Community impacts of the Guide to the proposed Murray-Darling Basin Plan

Volume 5. Regional Analysis – southern Basin overview

May 2011

Report prepared for the Murray-Darling Basin Authority

A consortium of EBC, RMCG, MJA, EconSearch, Geoff McLeod, Tim Cummins, Guy Roth and David Cornish

Key contact details:
Dr Mark Fenton, Director EBC, mark@ebc.net.au
Rozi Boyle, Associate Partner RMCG, rozib@rmcg.com.au
Matthew Toulmin, Partner and Principal Consultant RMCG, matthewt@rmcg.com.au
Dr John Marsden, Director, Marsden Jacob Associates (MJA), john.marsden@marsdenjacob.com.au

© Copyright Commonwealth of Australia 2011.
This work is copyright. With the exception of the photographs, any logo or emblem, and any trademarks, the work may be stored, retrieved and reproduced in whole or in part, provided that it is not sold or used for commercial benefit. Any reproduction of information from this work must acknowledge the Murray–Darling Basin Authority, the Commonwealth of Australia or the relevant third party, as appropriate, as the owner of copyright in any selected material or information. Apart from any use permitted under the Copyright Act 1968 (Cth) or above, no part of this work may be reproduced by any process without prior written permission from the Commonwealth. Requests and inquiries concerning reproduction and rights should be addressed to the MDBA Copyright Administration, Murray-Darling Basin Authority, GPO Box 1801, Canberra ACT 2601 or by contacting + 61 2 6279 0100.

Disclaimer
This document has been prepared for the Murray-Darling Basin Authority and is made available for general use and to assist public knowledge and discussion regarding the integrated and sustainable management of the Basin's natural water resources. The opinions, comments and analysis (including those of third parties) expressed in this document are for information purposes only. This document does not indicate the Murray-Darling Basin Authority's commitment to undertake or implement a particular course of action, and should not be relied upon in relation to any particular action or decision taken. Users should note that developments in Commonwealth policy, input from consultation and other circumstances may result in changes to the approaches set out in this document.

Disclaimer:
This report has been prepared in accordance with the scope of services described in the contract or agreement between RMCG and the Client. Any findings, conclusions or recommendations only apply to the aforementioned circumstances and no greater reliance should be assumed or drawn by the Client. Furthermore, the report has been prepared solely for use by the Client and RMCG accepts no responsibility for its use by other parties.
Table of Contents

1 INTRODUCTION .......................................................... 2
   1.1 About this study ........................................................... 2
   1.2 The purpose of this report ................................................. 6

2 DEFINING THE SOUTHERN CONNECTED BASIN .......... 7

3 UNDERSTANDING THE SMDB AS AN INTEGRATED MIX OF SOCIAL CATCHMENTS ................ 10

4 UNDERSTANDING THE SMDB AS A MIX OF IRRIGATED INDUSTRIES .................. 15
   4.1 The value and distribution of agricultural production .................... 15
   4.2 The key irrigated industries in the southern-connected Basin ............... 17
   4.3 The interaction between social catchments and processing industries ....... 25

5 UNDERSTANDING THE SMDB AS A MIX OF PEOPLE INTERACTING WITH THE LANDSCAPE .... 29
   5.1 Landscapes ........................................................................ 29
   5.2 Horticulture soils ................................................................ 30
   5.3 Dairy soils and location .......................................................... 30
   5.4 Rice soils and location ............................................................. 31
   5.5 Mixed farming and location .................................................... 31
   5.6 Commandable land and opportunistic irrigation ......................... 31
   5.7 Implications for the future ....................................................... 32

6 UNDERSTANDING THE SMDB AS MIX OF PEOPLE INTERACTING WITH DIFFERENT WATER ENTITLEMENTS ...... 33
   6.1 Water entitlements in different parts of the Basin .......................... 33
   6.2 Usage in a normal year versus drought .................................... 35
   6.3 Water trade patterns also show increasing connectivity in the southern-connected Basin .................................................. 37
   6.4 Comparison of proposed SDLs with the Drought ........................ 40

7 BASELINE TRENDS .......................................................... 47
   7.1 Horticulture ....................................................................... 47
   7.2 Dairy ................................................................................... 47
   7.3 Rice and mixed farms ............................................................. 48
   7.4 Conclusions ....................................................................... 49

8 POTENTIAL IMPACTS OF THE GUIDE’S PROPOSED SDLS .......... 51
   8.1 Horticulture ....................................................................... 51
   8.2 Dairy ................................................................................... 51
8.3 Rice and mixed farms ............................................................................................................. 51
8.4 A new equilibrium of industries ............................................................................................. 52

9 COMMUNITY RESILIENCE AND THE ABILITY TO ADAPT TO SDLS 53
Community impacts of the proposed Murray-Darling Basin Plan

Preface

This report is Volume 5 in a suite of documents that has been prepared by the EBC consortium on the potential community impacts of the proposals in the *Guide to the proposed Murray-Darling Basin Plan*.

The MDBA commissioned the consortium to assess the potential community impacts of the proposals in the *Guide*. The primary objective was to understand the impacts on local, small-scale, human issues and costs during the short and medium term. A key aim was to consult with communities to understand how they would be impacted by proposals in the *Guide*.

A round of interviews with key informants was conducted from January to April 2011, covering 48 social catchments, 80 local government areas and 119 towns and regional centres. The discussions involved nearly 700 people from across the full range of sectors and employment groups. Additional economic analysis was undertaken to supplement and inform the outcomes of the community interviews.

The outcome of the project is reported in nine volumes:

- **Volume 1**: An Executive Summary - provides an overview and condensed report on the core outcomes of the project;
- **Volume 2**: Methodology - sets out the framework and analytical methodology for the study;
- **Volume 3**: Community Impact - provides a comprehensive report on the breadth of the issues raised in the community impact assessment. This includes the identification of a number of significant issues which are material for the roll-out of the draft Basin Plan;
- **Volume 4**: Informing choices - takes the key issues from Volume 3 and provides further analysis and assessment of the issues to provide information to optimise decisions on the development and implementation of the draft plan at least cost to the community;
- **Volume 5**: Regional analysis: Southern Connected Basin Overview;
- **Volume 6**: Regional analysis Queensland - provides detailed reports on the key findings from the community engagement process at a regional scale. These regional analyses focus on the short to medium term impacts of the proposals in the Guide on industries and communities at the local level;
- **Volume 7**: Regional analysis New South Wales;
- **Volume 8**: Regional analysis Victoria; and
- **Volume 9**: Regional analysis South Australia.
1 Introduction

1.1 About this study

This study was commissioned by the Murray-Darling Basin Authority to assess the potential impacts of the proposals in the *Guide to the proposed Basin Plan* on local, small-scale, human issues and costs during the short and medium term.

The project was delivered using a suite of tools including community interviews, data analysis and economic modelling. These complementary approaches provided a robust basis for the assessment.

The community impact assessment was targeted at ‘social catchments’. This is a level of social grouping that reflects community identity and local economic interaction and enabled the study to capture impacts that occurred at a small scale. Around 50 such social catchments were selected across the Basin, mostly centred on towns that are at the heart of regional communities.

A comprehensive interview program was undertaken throughout the Basin early in 2011, with almost 700 interviews with key informants in nearly 50 social catchments. These semi-structured interviews obtained and assessed the potential impact of the Guide on farmers, businesses and communities within each social catchment. The impact assessment was structured to take account of the wider factors impacting on regional communities to identify the additional impacts that the Guide would have, over and above an agreed baseline.

