting from perennial to annual pastures, which have a shorter watering season and require less water per hectare. Approximately 180,000 ha of perennial pasture was irrigated in the SIR in 1996/97, of which 28% or 50,000 ha had disappeared by 2003/04.

4.5.2 **Mixed Farming Adjustments**

Mixed farming on the Goulburn System is the largest net exporter of water in GMW in absolute terms, exporting both permanent and temporary water. The Goulburn System was the main seller of net water with a larger mixed farming sector than the Murray System.

Mixed farmers may have more flexibility to sell water on the market because their ongoing water reliability requirement is less than a dairy or horticulture business.

There was clear evidence during discussions (focus groups) that the cropping farmers and the mixed cropping and grazing farmers were by far the most opportunistic water users…These findings clearly reflect the fact that cropping farmers have a high level of flexibility in water use from season to season without a significant impact on capital investments and their long term viability (Bjornlund, H 2005: 12).
Table 8 - Absolute trade by mixed farming across GMW’s main irrigation districts (ML)

<table>
<thead>
<tr>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual Permanent Net Trade</td>
<td>-3,960</td>
<td>-4,894</td>
<td>-1,394</td>
<td>-5,041</td>
<td>-2,076</td>
<td>-14,426</td>
<td>-4,502</td>
</tr>
<tr>
<td>Cumulative Permanent adjusted for allocation</td>
<td>-6,540</td>
<td>-13,521</td>
<td>-15,787</td>
<td>-22,143</td>
<td>-16,292</td>
<td>-31,791</td>
<td>-36,359</td>
</tr>
<tr>
<td>Absolute Trade</td>
<td>-19,681</td>
<td>-34,984</td>
<td>-38,417</td>
<td>-38,114</td>
<td>-29,772</td>
<td>-56,133</td>
<td>-52,486</td>
</tr>
</tbody>
</table>

During the 2006/07 drought, temporary water on the Goulburn System had reached a record high of $950/ML, more than $300/ML higher than the spot price during the 2002/03 drought. In a normal allocation year (around 100%) temporary water on the Goulburn sells on average for about $60 ML.

Many reports claim that horticulture and dairy farming are high value uses relative to mixed farming; however these valuations are based on gross margin analysis and an assumption of reliable water allocations, both of which are not practical.

Mixed farming offers a region diversification that can protect local economies from downturns in particular commodity prices.

Rural sociologists do normally not define sustainable development as some well-defined end-point; rather, they consider it as a multidimensional process towards socially, economically and environmentally strong communities, with a flexible economy not totally dependent on the seasonal price for specific commodities (Bjornlund, H 2005).

4.5.3 Horticulture adjustments

Horticulture, both in GMW and Sunraysia, has expanded its areas of planting significantly, growing in GMW by 33% and in Sunraysia by 38%.

Table 9 shows that in the six years between 1997 and 2003, Sunraysia grew in area by almost 40%. This is mainly due to new irrigation developments on areas that were dry land farms adjacent to the Murray River, which grew by 75%. In comparison, growth on traditional irrigation districts in Sunraysia only grew by 5%. A case study on horticultural growth in

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23 Note PIRVic’s figures are based on a sample of about 70% of the irrigation area. See “Appendix C – Land and water use change” for more information.

24 Gross margins, while easy to measure, fail to account for significant capital costs that are characteristic of horticulture and dairy enterprises (vine posts, plantings, irrigation infrastructure, dairy rotaries, dairy stock etc). Nor does gross margin analysis include owner labour, which in the case of a family-run dairy farm, is a significant expense. Because of these omissions, the use of gross margins analysis is not suitable for determining a profitable use of water.
Sunraysia is provided in Chapter 5: Economic Analysis. Further data on land use change is provided in Appendix C.

Spectacular growth in almond plantations occurred during this time and these were predominantly structured as Managed Investment Schemes (MIS). MIS are typically owned by large agribusiness companies such as TimberCorp. Strong growth also occurred in vegetables and fruit trees. Grapevines are the predominate plants in northern Victoria.

Table 9 - Land use change in Sunraysia's pumped districts and diversion areas (Victoria) *(SunRISE21 2007)*

<table>
<thead>
<tr>
<th></th>
<th>Pumped Districts Total</th>
<th>Private Diverters Total</th>
<th>Sunraysia Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grapevine</td>
<td>14,765</td>
<td>15,165</td>
<td>3%</td>
</tr>
<tr>
<td>Citrus</td>
<td>530</td>
<td>390</td>
<td>-26%</td>
</tr>
<tr>
<td>Nut tree</td>
<td>140</td>
<td>155</td>
<td>11%</td>
</tr>
<tr>
<td>Fruit tree</td>
<td>235</td>
<td>225</td>
<td>-4%</td>
</tr>
<tr>
<td>Field crop</td>
<td>500</td>
<td>515</td>
<td>3%</td>
</tr>
<tr>
<td>Vegetable</td>
<td>330</td>
<td>495</td>
<td>50%</td>
</tr>
<tr>
<td>Other</td>
<td>200</td>
<td>165</td>
<td>-18%</td>
</tr>
<tr>
<td>Vacant</td>
<td>100</td>
<td>575</td>
<td>475%</td>
</tr>
<tr>
<td><strong>Total Hectares</strong></td>
<td>16,800</td>
<td>17,685</td>
<td>5%</td>
</tr>
</tbody>
</table>

* ∆ % change 1997 to 2003

Table 10 represents absolute trade results for horticulture in GMW's region and shows that horticulture’s absolute trade results fluctuate, including a relatively high purchase of temporary water in 2002/03 possibly to offset the low allocations during the drought and ensure constant watering of valuable crops.

The horticulture sector has used the market to expand production and protect valuable perennial assets from drought. If we look at water use change in Figure 12 we find that horticulture is the only sector that increased its water use during the 2002/03 drought. Other sectors used water opportunistically, more or less in line with allocations.
Table 10 - Absolute trade by horticulture across GMW’s main irrigation districts (ML)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual Permanent Net Trade</td>
<td>246</td>
<td>126</td>
<td>70</td>
<td>30</td>
<td>681</td>
<td>7,914</td>
<td>2,096</td>
</tr>
<tr>
<td>Cumulative Permanent</td>
<td>246</td>
<td>372</td>
<td>442</td>
<td>472</td>
<td>1,153</td>
<td>9,067</td>
<td>11,163</td>
</tr>
<tr>
<td>Cumulative Permanent [adjusted for allocation]</td>
<td>266</td>
<td>354</td>
<td>442</td>
<td>522</td>
<td>664</td>
<td>9,067</td>
<td>11,163</td>
</tr>
<tr>
<td>Annual Temporary Net Trade</td>
<td>2,609</td>
<td>1,831</td>
<td>-2,240</td>
<td>-12,653</td>
<td>12,315</td>
<td>-12,813</td>
<td>-9,286</td>
</tr>
<tr>
<td>Absolute Trade</td>
<td>2,875</td>
<td>2,185</td>
<td>-1,798</td>
<td>-12,131</td>
<td>12,979</td>
<td>-3,746</td>
<td>1,877</td>
</tr>
</tbody>
</table>

Figure 13 demonstrates how trade has facilitated a smoothing of horticulture’s water use across various climatic conditions and allocations. The pink line represents actual water use minus absolute trade and shows that water use by horticulture during the 2002/03 drought would have been significantly less had the sector not been able to access trade.