The interviews used lines of enquiry that explored the current context, responses to the Guide, the baseline (a dynamic baseline, if there were no Basin Plan), the impacts of buyback and irrigation modernisation to date, and the impacts of future buyback and/or modernisation to meet the scenarios set out in the Guide. There were four groups of interviewees, with four tailored lines of enquiry, so that impacts could be traced from farmers, through the farm value chain (including processors), and into the community with a focus on businesses and services (Figure 1–1).
The relative impact of the Guide at a local level depended on the scale of the proposed change, the mechanisms by which compensated environmental water recovery occurred, and the inherent capacity of the communities in social catchment to adjust. The capacity of communities to adapt to compensated environmental water recovery depended on two attributes: ‘size’, with a threshold at a figure around 10,000 people; and ‘dependency on irrigated agriculture’, with a threshold at around 15% of total employment in agricultural related sectors.

Using these two criteria allows the multiple social catchments across the Basin to be analysed within four major categories (Figure 1–2):

- **Category 1**: Small towns that are highly dependent on irrigated agriculture and are often geographically isolated, such as Hillston. These smaller communities are often subject to wider economic and demographic forces that are driving a
decline in their size and vitality. Reductions in water availability could increase the speed and extent of these changes for those communities;

- **Category 2**: Small diverse towns such as Echuca that combine high-value irrigation with tourism and other sectors. They are insulated to some extent from the impacts of reduced water availability;

- **Category 3**: Larger towns that are highly dependent on irrigated agriculture, such as Griffith, Robinvale and Loxton. These centres are robust with current diversion limits but would be highly exposed to proposed reductions in water availability; and

- **Category 4**: Large, diverse growing regional centres, such as Bendigo or Mildura that have a breadth of activity and employment. These are relatively insulated from reductions in water availability in the region.

The relative vulnerability of towns across the Basin as a whole is shown in Figure 1–3.

It is very important to recognise that relative vulnerability does not necessarily mean that towns will be more negatively impacted by the forthcoming Basin Plan. Other factors are also important; in particular, the relative exposure of towns to the proposed changes is critical. Not all vulnerable towns will necessarily face significant reductions in irrigation activity under the Basin Plan. A number of factors, in turn, affect exposure – these include the extent of the change from the current to the proposed sustainable diversion limit; the types of water entitlement sought by the Commonwealth; the mode of procurement (e.g. buy-back vs. modernisation); etc. Some of these key policy settings that affect exposure are discussed in Volume 4 of this study.
Figure 1–3. Social catchments in the Murray-Darling Basin, showing relative vulnerability of towns to reduced irrigation.
1.2 The purpose of this report

The purpose of this report is to describe the features of the southern-connected Murray-Darling Basin (sMDB) so as to better explain how the social catchments, industries and landscapes within it interact. The report illustrates how these interactions will determine how irrigated agriculture will respond to the implementation of the Basin Plan, and how in turn this will determine the flow-on effects for the rest of the community.

Our related work analysed how the proposed sustainable diversion limits (SDLs) in the Guide would affect each of the individual regions that make up the southern-connected Basin. This report looks at the southern-connected Basin as a whole rather than as the sum of its parts. It is vital to understand the connections between the component regions because water trade means that an impact in one region, or one industry, has implications for other regions throughout the southern-connected Basin. This report should be read together with the regional reports for those regions that lie within the southern connected Basin (see page 1). This report does not seek to duplicate the more detailed information in those reports.

To the extent that the Guide concentrates on increasing flows through the Lower Lakes and the Coorong it must also concentrate on reducing diversions in the southern-connected Basin. Because it is connected it will be the subsequent rounds of water trade, perhaps more than the initial buy-back, that will ultimately determine the longer-term socio-economic impacts of the Basin Plan. It is for that reason that this report looks at the southern-connected Basin as a whole rather than the individual regions within it. Nonetheless, where appropriate it also highlights those aspects of the proposals that have localised impacts.

To look at the whole it is necessary to understand that there are more connections in this system than just water trade. Consequently this report also looks at how:

- connections between social catchments often transcend individual valleys. The southern-connected Basin is densely populated relative to the northern Basin, with economic and social interconnections spanning regions. Connections to the main regional centres and on to the main capital city (which may not be in the same state) are particularly important in terms of flow-on effects;

- the three key irrigation industries in the southern-connected Basin - rice, horticulture and dairy - also often transcend individual valleys. These industries are located where they are because of a mix of settlement history, climate, landscape characteristics and the reliability of different water entitlement types. Their location in turn has influenced the location of the main processing industries; and

- water delivery infrastructure often provides connections between different valleys, particularly in Victoria where the Goulburn-Murray irrigation district is managed as one system.
2 Defining the southern connected Basin

The southern connected Basin may be defined as the following (Figure 2-1):

- major catchments:
  - South Australian Murray;
  - Sunraysia (Nyah to Border Region/NSW and Victoria including Lower Darling);
  - NSW Murray;
  - Victorian Murray;
  - Victorian Goulburn;
  - NSW Murrumbidgee; and

- minor catchments:
  - Victorian Ovens, Kiewa, Loddon and Campaspe.

---

Diversions and entitlements for the southern catchments are shown in Table 2-1.

### Table 2-1. River diversions from the southern-connected Basin.  

<table>
<thead>
<tr>
<th>Region</th>
<th>High reliability entitlements GL (irrigation only)</th>
<th>Low reliability entitlements GL (irrigation only)</th>
<th>Diversions GL/y (all includes losses and non irrigation)</th>
<th>Main crops</th>
</tr>
</thead>
<tbody>
<tr>
<td>SA Murray</td>
<td>554</td>
<td>-</td>
<td>665</td>
<td>Mostly horticulture</td>
</tr>
<tr>
<td>Vic Murray</td>
<td>1,169</td>
<td>291</td>
<td>1,641</td>
<td>Mostly dairy, but includes 474 GL for horticulture in Vic Sunraysia</td>
</tr>
<tr>
<td>Vic Goulburn-Broken</td>
<td>978</td>
<td>438</td>
<td>1,607</td>
<td>Mostly dairying and mixed, some horticulture</td>
</tr>
<tr>
<td>Vic Ovens, Kiewa</td>
<td>42</td>
<td>13</td>
<td>36</td>
<td>Mostly dairy and some viticulture</td>
</tr>
<tr>
<td>Vic Loddon Campaspe</td>
<td>58</td>
<td>27</td>
<td>210</td>
<td>Mostly mixed</td>
</tr>
<tr>
<td>NSW Murray</td>
<td>198</td>
<td>1,670</td>
<td>1,721</td>
<td>Mostly horticulture, some lake bed broad acre cropping in high allocation years</td>
</tr>
<tr>
<td>NSW Lower Darling</td>
<td>8</td>
<td>30 plus 250 GL supplementary</td>
<td>55</td>
<td>Mostly horticulture</td>
</tr>
<tr>
<td>NSW Murrumbidgee</td>
<td>298</td>
<td>2,043 plus 220 GL supplementary</td>
<td>2,061</td>
<td>Rice, mixed cropping and horticulture</td>
</tr>
<tr>
<td>Southern-connected Basin excluding Darling</td>
<td>3,305</td>
<td>4,512 plus 470 GL supplementary</td>
<td>7,996</td>
<td>All except cotton</td>
</tr>
<tr>
<td>MDB</td>
<td></td>
<td></td>
<td>10,942</td>
<td>All</td>
</tr>
</tbody>
</table>

Table 2-1 shows that the southern-connected Basin represents 73% of all diversions in the MDB. It is a critical source of water for the environment.

The Guide outlined that the Lower Lakes were a key driver for its SDL proposals (requiring flows of at least 1,960 GL additional environmental flows). If the requirement for water in the Lower Lakes is required in all years (although it is unclear from the Guide how much is required in the low allocation years) and the level of connection between the Northern Basin and the southern-connected Basin is so low that it cannot be relied upon to contribute to the additional needs of the Lower Lakes, then this would have the following implications:

- the southern-connected Basin would be required to meet a very high proportion (maybe close to 100%) of the requirements of the Lower Lakes from the current diversions, **this is 25% of the southern-connected Basin diversions**; and

---

2 Source: for baseline diversions, Table C.1 in MDBA, 2010, *Guide to the proposed Basin Plan*. Irrigation Entitlements from water registers and water sharing plans for each valley in each state.

3 Table 6.2 page 74 in MDBA, 2010, *Guide to the proposed Basin Plan*. 

EBC, RMCG, Marsden Jacob Associates, EconSearch, Geoff McLeod, Tim Cummins, Guy Roth and David Cornish
• if only high reliability entitlements can provide the water in dry years for the Lower Lakes, then depending upon how much the Lower Lakes requires in the dry years, potentially 60% of all the southern-connected Basin high reliability entitlements will be required for meeting the needs of the Lower Lakes. This could have enormous implications for high reliability users such as horticulture and dairying.
3 Understanding the sMDB as an integrated mix of social catchments

The concept of social catchments is used to represent the way in which people relate to things like location, regional identity, feelings of common purpose and a sense of community (see Volume 2, of this study, Methodology). The concept of social catchments is also strongly linked to the concept of social capital. A social catchment is the area occupied by a group of households and individuals who are in some form of regular interaction and which the inhabitants identify as ‘their’ community or region.

Social catchments are nested, in that small social catchments tend to sit within larger social catchments. The relative ranking or order of towns within a region can be determined by examining the goods and services the towns provide. Larger towns have larger social catchments than smaller towns by virtue of the broader range of goods and services offered. The larger social catchment comes about because people are prepared to travel further to access a more diverse range of goods and services than may be available closer to where they live. People living within the social catchment will travel regularly to the central place of that catchment.

The social catchments of the southern-connected Basin are illustrated in Figure 3-1 and Figure 3-2.
Figure 3-1. Social catchments in NSW and Victoria.\(^4\)

\(^4\) Source: EBC Consortium analysis. For methodology, please refer to Volume 2 of this study.
Figure 3-2. Social catchments in South Australia.  

Source: EBC Consortium analysis. For methodology, please refer to Volume 2 of this study.
The linkages between towns within these various social catchments are briefly explained in Table 3-1. The Table also shows how each relates to the capital cities.

### Table 3-1. Towns in the southern-connected Basin

<table>
<thead>
<tr>
<th>Capital cities</th>
<th>Regional Centres (&gt;10,000)</th>
<th>District towns (3000-10000)</th>
<th>Localities (&lt;3000)</th>
<th>Dependency on irrigation</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adelaide</td>
<td>Mildura Renmark</td>
<td>Few</td>
<td>High</td>
<td>Linked to other Riverland towns and Mildura through irrigated horticulture economy and transport links</td>
<td></td>
</tr>
<tr>
<td>Adelaide</td>
<td>Mildura Berri</td>
<td>Few</td>
<td>High</td>
<td>Linked to other Riverland towns and Mildura through irrigated horticulture economy and transport links</td>
<td></td>
</tr>
<tr>
<td>Adelaide</td>
<td>Mildura Loxton</td>
<td>Few</td>
<td>High</td>
<td>Linked to other Riverland towns and Mildura through irrigated horticulture economy and transport links</td>
<td></td>
</tr>
<tr>
<td>Adelaide</td>
<td>Mildura Barmera</td>
<td>Few</td>
<td>High</td>
<td>Linked to other Riverland towns and Mildura through irrigated horticulture economy and transport links</td>
<td></td>
</tr>
<tr>
<td>Adelaide</td>
<td>Nil Waikerie</td>
<td>Few</td>
<td>High</td>
<td>Linked to other Riverland towns and Adelaide through irrigated horticulture economy and transport links</td>
<td></td>
</tr>
<tr>
<td>Adelaide</td>
<td>Murray Bridge Nil</td>
<td>Many</td>
<td>High</td>
<td>Linked to Adelaide-Melbourne transport links and also coastal tourism, manufacturing centre, dairying, chicken raising, pig breeding, tomato and snow pea growing.</td>
<td></td>
</tr>
<tr>
<td>Melbourne</td>
<td>Mildura Swan Hill, Wentworth, Renmark, Robinvale, Red Cliffs, Merbein, Dareton</td>
<td>High</td>
<td>Links to Mildura, Griffith, Adelaide, Melbourne. Wine, dried fruit, table grapes, citrus, almonds vegetables</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Melbourne</td>
<td>Shepparton Benalla, Cobram, Tongala</td>
<td>Many</td>
<td>High</td>
<td>Links to Shepparton and exports to Melbourne Dairying in GMID and horticulture (pome and stone fruit)</td>
<td></td>
</tr>
<tr>
<td>Melbourne</td>
<td>Bendigo Swan Hill, Kerang, Cohuna, Rochester, Many, E.g. Pyramid Hill and Boort</td>
<td>High in North, Low in Bendigo</td>
<td>Links to Shepparton and Bendigo. Dairying in GMID and horticulture (grapes and stone fruit at Swan Hill), tomatoes Echuca</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Melbourne</td>
<td>Echuca Kerang, Cohuna, Rochester, Tongala, Deniliquin</td>
<td>Few</td>
<td>High</td>
<td>Links to Shepparton and Bendigo. Dairying in GMID, tourism at Echuca,</td>
<td></td>
</tr>
<tr>
<td>Melbourne</td>
<td>Echuca Deniliquin Finley</td>
<td>Few</td>
<td>High</td>
<td>Cropping and rice.</td>
<td></td>
</tr>
<tr>
<td>Melbourne</td>
<td>Albury-Wodonga Wangaratta</td>
<td>Many</td>
<td>Low</td>
<td>Linked to Sydney – Melbourne Canberra corridor, not an irrigation based economy</td>
<td></td>
</tr>
<tr>
<td>Sydney</td>
<td>Griffith Leeton</td>
<td>Few</td>
<td>High</td>
<td>Wine, prunes, citrus, vegetables, rice, cropping. Wine links to Mildura and Riverland.</td>
<td></td>
</tr>
<tr>
<td>Sydney</td>
<td>Wagga Wagga</td>
<td>Few</td>
<td>Low</td>
<td>Cropping</td>
<td></td>
</tr>
</tbody>
</table>
The key points to take from this discussion are:

- the social catchments are nested and they are interconnected in ways that transcend state boundaries. For example, Echuca is linked to Deniliquin as well as Shepparton, Kerang and Bendigo; and

- this interconnectedness means that the impacts of the proposed SDLs will be spread across and between regions; those regions cannot be looked at in isolation from each other.
4 Understanding the sMDB as a mix of irrigated industries