![Figure 13 - Horticulture's water use and what it would have been without absolute trade](Source: PIRVic)

Note PIRVic’s figures are based on a sample of about 70% of the irrigation area. See “Appendix C – Land and water use change” for more information.
Had this sector not been able to access additional water on the market during low allocations, the long-term cost to valuable perennial crops would likely have been significant.

Appendix D provides a detailed overview by district of GMW’s temporary trade behaviour during the 2002/03 drought and subsequent years.

4.5.4 **THE NEW GENERATION FARM - MANAGED INVESTMENT SCHEMES**

In recent years a new type of irrigation farm has emerged. Managed Investment Schemes (MIS) have been used to establish many of the new horticultural developments adjacent to the Murray River in Sunraysia and in Boort.

The key for MIS investors is that the losses that are characteristic of agribusiness during early years of development are immediately tax-deductible against other sources of income. This is a significant taxation incentive for some investors.

In 2005/2006 the rate of growth for MIS timber schemes was negative, whilst horticultural MIS projects grew by 71%. Approximately 16,000 ha of non-timber MIS projects were established in Victoria between 2002 and 2006. These were mainly almond, olive, cropping and grape investments (Regional Development Victoria 2006).

MIS schemes have received significant media attention due to concerns from some farmers that tax concessions, which are not readily accessible to the family farm, may create distortions in water and relevant irrigated commodity markets.

There are also cultural differences between MIS schemes and traditional irrigation farms that are symbolic of existing tensions between the ‘bush’ and the ‘city.’ MIS investments have introduced irrigation enterprises of a scale and style never encountered before in rural Victoria. MIS schemes have also increased competition for labour and capital (including water).

In February 2007, the Minister for Revenue and Assistant Treasurer, Peter Dutton, announced that the Australian Tax Office (ATO) would not issue further Product Rulings (which protects the deductibility of schemes) for non-forestry agribusiness MIS after 30 June 2007.

> The effect of this change of interpretation of the current law is that investors in MIS would no longer be able to claim upfront deductions for their contributions to the MIS. The effect of the likely change in interpretation by the ATO will be to place investments in non-forestry agribusiness MIS on the same footing as other ‘passive’ investments in agriculture (Victorian Government 2007).

At the time of writing this report, MIS operators are liaising with the ATO about transitional arrangements for the introduction of the new ruling (on the basis of minimising local employment impacts). Determining whether (or what proportion of) MIS’s recent agribusiness growth was fuelled by a tax advantage or by entrepreneurial spirit is beyond the scope of this Study.

The next section further explores the economic drivers of trade and how trading provides irrigators with a sophisticated value creation and risk management tool.
4.6 Trade Effects on Local Economies

Individuals that participate in trade generate value (otherwise they would not trade). The further beneficiaries of this value creation depend on whether this value is reinvested or consumed within the local economy or elsewhere.

The net value created by trade is positive, but there may be local distributional impacts.

The distribution effects of the water trade depend on whether the people who sell the water stay in the region (and reinvest their wealth, existing labour and capital locally) and whether they invest it outside the region. The effects will also depend on whether those purchasing temporary allocations and doing so to offset their sale of entitlements, or whether those irrigators selling entitlements are different to those who are purchasing allocations.

In the last 15 years, trading has facilitated the transfer of entitlements across regions and industry sectors in northern Victoria. These transfers have allowed regions and industries to adjust to a range of pressures such as drought, business risk, business expansion and environmental pressures such as salinity.

In GMW’s main irrigation districts (Shepparton, Central Goulburn, Murray Valley, Torrumbarry, Rochester and Pyramid Hill), the number of people employed in Agriculture, Forestry and Fishing (A,F&F) declined between 1996 - 2001 by 5%, while other sectors of these economies grew, leading to an overall increase in people employed by 5%.

The trend of a shrinking agricultural sector relative to other parts of the economy is consistent with general long-term trends in Australia and other Westernised economies.

The level of wealth reinvestment within local economies will vary across districts. In Pyramid Boort, employment in A, F&F declined by 4% and overall local employment also decreased by 9%. Pyramid Boort also had the highest loss of population (2.4%) of any GMW district between 1991 and 2001. Pyramid Boort has the least diversified economy of any irrigation area.

In contrast, other districts saw their population and total persons employed increase. Despite a decline in employment in agriculture within GMW, employment overall increased. Central Goulburn experienced a decline in persons employed in A, F&F of 7% but the number of total persons employed increased by 6%. Similarly, Shepparton experienced a 5% decline in persons employed in A, F&F, but employment overall increased by 16%. The population also increased in Central Goulburn (5.6%) and Shepparton (2.7%) during this period.

During this period of adjustment, Pyramid Boort also experienced the largest percentage rise in average weekly household income and the second highest rise in average weekly individual income of any irrigation district (between 1996 and 2001).

Water trade allowed farmers on marginal properties to realise (sell) the capital value of their water entitlement that was previously tied to less productive land. Water trading provides opportunities to exit the industry, retire areas of unproductive land and respond to the opportunity cost of traded water.

26 Based on place of enumeration, i.e. employment type of the resident (where he or she lives, not where he or she works).
27 The categorisation of industry type changed between the 1991 and 1996 censuses, thus comparisons of the industry structure are limited to the 1996 and 2001 periods.
28 There is little forestry or fisheries within irrigation districts so we assume that A, F&F represents agriculture only.
There may be distributional effects from the sale of water permanently out of an area when it leads to the reconfiguration and closure of irrigation channels. In some cases the average channel maintenance cost per user will fall, in other cases, when people leave, the average cost per person will increase.\footnote{29}

Sunraysia\footnote{30} behaved differently to GMW and increased both persons employed in A, F&F by 10.5\% and total persons employed by 16\%. In the case of Sunraysia, the purchase of permanent water has facilitated significant development in new irrigation. This has coincided with positive employment and consumption effects on the local economy, which has grown in line with the new irrigation developments. A case study on Sunraysia growth is provided in Chapter 5: Economic Analysis.