4.1 The value and distribution of agricultural production

Agriculture is an important component of the local economy for each of the social catchments mapped in the previous section. Table 4-1 shows that the total value of agriculture for the southern-connected Basin in 2005/06 was $9.6 billion (including dryland production). This compares with $15 billion annual agricultural production for the Basin as a whole.6

Table 4-1 Regions and production of the southern-connected Basin.7

<table>
<thead>
<tr>
<th>Region</th>
<th>2003–04</th>
<th>2005–06</th>
</tr>
</thead>
<tbody>
<tr>
<td>NSW Lower Darling</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agriculture—total value ($m)</td>
<td>216</td>
<td>219</td>
</tr>
<tr>
<td>Water use (GL)</td>
<td>68</td>
<td>96</td>
</tr>
<tr>
<td>Change in water use due to trading (GL)</td>
<td>20</td>
<td>0</td>
</tr>
<tr>
<td>Intraregional allocation trading (GL)</td>
<td>n.a.</td>
<td>21.8</td>
</tr>
<tr>
<td>NSW Murrumbidgee</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agriculture—total value ($m)</td>
<td>961</td>
<td>931</td>
</tr>
<tr>
<td>Water use (GL)</td>
<td>2 719</td>
<td>2 138</td>
</tr>
<tr>
<td>Change in water use due to trading (GL)</td>
<td>-30</td>
<td>-6</td>
</tr>
<tr>
<td>Intraregional allocation trading (GL)</td>
<td>152.9</td>
<td>102.7</td>
</tr>
<tr>
<td>NSW Murray</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agriculture—total value ($m)</td>
<td>858</td>
<td>879</td>
</tr>
<tr>
<td>Water use (GL)</td>
<td>2 378</td>
<td>2 034</td>
</tr>
<tr>
<td>Change in water use due to trading (GL)</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Intraregional allocation trading (GL)</td>
<td>107.8</td>
<td>154.4</td>
</tr>
<tr>
<td>SA Murray</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agriculture—total value ($m)</td>
<td>1 203</td>
<td>1 222</td>
</tr>
<tr>
<td>Water use (GL)</td>
<td>880</td>
<td>889</td>
</tr>
<tr>
<td>Change in water use due to trading (GL)</td>
<td>13</td>
<td>-4</td>
</tr>
<tr>
<td>Intraregional allocation trading (GL)</td>
<td>0.7</td>
<td>49.1</td>
</tr>
<tr>
<td>Vic. Goulburn</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agriculture—total value ($m)</td>
<td>958</td>
<td>1 068</td>
</tr>
<tr>
<td>Water use (GL)</td>
<td>756</td>
<td>796</td>
</tr>
<tr>
<td>Change in water use due to trading (GL)</td>
<td>3</td>
<td>-22</td>
</tr>
<tr>
<td>Intraregional allocation trading (GL)</td>
<td>142</td>
<td>164</td>
</tr>
<tr>
<td>Vic. Loddon and Campaspe</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agriculture—total value ($m)</td>
<td>157</td>
<td>131</td>
</tr>
<tr>
<td>Water use (GL)</td>
<td>558</td>
<td>589</td>
</tr>
<tr>
<td>Change in water use due to trading (GL)</td>
<td>-4</td>
<td>38</td>
</tr>
<tr>
<td>Intraregional allocation trading (GL)</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Vic. Murray above Barmania</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agriculture—total value ($m)</td>
<td>573</td>
<td>629</td>
</tr>
<tr>
<td>Water use (GL) (Murray above/below Barmania)</td>
<td>2 008</td>
<td>1 526</td>
</tr>
<tr>
<td>Change in water use due to trading (GL)</td>
<td>-1.6</td>
<td>3.8</td>
</tr>
<tr>
<td>Intraregional allocation trading (GL)</td>
<td>6</td>
<td>20</td>
</tr>
<tr>
<td>Vic. Murray below Barmania</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agriculture—total value ($m)</td>
<td>1 116</td>
<td>1 040</td>
</tr>
<tr>
<td>Water use (GL) (Murray above/below Barmania)</td>
<td>2 008</td>
<td>1 526</td>
</tr>
<tr>
<td>Change in water use due to trading (GL)</td>
<td>-2</td>
<td>6</td>
</tr>
<tr>
<td>Intraregional allocation trading (GL)</td>
<td>21</td>
<td>69</td>
</tr>
</tbody>
</table>

---

6 page 21 in MDBA, 2010, Guide to the proposed Basin Plan
The gross value of irrigated agricultural production across the Basin was around $5.5 billion in 2005/6, as illustrated in Figure 4-1. The irrigation sector continues to be vibrant and innovative despite the hardships of the recent drought. There was an increase in the value of agriculture between 2000/01 and 2005/06, despite a fall in water use (measured using irrigation diversions and total volume applied). This may be related to changes in commodity prices or changes in dryland production, which can be extremely variable.

![Figure 4-1. Changes in agricultural production versus water use in MDB.](source)

The gross value of irrigated agriculture production fell by proportionally less than the total water use from 2005/06 to 2006/07 while the GVIAP was reduced to a lesser extent. In part this may be because the higher value irrigation industries, using more secure entitlements, were less affected, and bought water to meet shortfalls. Changes in commodity prices perhaps explain a larger part.

The key point is that the southern-connected Basin is a significant component of the economy of the Basin and has used water trade to minimise the impact of water shortages.

In addition, the southern-connected Basin has significant areas of dryland farming and regional towns (e.g. Bendigo, Albury/Wodonga and Wagga) which lie outside of the main irrigated areas. The economic impact of irrigation is concentrated on the remaining areas, however economic data at a regional scale includes dryland areas and large, diverse towns that may lie within those regions, and therefore tends to obscure the importance of irrigation for local irrigation-dependent towns.

---

4.2 The key irrigated industries in the southern-connected Basin

As will be discussed in more detail later in the report, the three main irrigation industries in the southern-connected Basin are rice, dairy and horticulture (cotton is, at present, primarily a northern crop – although some southwards expansion currently is occurring). It is important to understand, however, that there is also a range of other smaller irrigation industries. In the context of SDLs it is also important to understand the volumes of water used by the various crops grown in the Basin. The information in Table 4-2 along with that portrayed in Figure 4-2 and Figure 4-3 will help to understand those relationships.