Detailed tables of employment in A, F&F between 1996 and 2001 are provided in Appendix B.

\footnote{29} The irrigators that remain on the system find it more expensive because the cost sharing is spread over a smaller base. “Stranded assets” refers to a relatively unusual experience when there are not enough farmers to pay the cost of keeping a delivery system operational and the water authority proposes to close it. The potential for stranded assets is being addressed by government and GMW through a process known as “Reconfiguration Planning.”

\footnote{30} Nyah is included with the Sunraysia because it is similar in terms of land use (horticulture) and is supplied by the Murray River.
5. ECONOMIC ANALYSIS

Markets can create value for participants by allocating goods efficiently. To analyse the economic impact of Victoria’s water market, this Study evaluates how the market is creating value for irrigators and reallocating entitlements to their most economically productive use.

The total value created by a transaction is measured by the difference between the minimum price a seller will accept and the maximum price a buyer will pay. These prices are referred to as a seller’s ‘willingness to sell’ (WTS) and a buyer’s ‘willingness to pay’ (WTP). The term ‘value’ (WTP less WTS) is analogous to ‘benefit.’ An example of how value is calculated is provided in Figure 14.

For irrigators selling an entitlement in Victoria’s water market, their willingness to sell will be based on the opportunity cost of the entitlement, which is the expected value of the opportunities that the irrigator foregoes in order to sell the entitlement. Thus, for example, an irrigator will consider the value that the entitlement would otherwise earn as an agricultural input, and also the cost or benefit of subsequent changes to land and labour use.

Buyers in the water market will go through a comparable process when they decide how much they are willing to pay for entitlement, taking into account factors such as the income they can earn by using the entitlement as an agricultural input as well as the investment opportunities that they forego when funds are used to purchase the entitlement.

Establishing an individual’s willingness to pay or sell is complex and will reflect each irrigator’s different business and personal considerations. If, for example, irrigators wish to purchase entitlements to avoid the risk of losing crops to drought, the price that they are willing to pay will reflect their risk management decisions and the scarcity of water. When water is scarce, the seller will appropriate most of the value. In other circumstances buyers will appropriate a greater share of the value. The market price of water is therefore a function of each participant’s complex business circumstances, such as commodity prices, the cost structure of the business, land productivity and environmental pressures, as well as the participant’s personal characteristics, including risk management strategies.

![Figure 14 - Value created by the market](image-url)
5.1 **THE MARKET CREATING VALUE**

Market activity is measured by both the volume of water traded and the number of trades executed. Victoria’s irrigators have participated in the water market since its inception, with the level of market activity increasing.

![Volume of permanent and temporary trade 1991/92 - 2005/06](chart)

The volume of temporary water purchased through the market has increased through time. The market for temporary water reflects seasonal pressures; irrigators enter the market for temporary water to protect production in periods of stress. Dry seasons in 1994/95, 1997/98 and 2002/03 are associated with spikes in the volume of temporary water traded in Victoria, with a significant increase in the volume traded annually since the beginning of the ‘long dry’ in 1997.

While the scale of Figure 15 makes changes to permanent trade look relatively insignificant, the volume of permanent trade has also grown over time, picking up significantly following the 2002/03 drought. The sale and purchase of entitlements are driven by irrigation trends – that is, adjustment towards more economically-efficient irrigated production. For irrigators wishing to expand their business, the water market makes it possible to source additional entitlements. Conversely, for struggling irrigators the market makes it possible to exit the industry or to restructure in favour of different crop mixes. The data demonstrates that value is being created for both buyers and sellers as some irrigators permanently reduce their irrigation, while others purchase additional water for ongoing use. The market facilitates adjustment in the irrigated agriculture sector.

The benefits of entitlement reallocation are well illustrated by Sunraysia and Pyramid Boort’s trade experience in the last 15 years. In order to explore the impact of the market in greater detail, market activity during drought periods will be explored in a detailed case study highlighting the role of the market as a risk management tool.

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31 1994/95 was also the introduction of the interim Murray Darling Basin cap.
32 Market activity during drought periods will be explored in a detailed case study highlighting the role of the market as a risk management tool.
depth, the Sunraysia Region is the focus of the following case study. The effects of temporary and permanent trade on Pyramid Boort (on industry sectors, population growth and income) are discussed throughout Chapter 4: Victoria’s trade experience.

5.1.1 CASE STUDY: HORTICULTURE IN SUNRAYSIA

Until 1988/89 Sunraysia’s irrigation enterprises were constrained by fixed water allocations, with dry land grazing the dominant land use. The water market has made it possible for irrigators in Sunraysia to purchase water and increase production of water-dependent, high-value crops. Sunraysia’s irrigation sector has expanded significantly; in the six years from 1997 to 2003 the number of hectares irrigated in Sunraysia grew by nearly 40%. Since the commencement of trade downstream of Nyah, approximately 116,000 ML – equivalent to 70% of the Sunraysia’s original entitlement – has been imported into the Region.

Since 1994, private diverters have invested heavily in their capacity to irrigate. Private diverters pump directly from the Murray River using privately owned infrastructure. Traditional irrigation requires water authorities to deliver water to properties, which can occur several days after an order is placed. Private infrastructure offers irrigators autonomy and the ability to use their entitlement as needed.

![Private diversion pumps on the River Murray in Sunraysia](image)

*Figure 16 - Private diversion pumps on the River Murray in Sunraysia (image)*

(Photograph: DSE)

Permanent water imports into Sunraysia have typically serviced the conversion of dry land farms into large scale irrigation enterprises. Despite recent market downturns in some horticultural products such as wine grapes, the Sunraysia irrigation region has continued to enjoy strong growth. Value-added processing, packaging and transport services have developed to support the Region’s new harvests.
While employment in agriculture, forestry and fisheries (A, F&F) has generally declined across Australia and within neighbouring GMW (by 5%), employment in Sunraysia grew by 10.5% between 1991 and 2001. The average annual population growth rate\textsuperscript{33} between 1981 and 2001 was 2.3\%, with Mildura as the third fastest-growing town in Victoria after Bendigo and Wodonga (Department of Sustainability & Environment 2004).

An internal report to the Victorian Government states:

“The Mallee region has, and still is, experiencing substantial growth in irrigated horticulture linked to new investment in processing, packaging and transport. This investment has directly contributed to the Mallee continuing to be one of the fastest growing regional economies in Australia” (Burns 2002).

\textsuperscript{33} Numerical growth with a population of over 1000 people.
The growth of irrigation in Sunraysia suggests that the previous allocation system, which tied water entitlements to land, constrained this opportunity for economic development of the region. The water market has made it possible for irrigators to purchase the water required to develop high value irrigation enterprises. Preliminary population and employment growth figures indicate that the region as a whole has benefited from the value created by the water market.

Economic theory and data (land use change, salinity mapping, ABS and trade data) also suggest that overall, irrigators and regions that sell entitlements benefit. As detailed in Chapter 4: Victoria’s trade experience, irrigators in Pyramid Boort sold the greatest volume of net temporary and permanent (absolute trade) between 1991/92 and 2000/01 of any area in Victoria. Over the same period, Pyramid Boort experienced the highest growth in individual and household income of any irrigation area in Victoria.

Victoria’s water market is creating value for irrigators and reallocating water entitlements to higher-value users. Activity in the market for temporary water is influenced mainly by seasonal considerations, while activity in the market for entitlements is often driven by structural adjustment in the irrigated agriculture sector (Branson, 1999: 12). Activity in both permanent and temporary trade also facilitates the balancing of price risk considerations across industry sectors.

Economic benefits of the market are well illustrated by the experiences of Sunraysia (a significant purchaser of entitlements) and Pyramid Boort (a significant seller of entitlements).

### 5.2 THE MARKET AS A RISK MANAGEMENT TOOL

Irrigated agriculture is exposed to climatic variability and natural fluctuations in the available water supply. Managing environmental pressures is crucial to the viability of Victoria’s agriculture sector. The market allows people to purchase water to start or finish off a crop when natural rainfall and/or existing allocations are inadequate. This is particularly crucial during drought periods – for example, valuable perennial crops, such as wine grapes, can suffer significant damage during a drought, which would destroy a crop that took years to grow and would otherwise provide yields for many years into the future. Without an efficient water market, farmers with drought-sensitive crops are unable to purchase additional water, even if other irrigators are willing to sell. The market therefore improves irrigators’ scope to manage environmental pressures and the production risks that these create.

#### 5.2.1 CASE STUDY: THE MARKET AS A RISK MANAGEMENT TOOL DURING DROUGHT

In order to consider the benefits of the market during drought, the level of market activity will be examined and qualitative surveys of irrigators cited.

Market data suggest that as water availability falls, the volume of water purchased and the number of transactions in the market increase. In 2002/03 the volume of water available was 617,066 ML less than the volume available in the previous year.

Figure 19 shows that the number of trades increased during the 2002/03 drought when water use declined, i.e. there was an inverse relationship between number of trades and water use.
Between 2001/02 and 2002/03 the volume of water traded in GMW’s districts and major river networks increased by 11% (27,000 ML), while the number of transactions increased by 81% (Table 11). This indicates that irrigators were entering the market more frequently, but purchasing less water than they would during non-drought circumstances. In Lower Murray Water (LMW) the volume of trade increased by 13,489 ML (38%) and the number of transactions increased by 238% compared to the previous year. Again, the average volume purchased per transaction declined, reflecting the higher cost of temporary water during drought.\textsuperscript{34}

### Table 11 - Number of temporary trade transactions\textsuperscript{35}

<table>
<thead>
<tr>
<th>Season</th>
<th>GMW</th>
<th>LMW</th>
<th>FMIT</th>
<th>SRW</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000-01</td>
<td>3,415</td>
<td>237</td>
<td>N/A</td>
<td>161</td>
</tr>
<tr>
<td>2001-02</td>
<td>5,851</td>
<td>447</td>
<td>30</td>
<td>82</td>
</tr>
<tr>
<td>2002-03</td>
<td>10,575</td>
<td>1,509</td>
<td>401</td>
<td>683</td>
</tr>
<tr>
<td>2003-04</td>
<td>7,492</td>
<td>846</td>
<td>285</td>
<td>379</td>
</tr>
<tr>
<td>2004-05</td>
<td>7,619</td>
<td>1,213</td>
<td>378</td>
<td>201</td>
</tr>
</tbody>
</table>

\textsuperscript{34} Note that FMIT’s increase is likely to be distorted because 2001/02 was the first season FMIT irrigators were permitted to trade with other districts.

\textsuperscript{35} Collated by DSE from data provided by water authorities.
An increase in prices during a drought reveals the increased value irrigators place on water during periods of scarcity. Watermove data indicate that during the 2002/03 drought, temporary water traded in the Goulburn System for $500/ML in the middle of October 2002 and again in early January 2003. In subsequent years, and as water allocations returned to normal (approximately 100%), the price of water has varied between $15 and $100/ML, with an average price of approximately $60/ML. In mid-December 2006, when allocations on the Goulburn fell again, this time to 24%, the price of temporary water reached $950/ML. In contrast, in the Murray system where allocations were closer to 90%, the market price for water was $530/ML (Watermove 2006).

Market data demonstrate that during periods of drought, irrigators rely on the market as a means of managing the risks to their businesses. The work of rural researchers confirms the importance of the market as a risk-management tool during drought:

They (Dairy farmers) clearly express the view that without the temporary market they would not have been able to manage the recent drought as well as they did and communities would have suffered more (Bjornlund, H 2005: 14).

Informal (temporary) markets have significantly improved irrigators’ ability to respond to changing resource availability…The workshop and focus groups emphasised that one of the most important functions of informal markets during the last five years has been to assist farmers managing the drought ... (Bjornlund, H 2005: 20).

In addition to environmental pressures, Victoria’s irrigators are affected by variables including, for example, changes in agricultural commodity prices and changes in the price of the Australian dollar. These variables can create financial risk for irrigators and the market once again provides additional options to manage these risks.

The market can simultaneously reduce irrigators’ exposure to production risk (by making it possible to purchase entitlements) and reduce financial risks (by creating value for both buyers and sellers). These roles are particularly valuable to irrigators during periods of water scarcity.

Although market data cannot be used to quantify the monetary value created by the market, models can be used to estimate the economic benefits for individuals and sectors.

The Water Policy Model (WPM) was developed in the mid-1990s to understand the economic welfare implications of changing water use in the southern Murray Darling Basin. The WPM estimates farm-gate profits in the presence of trade and compares this to the base case of no trade. The WPM estimates (and then aggregates) the value created when water is traded from the lowest-value user to the highest-value user, as occurs in market transactions.

The WPM finds that under drought conditions comparable to the 2002/03 drought, water trade created $29 million (Department of Sustainability & Environment 2006) worth of farm-gate value to irrigators in GMW’s main irrigation districts. The WPM is discussed in more detail in Appendix D.