<table>
<thead>
<tr>
<th>Commodity group</th>
<th>Number of farm businesses irrigating</th>
<th>Area under pasture or crop '000 ha</th>
<th>Area irrigated '000 ha</th>
<th>Water applied ML</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cereals for grain &amp; seed(^a)</td>
<td>1,714</td>
<td>9,649</td>
<td>258</td>
<td>623,678</td>
</tr>
<tr>
<td>Hay production</td>
<td>4,159</td>
<td>893</td>
<td>200</td>
<td>648,762</td>
</tr>
<tr>
<td>Cotton</td>
<td>638</td>
<td>303</td>
<td>247</td>
<td>1,574,435</td>
</tr>
<tr>
<td>Rice</td>
<td>1,055</td>
<td>102</td>
<td>102</td>
<td>1,251,881</td>
</tr>
<tr>
<td>Other broadacre crops</td>
<td>490</td>
<td>1,028</td>
<td>38</td>
<td>117,654</td>
</tr>
<tr>
<td>Fruit and nuts</td>
<td>3,116</td>
<td>88</td>
<td>75</td>
<td>412,653</td>
</tr>
<tr>
<td>Grapes</td>
<td>4,845</td>
<td>114</td>
<td>106</td>
<td>514,819</td>
</tr>
<tr>
<td>Vegetables</td>
<td>1,062</td>
<td>36</td>
<td>32</td>
<td>152,002</td>
</tr>
<tr>
<td>Nurseries, cut flowers &amp; turf(^f)</td>
<td>426</td>
<td>4</td>
<td>2</td>
<td>12,166</td>
</tr>
<tr>
<td>Dairy production</td>
<td>3,170</td>
<td>918</td>
<td>220</td>
<td>1,028,430</td>
</tr>
<tr>
<td>Meat cattle</td>
<td>6,181</td>
<td>51,047</td>
<td>180</td>
<td>556,402</td>
</tr>
<tr>
<td>Sheep &amp; other livestock(^c)</td>
<td>3,422</td>
<td>49,819</td>
<td>177</td>
<td>439,364</td>
</tr>
<tr>
<td>Total Murray–Darling Basin</td>
<td>18,634</td>
<td>83,725</td>
<td>1,654</td>
<td>7,369,806</td>
</tr>
</tbody>
</table>

Source: ABS, Agricultural Census, 2005–06
Footnotes: \(^c\) excludes rice. **includes sheep, domesticated buffalo and goats but excludes pigs, poultry and eggs.

Table 4-2. Irrigation areas and water use of the MDB.\(^9\)

Figure 4-2. Selected irrigation data by region.\textsuperscript{10}

Figure 4-3. Region shares of total Murray-Darling Basin GVAP for selected commodities.\textsuperscript{11}

\textsuperscript{10} Figure 27 in ABS/ABARE/BRS 2009, Socio-economic context for the Murray–Darling Basin – Descriptive report, ABS/ABARE/BRS Report to the Murray–Darling Basin Authority, Canberra, September.

\textsuperscript{11} Figure 28 in ABS/ABARE/BRS 2009, Socio-economic context for the Murray–Darling Basin – Descriptive report, ABS/ABARE/BRS Report to the Murray–Darling Basin Authority, Canberra, September. GVAP = gross value of agricultural production.
The table and charts above show that the southern-connected Basin provides most of the GVIAP in the Basin and that rice, dairy and horticulture dominate southern economic agricultural production. The rest of this section of the report details the main characteristics of these industries.

**Perennial Horticulture**

The main perennial horticultural crops grown in the MDB include:

- wine grapes – north east Victoria, Murrumbidgee, Sunraysia, Riverland, Lower Lakes;
- citrus – Murrumbidgee, Murray Valley, Riverland;
- table grapes – Sunraysia;
- dried fruit – Sunraysia (grapes), Murrumbidgee (prunes);
- almonds – Sunraysia, Riverland;
- stone fruit – northern Victoria, Riverland; and
- pome fruit – northern Victoria.

With the onset of water entitlement trade there was significant growth of perennial plantings (>30% increase in Sunraysia and significant expansion in Griffith), particularly of wine grapes and almonds. Moreover, during the drought there was significant trade of water allocations from all valleys to the horticultural areas.

In South Australia and Victoria, low water allocations combined with low commodity prices led to a reduction in the area of permanent plantings in the period 2007 – 2010. In some districts the area of plantings was reduced by up to 30% and overall by 10 to 20%.\(^{12}\) The plantings removed mostly were wine grapes and older citrus plantings. This did not occur to the same extent in the Murrumbidgee or NSW Murray, where water allocations to high security entitlements were higher.

Profitability is highly variable across perennial horticultural crops. It is related to international competition and the relative value of the Australian dollar. Wine grape profitability has fallen significantly, from the 1990s, to current highly negative levels due to a combination of the high cost of water purchases and low grape prices. Profitability of wine grapes is expected to remain low until the current over-supply is corrected. Industry estimates that at least 20% of bearing vines are surplus to requirements and large areas already have been abandoned in Sunraysia.

Profitability of citrus production has remained relatively stable, with a high reliance on exports to the US. In 2009 exports to the US were impacted by competition from

\(^{12}\) EBC Consortium estimate
Chile. Table grape profitability is volatile. Despite this, there has been expansion in the industry in recent years. This sector is less exposed to international competition due to the perishable quality of the product. Dried fruit had many years of low, but stable, prices and recently an improvement in profitability. In a reversal of the past trend, a gradual transition from some wine grapes to dried fruit is expected.

Large areas of almonds were planted in the late 2000s funded by Managed Investment Schemes. The almond market is expected to grow driven by population growth in developing countries such as China and India. The planted area has expanded six-fold since 2000 and more than 80% of plantings are yet to reach full maturity.

Large areas of almonds were planted in the late 2000s funded by Managed Investment Schemes. The almond market is expected to grow driven by population growth in developing countries such as China and India. The planted area has expanded six-fold since 2000 and more than 80% of plantings are yet to reach full maturity.

The stone fruit and pome fruit sectors have experienced volatile profitability levels, although the area planted to these crops has remained relatively stable. There has been some reduction in canning varieties, particularly pears in the Goulburn Valley. Nonetheless, the future looks strong for those who can afford to invest around $45,000 per hectare for high-density plantings. For pome fruit, imports from China, America, and New Zealand are a threat, as the domestic market for pome fruit is very important. It is likely that many will drop out if they do not have the capital or energy to change, if there is less water.

For all crops there is continued pressure to amalgamate properties or develop greenfield sites to achieve economies of scale. This is less so for labour-intensive crops such as hand picked fruit crops like table grapes and stone fruit. Investment in the industry is currently low due to uncertainty about future water availability and commodity prices. Commodity prices will vary depending on the exchange rate, fallout from the demise of MIS and lower-risk approaches being taken by investors. As a result, expansion in perennial plantings has slowed.

Historically, the profit per megalitre of water used for perennial horticulture has been high relative to the other major water users such as rice, dairy and mixed farms. This underpinned the industry expansion following the introduction of water trade. This expansion was underpinned by high reliability Victorian water entitlements purchased from mixed farmers and to some extent from dairy farmers. Currently, some horticulturists are selling entitlements, to keep debt down, and buying allocations to meet the balance of their needs. Others, most notably wine grape farmers, are selling entitlements and going out of business.

**Annual horticulture**

The main annual horticultural crops grown in the MDB include:

- potatoes – Riverland, Sunraysia, Murrumbidgee
- lettuce – Murrumbidgee (winter Crops)

---

13 Almond Board Australia
14 ABS 7121.0.55.002 Agricultural Survey, Apples and Pears; Australia, 2007-09
• melons – Murrumbidgee, Sunraysia, Riverland
• sweet corn – Murrumbidgee
• processing tomatoes – Northern Victoria
• onions – Riverland, Murrumbidgee
• pumpkins – Murrumbidgee, Sunraysia, Riverland
• carrots – Murrumbidgee, Sunraysia
• asparagus (strictly a perennial species) – Sunraysia
• fresh tomatoes – Northern Victoria, Riverland

There was a 45% increase in area planted between 1996/7 and 2001/2 with major increases in the larger growing regions. Part of this can be explained by a commensurate reduction in the production areas close to the expanding real estate markets of capital cities. Moreover, the planted area for annual horticulture does fluctuate with expected demands and prices.