Another model called “The Enormous Regional Model” (TERM) has been expanded to account for the economic impacts of water trading and changing water use across the Southern Murray Darling Basin.

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36 Because the majority of trades occur through private brokers, Watermove data can only be used as a proxy for market prices. Brokers do not disclose the price at which entitlements are purchased.
37 Land and Water Resources and Development Corporation (LWRDC) 2002
38 A preliminary run of an updated WPM was conducted in early 2007 by the Department of Sustainability and Environment.
TERM is a flexible regional computable general equilibrium modelling framework for Australia. The master database contains 169 sectors and 56 regions, which are aggregated to sectors and regions of interest for running simulations. Being a "bottom-up" Computable General Equilibrium model which treats each region as a separate economy, TERM is able to assess the flow-on effects of changes in land, labour and capital as a consequence of trade and to explore how interacting sectors of the economy respond to these changes. In other words, TERM is a comparative static economic model that adjusts across all relevant sectors and regions of the Australian economy when a significant shock such as drought occurs.

TERM-Water is a water-enhanced version of TERM. It represents irrigation sectors at the statistical division level in the Murray-Darling Basin and also includes the rest of the Australian economy. TERM-Water distinguishes irrigation from dry-land sectors and pays attention to the mobility of farm factors between activities in response to water shortages.

The TERM-Water model has been applied to drought and water trade, and the impact on Australia’s economy, regions and industries. Results from this modelling have found that the gains from water trade rise as water scarcity worsens. The results suggest that water trading is particularly valuable in times of drought (G Wittwer, 2007).

Results from TERM-Water model applications, including to the 2006-07 drought in Australia, are expected to be published by the authors in 2008.

Market data, case studies and economic models highlight the effectiveness of the market allocation mechanism. During drought particularly high levels of market activity have been observed, reallocating entitlements to higher-value use. It is important to recognise that it would not be possible for a Government authority to allocate Victoria’s scarce water resources as efficiently as the market; this is due to the level of private information required to inform the allocation process. The market factors irrigators’ private information into the allocation process because this information is implicit in the prices irrigators nominate as their willingness to buy and sell. It is in the irrigator’s best interests to accurately reveal this information. The market is therefore able to resolve complex allocation problems even when water is scarce.

5.3 TERMINOLOGY

It is important to clarify that an economically efficient allocation of entitlements is not equivalent to a technologically or physically efficient use of water. Thus, for example, it is possible that irrigators using drip irrigation will sell their entitlement to irrigators using flood irrigation. This transaction occurs because flood-irrigators can create more value with the entitlement than drip-irrigators (they are a more economically efficient user of water), despite their water-intensive techniques.

Despite the distinction between economic and technically efficient water use, a water market creates strong incentives to use water in a physically efficient manner. Prior to the introduction of the market, an irrigator with generous allocations had no incentive to minimise water use, as there was no cost associated with wasting water. The water market creates an opportunity cost for water – because irrigators can sell their entitlements in the market. Any water ‘wasted’ by farmers represents foregone income from the market and this increases irrigators’ incentive to invest in water-efficient technology.
5.4 **Economic Analysis: Conclusion**

The water market has created economic value for Victoria’s irrigators. The market has allowed some irrigators to expand their high-value, water-dependent irrigated enterprises, while other irrigators have improved their economic wellbeing by selling either permanent or temporary entitlements.

During drought conditions, the market is a particularly valuable mechanism for irrigators. Irrigators use the market to manage production and financial risks; in this manner the market can alleviate the economic losses associated with water scarcity.
6. SOCIAL PERCEPTIONS OF TRADE

We have seen that trading provides irrigators with a flexible business tool that facilitates creation of economic value. There are however, distributional impacts and complex belief systems (not expressed in markets) that influence people’s perceptions of trade.

“Social analysis seeks to understand and assess the impacts of change on individuals, families, communities and society. It draws on existing knowledge and methods used in a number of different social science disciplines including sociology, psychology, human geography, environmental studies, economics and political science. It involves both beliefs and realities” (Murray Darling Basin Commission 2004: 12).

The social impacts of trade vary for a range of reasons and can affect irrigation sectors and regions differently. There are however, observable groups of behaviour that provide insight into the factors that influence people’s trade experience.

No pretence is made that a thorough understanding of these issues has been achieved. The objective of this Chapter is to source relevant information that helps us understand how trade affects rural Victorians.

This Chapter:

- canvasses a broad range of views expressed in various media and studies on people’s perceptions to trade;
- explores the factors that may influence people’s perceptions; and

6.1 SOCIAL INDICATORS IN RURAL VICTORIA – ABS CENSUS DATA

A collection and analysis of ABS Census data was conducted to identify changes to the social and economic demographics of irrigation areas in Victoria. The changes can not be attributed solely to trade because regional adjustment is influenced by a complex range of factors. This Chapter presents information that highlights relative change in irrigation areas and compares this to Regional Victoria (that is all of Victoria less the Melbourne Statistical District, including the large towns). It does not attempt to draw conclusions in relation to water trade data.

The methodology used to collect the data and additional results (population age structure, change in median age, unemployment by district, income by district, total persons employed, occupation structure and sector exit rates) is outlined in Appendix B.

6.1.1 POPULATION GROWTH

Between 1991 and 2001, the population of the irrigation districts rose at an average annual rate of 3% compared to a population growth rate of 0.5% for Regional Victoria. The combined irrigation districts examined in the report accounted for approximately 35% of the total population growth in Regional Victoria between 1991 and 2001.

As the population ages, the median age will also rise. In the period 1991 to 2001, the median age of Regional Victoria (RV) rose by 10% to 34 years, while the median age of the irrigation areas rose by 7% (to 32 years).
However, there were six districts that experienced negative growth between 1991 and 2001. Irrigation districts in Southern Victoria generally fared worse than northern irrigation areas.

Table 12 shows population growth across Victoria’s irrigation areas between 1991 and 2001.