In recent years the growth of the industry has reversed due to imports from New Zealand, China, South Africa, South America (particularly processed vegetables). The Australian vegetable industry has had falling exports in the last few years.

The profitability of vegetable growing is enormously variable, with both high losses and high profits existing between seasons, crop types, markets and enterprises. Large-scale enterprises that can spread risk through forward price contracts, multiple regions of production and multiple crops types can lower risks. Nonetheless, because the barriers to entry are low, many small-scale enterprises come and go in the older irrigation districts.

The industry is in a period of re-adjustment due to increased international competition, especially for processed product. The fresh vegetable market is expanding with population growth and is less exposed to international competition. However, competition is increasing in some of Australia’s main export markets, with a resulting loss of market share.

Developments currently occurring within the industry include:

• scale: An Increasing trend to larger scale businesses to spread overhead costs, and risks;
• relocation of investment: Fresh vegetable production historically has been located close to urban centres. However, increasing competition for land on the urban fringes is encouraging relocation to areas of suitable capability away from urban settlement; and
innovation: Mechanisation and supply chain innovations are key to future competitiveness.

Annual horticultural crops will always be a highly competitive industry with tight margins, due to the low entry costs. For most annual horticulture, water costs are a relatively small component of total costs and therefore production is not highly sensitive to water price. However, at high water prices the high level of mobility of the industry will mean that it can relocate to other lower price regions.

Annual horticultural crop plantings primarily depend on supply and demand of the fruit and vegetable market and less on water availability. In times of water shortage some lower value annual plantings may be reduced and these may expand if water availability returns to long-term average levels.

Annual crop production is highly mobile. It would be expected that different price points would affect where production is located. However the reality is more complex. Lower land values and ability to achieve scale are also a big advantage for inland districts, but generally the MDB districts are too hot for summer vegetable production and many producers need winter and summer production areas to achieve continuity of supply.

**Dairy**

The majority of the dairy industry in the Murray-Darling Basin (MDB) is located in the southern-connected Basin, where approximately 2,600 dairy farms account for 32% of all dairy farms in Australia. They hold water entitlements totalling 1,457,000 megalitres[^15] and produce 2.1 billion litres of milk totalling $800 million in farm gate value[^16]. While there are significant pockets of dairying on the Murrumbidgee River and the Murray regions of both New South Wales and South Australia, the majority of production by far is based in Victoria.

As a result of a down turn in prices in 2008 and low water allocations due to the drought, milk production from the region has continued to decline as farms exit the industry. Increasing cost of production, as a result of low water allocations and subsequent higher feed prices, has been the major cause of the financial pressure on farms.

In response to low water allocations, dairy farmers have made significant changes to their feed base. In the past, with good access to water, farms were able to fully irrigate perennial pastures and home-grown feed typically ranged from 60 to 70% of the farm’s total feed requirements. However, during the last ten years of reduced water availability, there has been a move away from perennial pasture to more flexible feeding systems with an increased focus on annual crops, lucerne and pastures.

Significant lessons have been learnt during the period of low water availability and farms will operate at improved levels of water use efficiency. There will be reintroduction of perennial pastures as the sector recovers from drought, but it is unlikely that the area sown will return to the levels seen pre-drought. The use of lucerne and annual crops will be more prevalent as farms retain a level of flexibility in their feeding systems.

During periods of low water availability (as experienced in the past four years), dairy farmers have been net sellers of allocations; when water market prices are high dairy farmers are able to replace water with bought-in feed. This is a season-by-season decision that is influenced by:

- the price of allocations on the water markets;
- milk price;
- cost of feed substitutes; and
- individual farm water use efficiency level.

Farms continue to follow trends of increasing in size to achieve economies of scale, and of implementing new technology. The low water allocations and financial pressure on farms have slowed the rate of growth.

Historically, dairy farm profitability has been superior to the mixed cropping and rice industries and the growth of the industry had come at the expense of the mixed farming enterprises as dairy has bought up water from this sector. The medium to long term outlook for dairy demand remains positive and therefore it is reasonable to assume that milk prices will be at levels that will enable dairy farming to continue to out-compete mixed farming businesses, but not horticulture, in the market for water entitlements.

There has been some restructuring of the industry in terms of farm numbers and processing capacity; this will influence the rate of recovery. However, if water availability returns to long-term average levels, farms will be able to achieve higher levels of home-grown feed with improved margins. This will drive increased milk production and attract investment into the region as the security of water improves combined with relative low land prices compared to other dairy regions in Victoria.

The higher reliability of water in Victoria has made, and is likely to continue to make, dairying more attractive than in NSW. The general security water available in the NSW Murray area (where there is plenty of green field land with suitable soils and close to processing plants) has not been sufficient to encourage investment in dairying – unlike the case in Victoria, where high security water is more readily available. This has been exacerbated by the inability of Murray Irrigation to deliver any water (because of high losses with small deliveries) in dry years. It is possible that with further water trade this trend could be reversed but landholders would need...
to be convinced that the Murray Irrigation supply system would deliver the water in dry years.

**Rice**

The rice industry is located in the NSW Murray and Murrumbidgee valleys, and like dairying it has grown as farms transitioned from mixed/grazing farms, especially since the wool crash of 1989. Rice production reached a peak of 1.74 m tonnes in 2000/01. Prior to the drought, annual production averaged around 1.1 m tonnes. The largest crop grown since the onset of the drought in 2002/03 was slightly over 1 m tonnes in 2005/06. This crop was grown on 1,753 farms (approximately 104,000 ha) with an average yield of 9.9 t/ha.

Commonly, some 1,700 irrigation farms produce rice, with slightly over 50% located in the Murray Valley and the remainder located in the Murrumbidgee Valley. Average crop yields have increased from around 6-7 t/ha in the 1980s to 9-10 t/ha in recent years. A production low of 19,000 tonnes was grown in 2007/08 on 37 farms, the majority using groundwater to produce the crop.

Rice production has dramatically declined in response to low water availability since 2002/03. A return to long term average water availability in southern NSW at a commodity price of around $300/tonne would be expected to result in production levels of approximately 1 – 1.2 m tonnes. Approximately 1,000 GL would be required to produce that level of production.

**Mixed farms**

Mixed farming, in the form of irrigated cropping and grazing accounts for a significant but diminishing volume of water use in the southern-connected Basin. Three broad categories of these farms are discussed below.

**Out-sourced dairy feed production**

Mixed farming enterprises provide services to the dairy industry in the form of hay and agistment for young stock and dry cows.

**Mixed grazing - broad acre cropping**

There are substantial areas of land that are opportunistically cropped throughout the Murrumbidgee, NSW Murray and the western parts of the GMID. Some water is used to finish off winter cereals, but there is also some grazing on irrigated annual pastures. These farms tend to operate as integrated dryland and irrigation properties, generally on heavier soils. They are typically larger in scale than rice farms. In years of high allocations, these farms ramp up production to make use of NSW general security water and Victorian low reliability water. Such farms are the dominant land use around Pyramid Hill, Kerang and Boort in the GMID and also in southern NSW.
Rural residential

There is a growing number of rural residential properties in close proximity to towns such as Griffith, Shepparton, Mildura and the Riverland towns. Smaller irrigation properties attract similar prices to a house in town and provide an attractive lifestyle. This trend is likely to continue. The management of irrigation on these properties tends to be influenced by selecting enterprises that are low labour and can be contracted out – for example, broad acre grazing or mechanised grapes such as wine grapes.