<table>
<thead>
<tr>
<th>Rank</th>
<th>Irrigation district/area</th>
<th>Average Annual Growth</th>
<th>Total; Population 2001</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Red Cliffs</td>
<td>12.1%</td>
<td>0.7%</td>
</tr>
<tr>
<td>2</td>
<td>Central Goulburn</td>
<td>11.3%</td>
<td>0.2%</td>
</tr>
<tr>
<td>3</td>
<td>Shepparton</td>
<td>2.8%</td>
<td>2.5%</td>
</tr>
<tr>
<td>4</td>
<td>Murray River/Sunraysia</td>
<td>3.2%</td>
<td>1.5%</td>
</tr>
<tr>
<td>5</td>
<td>Tresco</td>
<td>4.8%</td>
<td>-0.2%</td>
</tr>
<tr>
<td>6</td>
<td>Rochester</td>
<td>1.8%</td>
<td>0.4%</td>
</tr>
<tr>
<td>7</td>
<td>FMIT</td>
<td>-3.2%</td>
<td>5.1%</td>
</tr>
<tr>
<td>8</td>
<td>Merbein</td>
<td>-0.3%</td>
<td>0.2%</td>
</tr>
<tr>
<td>9</td>
<td>Nyah</td>
<td>0.7%</td>
<td>-1.0%</td>
</tr>
<tr>
<td>10</td>
<td>Torrumbarry</td>
<td>-1.6%</td>
<td>-0.6%</td>
</tr>
<tr>
<td>11</td>
<td>Campaspe</td>
<td>-2.6%</td>
<td>0.5%</td>
</tr>
<tr>
<td>12</td>
<td>Pyramid and Boort</td>
<td>-2.5%</td>
<td>-2.4%</td>
</tr>
<tr>
<td>N/A</td>
<td>Murray Valley</td>
<td>N/A 39</td>
<td>-3.2%</td>
</tr>
<tr>
<td></td>
<td>Northern irrigation districts</td>
<td>5.4%</td>
<td>0.4%</td>
</tr>
<tr>
<td>1</td>
<td>Bacchus Marsh</td>
<td>3.4%</td>
<td>0.8%</td>
</tr>
<tr>
<td>2</td>
<td>Macalister</td>
<td>-2.5%</td>
<td>0.6%</td>
</tr>
<tr>
<td>3</td>
<td>Werribee</td>
<td>-8.0%</td>
<td>-2.9%</td>
</tr>
<tr>
<td></td>
<td>Regional Victoria</td>
<td>0.2%</td>
<td>0.7%</td>
</tr>
</tbody>
</table>

(ABS Census data) (Saturn Corporate Resources 2006)

39 Due to data collection boundary changes at ABS between the 1991 and 1996, population data for Murray Valley are not reliable.
6.1.2 **Labour Force**

In 1991, FMIT (14%), Central Goulburn (16%) and Shepparton (13%) had unemployment rates higher than the Regional Victoria (RV) average. However by 1996, no irrigation district had a higher unemployment rate than the RV average. In 2001, only the unemployment rate in FMIT was slightly higher (8%) than the RV average.

Overall, the unemployment rates among residents of the northern irrigation districts were well below the RV average and participation rates were considerably higher, indicating relatively strong local labour markets. The combined northern irrigation districts also had a higher proportion of persons in full-time work.

![Table 13 - Labour force characteristics](abs-census-data-saturn-corporate-resources-2006)

6.1.3 **Income**

In 1991, average weekly individual incomes in the irrigation districts were 5% higher than the Regional Victoria average of $278, but had fallen to be 2% below the Regional Victoria average in 1996. However, by 2001 the average individual weekly income had increased to $464 in the combined irrigation districts to be 5% higher than the $442 for Regional Victoria.
Average weekly household income in the combined irrigation districts were higher than those observed in RV in all years. In 1996 it was $778, well above $655 in Regional Victoria; by 2001 the irrigation districts figure had risen to $879 compared to $786 for Regional Victoria.

The Sunraysia/Murray River diversion areas had consistently lower income levels than northern irrigation districts. The highest individual and household incomes in 1991, 1996 and 2001 were in Shepparton.

6.1.4 INCOME EQUALITY

A study called *Community adversity and resilience* by Jesuit Social Services found that the absolute amount of income one receives may be less important in determining people’s health than the way wealth is distributed and people’s awareness of the inequalities. The study found income inequality was closely associated with increased mortality, homicide, burglary and decreased social trust. Countries with more equal income distributions have higher life expectancies than do countries in which wealth is more concentrated, regardless of GDP per capita (Vision V 2004).

The following charts depict the differences in income distribution equality between northern irrigation regions and Melbourne. The pink horizontal line depicts a hypothetical situation of perfect income equality. Along this curve, 90% of people receive 90% of the income and so on.

Figure 20 shows that in Melbourne (red curve) 90% of the people receive just over 60% of the income and the remaining 10% of people receive nearly 40%.

In northern Victoria’s irrigation districts, income distribution is more equally distributed than Melbourne, with 90% of the people receiving just under 80% of the income.

![Figure 20 - Income distribution in Victoria's irrigation districts and Melbourne (2001)](source: ABS Census)
6.2 **IRRIGATORS AND THE MEDIA**

The media provide a window from which to view community sentiment. In 2006, Sunraysia Irrigation Council chairman, Danny Lee, publicised an ambition to establish “water banks.”

Water banks aim to slow the volume of water permanently traded out of an area. Farmers would become shareholders by handing over part of their irrigation entitlement to the community water bank. The water entitlement could be temporarily traded or leased to the environment, urban users or other farmers within or outside of the district but not traded away permanently.

Mr Lee’s campaign reflects opinions shared by a number of (predominantly district) irrigators who believe permanent trade is bad for their local area. In various media, Mr Lee claimed that “The Federal and State Governments’ water trading policies are destroying rural communities...Everywhere I go rural problems are the same: loss of services, families being forced off the land, corporations replacing family businesses…The results are devastating to rural towns and regional economies.”

“CHRIS HARRISON doesn’t understand why everybody is not ‘screaming blue murder’ over the impact of water policy changes in Victoria. ‘After floods, fire and drought, we can recover,’ said the farmer from Pyramid Hill, who has a six gigalitre water right with Goulburn-Murray Water. “But (water reform) is a fundamental change....Mr Harrison is watching his community slowly die as families sell up and move away because of rising costs and uncertainty over water rights. ‘We can’t find the numbers for the CFA,’ he said. ‘We can’t make up the numbers for our footy team. But try and argue that with economic rationalists’ (The Sunday Age 2006a).

Support for trade reform tends to be expressed by the scientific, environmental and general business communities.

“It is widely accepted that a free market in water property rights is the best way for water to find a value that reflects its scarcity and allocate it to its most productive and efficient urban and agricultural uses (Australian Financial Review 2006a: 70). Now is the time to rigorously apply water rights and trading…Implementing the National Water Initiative quickly and fully must be the priority of the Prime Minister and the states’ leaders” (Australian Financial Review 2006b: 62).

Whilst most agree that the market assists irrigators to manage risk, create value and improve overall economic welfare, some argue that government has a responsibility to manage distributional impacts via adjustment assistance.

“The challenge for the powers that be is to ease farmers’ way into the new water market. Australia’s farmers have endured years of hardship…The contribution they have made to the country’s wealth over the past 200 years means they hold a revered place in the national psyche, and generous aid and welfare packages have been forthcoming. Yet like any other industry, farmers have to stand on their own…

One of the most important economic reforms of recent times has been the creation of a national trading market for water...And thanks to the flexibility offered by a trading market for water, farmers now enjoy options they have never had before...As a consequence, water is finally beginning to flow to the highest value users.

This new flexibility has several benefits. It means less water is being wasted and more wealth generated. It also means that farmers can use their water rights as a form of superannuation...But markets are notoriously unsentimental…The

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40 Water banks were also a major platform of Mr Lee’s campaign as a Country Alliance candidate for the Victorian Upper House election in 2006.
The challenge for government is to smooth the edges of this new free market, and provide the right structural adjustment to those most in need. But a free market for water should not be abandoned. In the long run, it will be the thing that most likely saves our agricultural industry (The Sunday Age 2006b). Temporary trade is generally supported by irrigators. On the other hand, irrigators' view of permanent trade vary.

A researcher, Henning Bjornlund has investigated irrigators’ perceptions to trade. His studies reveal a range of beliefs and factors that influence people's perceptions and these are explored below.

Discussions about markets for permanent water showed that most irrigators could see the benefits of trade but they were also concerned about potential negative impacts. This was particularly the case in NSW and Victoria and among irrigators that depended on communal infrastructure (Bjornlund, H 2004). The main concerns include:

- control of significant volumes of water by ‘water barons’;\footnote{Water baron is a term coined by certain parts of the Victorian irrigation community to describe non-irrigators who could buy significant volumes of water and use the market to opportunistically make money.}
- inequitable activisation (and profiting) of previously unused entitlements by ‘sleeper licences’;
- reduction in sales water available due to the uptake of water by sleeper licence holders;
- large volumes of water exported out of a particular area resulting in a reduction in economic activity;
- higher infrastructure costs and ‘stranded assets’;\footnote{“Stranded assets” is a term used to describe a situation when people no longer want to receive water and do not contribute to the cost of irrigation infrastructure. The irrigators that remain on the system find it more expensive because the cost sharing is spread over a smaller base. Stranded assets also refers to a relatively unusual experience when there are not enough farmers to pay the cost of keeping a delivery system operational and the water authority proposes to close it. The potential for stranded assets is being addressed by government and GMW through a process known as “Reconfiguration Planning.” The Plans are developed in consultation with farmers and are signed off by the Minister for Water. A range of options such as reducing delivery points per property or gifting channel ownership is explored in the Plans. If an agreement can not be reached and a water authority ceases to supply an individual, compensation provisions are provided for. The provision for water authorities to potentially cease supply is new and presents legitimate concerns for some irrigators. Whether these concerns continue depends on the outcome of reconfiguration planning. Further information is available at http://www.g-mwater.com.au}
- ceasing supply of water to properties which could destroy a person’s livelihood;
- land management issues (e.g. weeds) if properties are no longer farmed;
- uncertainty regarding environmental impacts (e.g. salinity and river health);
- equity issues regarding poorer farmers competing on the market against large profitable farmers; and
- uncertainty as to whether the existing supply system can deliver extra water i.e. to Sunraysia (infrastructure congestion).

Interviews and a survey conducted in 2006 titled The Social Implications of Permanent Water Trading in the Loddon-Campaspe irrigation region of Northern Victoria (Fenton, M 2006b) identified similar concerns.

The motivation not to sell permanent water is often influenced by broader social and community processes. Social norms are people’s beliefs about what attitudes and behaviours are normal, acceptable, or expected in a social context. It is not necessarily the case that such attitudes and
behaviours are held by the majority of people, only that there is a belief that this is so (Fenton, M 2006b: 12).

“Well, a lot of people feel there’s a moral issue there and they want their community to stay as a whole…I just think it’s criminal…because it’s breaking the community down…"

“We’d go into the pub…and there was a mind-set at the bar…there’s that bastard that sells water” (Fenton, M 2006b: 13).

Not all responses were negative. Both Bjornlund and Fenton’s studies identified a range of positive beliefs about permanent trade such as assisting people to retire, manage risk and debt.

“There were some big dairy farms we dealt with who saw water trading as a way out of a sticky situation...One guy for example, he said he owed the banks two million and his water was worth that, so he just pulled the pin and sold the water. It did give a lot of people the opportunity to bail out, so quite a few did” (Fenton, M 2006b: 11).

“Some people who have been farmers since they left school say…and they’re heading towards retiring age…they may not have had much in the way of a financial setup or superannuation plan. Then trading water…oh well…this will be my retirement fund” (Fenton, M 2006b: 11).

It should be noted that the Loddon Campaspe study focussed specifically on the sale, rather than purchase, of permanent water and includes the districts of Torrumbarry and Pyramid Hill, which are significant exporters of permanent water. The results provide insights into people’s perception of trade from a region that has a falling population, significant areas of C & D class (saline) soils and unviable infrastructure.

### 6.3 SOCIAL PERCEPTIONS VARY

Bjornlund observed that different perceptions exist depending on whether a person belongs to the following (generalised) categories (Bjornlund, H 2004):

- **district or private diverter**: private diverters who have developed previous dry land properties support trade while many on traditional districts are less supportive.

- **corporate or family farm**: large corporate farms support trading because it has enabled an entrepreneurial activity not previously possible. Many family farms find it difficult to compete with the corporate farms. ‘Blockies’ (a localised term for district irrigators) in Sunraysia comment on the difficulty of meeting the contract terms of large corporate competitors.

- **farm type**: of the groups interviewed, **dairy farmers** were most concerned about losing water for the environment and strongly argued that the community should pay for such water, not just farmers. Dairy farmers also made comments that the green movement has too much influence, securing city votes etc. They expressed strong beliefs that current water policies will generate the greatest social change ever seen and therefore called for policies that allow change to take place with dignity. They also believe that change was happening too fast. **Mixed farmers** were the most opportunistic, with low capital costs they are active in the trading market, taking advantage of commodity and water prices. **Horticulturalists’** motivation for trading was almost entirely based on the need for water to increase production by expanding plantings or new developments. They were strong supporters of the market.