In summary, the main industries of the southern-connected Basin are:

- horticulture, which is scattered throughout the southern-connected Basin (but is the only industry in SA and Sunraysia). It grew rapidly once entitlement trade became possible, but slowed in growth and contracted as a result of the wine grape collapse, and the drought;

- dairying, which is concentrated in the GMID. It also grew rapidly in the 1990s aided by water trade and at the expense of mixed farming. It contracted during the drought;

- rice, which is concentrated in the NSW Murray and Murrumbidgee. It also grew rapidly in the 1990s aided by water trade and at the expense of mixed farming. It also contracted during the drought; and

- mixed farming, which is scattered throughout NSW and the GMID (but it is concentrated to some extent in the western parts of the GMID). It has been diminishing since entitlement trade was introduced, but it will continue to be a significant water user when allocations are high and the market price for water is low.

4.3 The interaction between social catchments and processing industries

Water is the driver of social and economic activity at a much broader level than merely irrigated production on farm. Much of the food processing and value adding from irrigated production occurs in the sMDB Region.

Much of this processing activity relies on continuity of supply, and while some individual farms and industries can respond to reduced water supply, much of the processing infrastructure and the employment cannot. The impact of the drought coincided with a number of food processing facilities closing, e.g. the milk factory at Leitchville, and a juicing plant in the Riverland.

Key food processing centres have been established throughout the southern-connected Basin. It is important to note, however, that the various processing facilities often service irrigators outside the immediate social catchment in which they are located.
Horticulture

The wineries provide a striking example of southern Basin economic interconnectedness. Fruit, juice and wine move freely in all directions between the Riverland, Sunraysia, Griffith and the premium wine producing areas of South Australia and cooler climate areas of northern Victoria.

There are major wineries located in South Australia, Sunraysia and the Murrumbidgee area, and smaller ones in north-east Victoria, the Bendigo Region and the Goulburn Murray Irrigation District. There are well over 200 different wineries operating in the sMDB, some being small scale and others being large international operations. The larger ones tend to be located in the Riverland, Mildura and Griffith areas.

The Riverland, Sunraysia and Griffith also house major fruit packing and juicing facilities, which are similarly interconnected. Murray Bridge has vegetable packing facilities. The GMID is home to SPC Ardmona (now owned by Coca-Cola Amatil) with sites at Shepparton (fruit canning and juice), Mooroopna (fruit & tomatoes) and Kyabram (jams, juices). Tomatoes are processed at Echuca and Girgarre.  

There are also juice factories in Mildura and Leeton.

Fruit packing occurs throughout the horticultural regions, with approximately 100 sheds across the sMDB. Most of these are located in the Shepparton, Swan Hill, Mildura, Robinvale, Griffith and Leeton Regions.

There are also two packing sheds for dried fruit packing in Mildura. Almonds are processed at Robinvale and in the Riverland. Olives are grown at Boundary Bend and Boort and are processed at Boort.

Hops are grown in the North East of Victoria (Ovens valley) and there are wineries, nut, berry and cheese-making industries strongly related to tourism.

Rice

In the NSW Murray and Murrumbidgee, SunRice owns three rice mills, two value-add specialty rice foods plants and 18 aerated storage depots with a storage capacity of approximately 1.1 m tonnes.

Dairy

Milk is processed in various parts of the southern connected Basin. The various locations are listed in Table 4-3.

The dairy industry has processing plants at Stanhope, Tatura, Cobram, Rochester and Echuca with more than $800 million investment in the GMID alone by Tatura Milk

---
Industries, Fonterra Australia and the Murray Goulburn Cooperative. These produce a range of product mixes that are at high risk of impact from the reduced water availability proposed in the Guide.

More specialist processing occurs at Tongala and Strathmerton. These factories produce higher value product, which has medium susceptibility to reduced water availability.

**Table 4-3: Major dairy facilities**

<table>
<thead>
<tr>
<th>Dairy Company</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bega Cheese</td>
<td>Strathmerton</td>
</tr>
<tr>
<td>Murray Goulburn Cooperative</td>
<td>Leitchville, Rochester, Cobram, Kiewa</td>
</tr>
<tr>
<td>Fonterra (Australia)</td>
<td>Echuca, Stanhope, Wagga Wagga</td>
</tr>
<tr>
<td>National Foods</td>
<td>Jervois, Murray Bridge, Shepparton</td>
</tr>
<tr>
<td>Parmalat</td>
<td>Bendigo</td>
</tr>
<tr>
<td>Tatura Milk Industries</td>
<td>Tatura</td>
</tr>
<tr>
<td>Nestle</td>
<td>Tongala</td>
</tr>
</tbody>
</table>

Dairy is the major livestock industry in the region and requires specialist service providers. This includes herd improvement organisations, dairy equipment supply and service businesses as well as specialist veterinary services.

There is a number of stock feed companies located in the region primarily supplying the irrigated dairy industry. They have processing sites located in the region, sourcing inputs both locally and from outside the region.

Irrigation supports intensive livestock industries that then, in turn, require a larger number of sale yards and abattoirs to be located throughout the region.

**Intensive animal industries**

There are piggeries, feedlots and poultry producers located in the sMDB because of access to land, transport infrastructure, water supplies and feed. There are several located in northern Victoria and the Griffith region.

**Supporting Industries**

The intensity of demand for goods and services for the irrigation farms in the southern Basin supports a significant rural supply industry. This includes rural produce stores, fertiliser, chemical and seed suppliers, farm equipment suppliers, veterinary services and farm advisors.

Major road transport companies exist in the southern Basin, providing direct employment. A majority of transport activity is of irrigated produce (pre- and post-processing) as well as inputs for the major food processing facilities in the area.

---

18 source: EBC consortium analysis
Throughout the southern Basin regions are suppliers of irrigation equipment, with some major companies supplying services within and outside these regions. There are irrigation survey and design companies as well as earth-moving businesses that are totally dependant on irrigation. They are major employers in some regional communities.

Government departments and irrigation supply companies are also major employers within the irrigation regions, e.g. irrigation extension officers, researchers and water managers.

There is a number of businesses that provide goods and services directly to the major food processing companies in the southern Basin regions. They range from providers of cool storage facilities for perishable products, engineering services, through to equipment and packaging suppliers. Many of these support businesses are located in the regions, providing further employment and economic activity for communities that are heavily dependent on irrigation.

**Tourism**

The towns along the Murray River have an active and significant tourism industry. The industry has been developed on the back of the irrigation system. The river, and the associated lakes and weirs, provide consistent river levels that support recreational use, providing the ability to attract visitors throughout the year. The ability to access irrigation water supports the numerous high-class golf courses and associated service clubs along the Murray River and throughout the region which adds to the strength of the tourism industry.

The north east of Victoria and highland areas of NSW Murray and Murrumbidgee support alpine tourism which includes a close connection to horticulture, e.g. wineries, apples, nuts and berries.

**Consolidation**

In all regions and all industries, processing is consolidated into a few larger sites to achieve economies of scale. Produce moves across river catchment regions for processing, and consolidation of processing occurs into the larger regional towns, where there is readily available access to services and skilled labour needed for the larger scale operations.