- **financial viability of the business**: Irrigators with negative income are more concerned with community impacts and impacts of trade on remaining groups. This group spoke the least about using the market to purchase water except for using it as an exit strategy.
Irrigators with incomes between AUD$0 - $25,000 were concerned about the impact of big business and the activisation of sleeper licences. Their main concern was their livelihood. The AUD$50,000 plus irrigators were concerned about water barons, the Green Movement, declining annual allocations and 'stranded assets'. Markets are viewed positively because they offer opportunities to expand the business, provide security, flexibility and an ability to capitalise on commodity prices - to ‘push our enterprise to its limit.’ Irrigators with expanding farm businesses use markets to build their businesses and regard the cost of buying water as just another business cost. This group favours the market and wants it free and open. They are less concerned about community issues.

- whether there is an expectation of children to take over the farm: about a third of all farm families expect their business to continue in the family and a third are uncertain. Irrigators who expect family continuity show a higher degree of concern with the community impacts. Those who don’t expect family continuity are divided into two groups. The first consists of farmers on unviable properties who see no possibility of improving their position and who say that trading provides exit options. The second consists of farmers who do not consider their farm as a family business but a business investment. They favour the market and are less concerned about community impacts.

Perceptions on trade not only vary amongst individuals, but research shows that people have mixed feelings. In the Loddon Campaspe study, 47% of people believe permanent trade is bad for the area and 48% believe it is a good and bad (Fenton, M 2006c: iii).

“Look there’s mixed feelings and you probably would have picked this up in the dairy industry...You’ll get a quantity that say they’ve raped the farms by selling the permanent water off, to a degree I feel that that’s probably correct but then in terms of financial situation it’s helped people...Well the bad side of it I suppose it’s not good for the local area because the area is dependant on water, that’s how the district makes its income — from water, so if there’s less water, there’s less income, less income means less population and less population and so it goes on. On the positive side it means some farmers can leave the industry…to get out of it. So I don’t know whether that’s good or bad…” (Fenton, M 2006b: 14).

### 6.4 WATER AS HERITAGE

The passionate reactions of some rural Victorians to government water reform, both historically and recently, reflect the fact that water is critical to many rural irrigation communities, from a production and heritage perspective. Rochford has investigated rural water ownership from an ideological position and uses the recent decision to connect Bendigo to the Goulburn system to illustrate her point.

“The response of Campaspe and Rochester irrigators to the debate is indicative of the symbolism and meaning attached to water in that district. However, it also attracts meaning as a symbol of broader economic and political struggles diminishing and disempowering rural communities…Irrigation is imbued with heritage value as a focus and symbol of wider concerns. Water issues become a lightening rod for a more generalised disenchantment with political decision making” (Rochford, F 2006: 2).

The proposal to transfer water to the Coliban system is evidence of the prevailing discourse in water resource management in Victoria. However, it is only one aspect of a political rationality which has resulted in feelings of political disempowerment, dislocation and marginalisation of rural interests, and the loss of irrigation water to urban interests is symbolic of the generalised loss of power” (Rochford, F 2006: 2).

The current feeling in rural Victoria that water is fundamental to an area’s prosperity may be a legacy of a system that was established because irrigation development in many cases resulted in
the settlement of entire new areas. The idea of moving water out of an area is considered by some as removing the reason for the area’s existence, even though the regional economy may have in fact, diversified considerably.

“…the social objective of the time (was) to settle as many people in rural Victoria as possible. Between 1906/07 and 1934/35 the capacity of storages increased fourfold, the length of channels tripled, the area of irrigated districts increased from around 350,000 ha to over 810,000 ha and the population went from 12,700 to 80,000 in irrigation districts” (Langford, J, Forster, C & Malcolm, D 1999: 7).

Many of the irrigation districts that exist in Victoria were established as ‘soldier settlements,’ a social and economic policy of the day to encourage employment for returning soldiers and the development of the State’s natural resources. In 1910 the government was actively pursuing immigrants from England and America to settle in Rochester and Cohuna. Non-irrigated wheat and sheep farms were compulsorily acquired to develop irrigation districts. During this process the government drew up plans and allocated water and land packages.

“Irrigation businesses were considered as providers of a public service, not commercial businesses that need to be financially viable…In 1984/85 revenue only covered 74% of direct operating expenditure (let alone depreciation or return on investment)…The legacy of these investments was an unsustainable debt of some $400 million… In 1985 the Victorian government agreed to retire $330 million in debt incurred in constructing the irrigation infrastructure and again in 1992 the government retired a further $102.4 million debt” (Langford, J, Forster, C & Malcolm, D 1999: 16 & 18).

The legacy of government’s historical ‘soldier settlement’ policy is an interpretation by many irrigators that water is an individual’s ‘right’ in perpetuity, not a resource that belongs to everyone. This distinction is the basis for ongoing bitter debate between irrigators, cities and environmentalists.

Farmers as lobbyists link their way of life with a national ideal that receives some sympathy from urban centres.

“By claiming water as heritage, the community itself is imagined in a political manner which also evokes a national ideal. Naturalised rural values are represented as national ones…This notion of heritage is politically effective in the context of federal agricultural policy of government intervention based on historical ideologies which tout the political, commercial and symbolic importance of farming” (Solis, P 2006).

“Officially the federal government’s drought assistance is available only for viable businesses. However Prime Minister John Howard last year admitted that his government’s policy was also to maintain "a critical mass of farmers in order to preserve our "national identity" (Weekend Financial Review 2006).

At the turn of the 20th Century, when transportation did not allow wide-scale imports of food products and Melbourne’s economy was less sophisticated, rural Victoria’s role in Melbourne’s development was significant. Whilst it is true that food production is a vital service, in the 21st Century the role of rural Victoria in the State’s overall economy has declined and approximately two-thirds of irrigation production is sold to export markets.

6.4.1 SOCIAL PERCEPTIONS CONCLUSION

There is no single perception of trade. Like most things, views vary depending on people’s background, values and whether trade has helped them or led to a change in their local community that they do not support.
7. CONCLUSION

This study provides an overview of Victoria’s trade experience by bringing together data from a range of years and sources. It begins to demystify some of the anecdotal beliefs about Victoria’s water trade system and shows that water trading enables wealth creation and risk management options to irrigators that were previously not available.

The opening up of Victoria’s water trading system, which has coincided with one of the driest decades on record, has helped to lessen the burden of drought by providing a mechanism to manage this risk. The market has facilitated an efficient allocation of water in a way that government agencies could not do.

Whilst the social perceptions of permanent trade varies and further work to understand localised impacts may be warranted on a case by case basis, the market is providing overall benefits that support policy assumptions underlying the development of water trade in Victoria. Water trading provides greater choice and is increasingly being used by irrigators across regions and sectors to improve their business management.

Further market behaviour and trading trends are expected to develop after “unbundling” and further opening of the water market to include interstate trade. It is also important to understand how the market interacts with its local environments.
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