The key point here is that the secondary industries operate within the southern-connected Basin where the produce is grown, and that produce moves between river catchments, across administrative boundaries and through social catchments, according to market demands.
5 Understanding the sMDB as a mix of people interacting with the landscape

5.1 Landscapes

The location of an industry is influenced by the combination of a range of factors. These include soil type, property size, water security of entitlements available, climate, infrastructure, services, skilled labour availability and access to market.

This section covers the influence of landscapes, particularly with regard to soil types on crop locations in the southern-connected Basin (Figure 5-1).

![Soils of Australia](http://www.asris.csiro.au/Images/ASC_map.jpg)

**Figure 5-1. Soils of Australia.**

Most of the southern-connected Basin is part of an extensive alluvial plain within the Murray Basin. This has evolved into a large sedimentary basin. Many of the soils in the region are derived from alluvial sediments deposited by prior streams, as well as from aeolian sediments (deposited by the wind). The major soil types in the region are predominantly red-brown earths intermingled with areas of grey-brown and grey loamy soils, as well as Mallee soils in Sunraysia and South Australia. Alluvial soils also occur.

---

Soil types affect the type of irrigation industry in a region. Higher value irrigated crops are generally grown on the best quality soils. Soil quality largely is judged in terms of drainage characteristics and fertility.

The history of settlement in each of the irrigation districts also has had an influence on property size. The closer settlement policies in operation in each State at the time of development also had an influence on the location of industries and the reliability of the water entitlements that were part of the original endowment. For example, in the Riverland and Sunraysia the legacy of the original subdivisions is that many properties are too small to be viable unless they produce high value horticulture crops.

5.2 Horticulture soils

Horticulture tends to be attracted to regions with high quality soils, high reliability water entitlements and land that can be serviced at an affordable cost. The Mallee soils of South Australia, Sunraysia, parts of the GMID and parts of the Murrumbidgee Irrigation Area meet these criteria. In the GMID, the area northeast of Shepparton up to Cobram includes pockets of lighter textured fine sandy loams with good drainage characteristics. These soils often are taken up by orchards.

Since the introduction of water trade, water has moved to larger properties (previously dryland) on good soils for the development of new horticulture. The almond, wine and vegetable developments in the Victorian and SA Mallee exemplify this. There has also been a shift from broad acre lower value cropping and grazing to wine grapes and vegetables in the Murrumbidgee valley.

Since the drought and the wine grape crash, many smaller properties in the older irrigation districts have been dried off. Unless high wine grape prices return, these are unlikely to return to wine grapes due to their small block size. Economies of scale are now essential for mechanised wine grape production. Nonetheless, those small properties may return to production as new enterprises. New crops are being trialled; it is possible that they may establish new viable industries that do not require the scale of the large blocks. In the meantime these small blocks overwhelmingly remain as dryland without any prospects for generating revenue.

5.3 Dairy soils and location

Soils suitable for dairying tend to be the better quality draining riverine soils, with good water holding capacity. These are located across northern Victoria and the GMID. There are smaller areas of dairying located in southern NSW and the lower Murray of South Australia. Before the advent of water trade, dairying was limited in NSW because general security water is not reliable enough to meet the more constant water needs of dairying relative to rice. Dairying is limited in SA due to the lack of suitable soils and areas that can be cheaply commanded by gravity for surface irrigation.
Soils of suitable slope are important for efficient surface irrigation. The optimum slopes for a border check irrigation layout range from 1:500–1:1500. Very heavy soils tend to be avoided, because they are more prone to waterlogging and compaction. The highly suitable red-brown earths are predominantly found in the Goulburn Valley, extending west of Rochester and east to Yarrawonga.

5.4 Rice soils and location

Soils have to be approved for rice growing. The specific criteria are different for the Murrumbidgee and Murray valleys, but both include criteria based on the depth of clay rather than soil type alone.

Optimum slopes of a contour bay for rice production are 1:1000–1:1200. Soil types most likely to restrict water losses in rice are those with a high proportion of dispersive clay in the soil profile. In general, the best soils for rice growing are non-self-mulching clays and sodic transitional red-brown earths.

5.5 Mixed farming and location

Grey and brown soils of heavy texture are found interspersed throughout the GMID, NSW Murray and Murrumbidgee valleys especially on the floodplains. In Victoria they are found predominantly south of Gunbower, extending as far west as Kerang, Murrabit and Swan Hill. The soils usually associated with mixed farming have shallow grey to brown clay or clay loam surface soil, overlying a heavier clay subsoil. The clay subsoil is frequently of low permeability, and under irrigation, higher water tables are common.

5.6 Commandable land and opportunistic irrigation

Much of the irrigation districts were developed based on the concept of "commandable land", that is, land that could be supplied with water by gravity for surface irrigation. In other words, it meant land that could be irrigated from the water supply system without pumping.

In some cases this has meant heavier soils were selected for irrigation rather than those that were ideal (lighter soils often occur on the higher parts of the landscape). The heavy areas chosen have tended to be more prone to poor drainage, waterlogging and salinity. Therefore they have traditionally been used for lower value irrigation such as mixed farming and grazing. Developments in pumping technology now make it easier to irrigate the previously uncommandable, lighter soils.

The onset of water trade has meant that farmers on the heavy, less suitable irrigation soils have become net sellers of entitlements. Their farms are now becoming more like dryland properties, which may be irrigated occasionally on an opportunistic basis – if water is available at a low enough price to be attractive for the enterprise.

---

generally means irrigation only occurs in high allocation years, when all the demands for higher value irrigation has been met and water price is low.

5.7 Implications for the future

In the past industries developed as a function of property size (government policy - closer settlement), soil suitability and water security (see next chapter). Water trade now means that industries are being located based on soils and suitable property size first. In most of the southern-connected Basin water trade has meant that properties can purchase whichever of the various entitlement types has the reliability characteristics best suited to their needs.

Restructuring and green field development now is occurring right through the southern-connected Basin and is critical to the current and future locations of industries. The trend is that dairying is likely to remain as the dominant industry of the GMID, but is restructuring to larger farms located on the modernised NVIRP supply system. Meanwhile, opportunistic irrigation cropping and grazing will be a feature of mostly dryland farms on commandable land in southern NSW and the GMID.

Capital-intensive horticultural crops, such as wine grapes and almonds, will tend to relocate to greenfield sites, or previously broad acre irrigation on suitable soils in the Murrumbidgee Irrigation Area where those industries can benefit from economies of scale. Labour intensive horticultural crops, such as table grapes, will tend to remain in the traditional horticultural districts on smaller properties where there is a readily available source of labour.

All properties will continue to amalgamate and reduce in numbers as has occurred ever since agriculture commenced.

The key points are:

- there are sufficient soils of adequate quality for all industries;
- dairying and rice are likely to stay in their current locations; and
- horticulture has a broad range of locations and will continue to relocate and redevelop on the most suitable soils provided other requirements such as water security, scale, infrastructure, skilled labour, and market proximity can be met.
6 Understanding the sMDB as mix of people interacting with different water entitlements

6.1 Water entitlements in different parts of the Basin

There is a range of different entitlement types and security in the southern-connected Basin. These are listed and quantified in Table 6-1 along with a recent history of their expressed reliability over the decade from 1998-99 to 2008-09.

Table 6-1 Water allocations in the drought.21

<table>
<thead>
<tr>
<th>Water products</th>
<th>Entitlement volume on issue (GL)</th>
<th>End of season allocations (%) (year)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Higher reliability entitlements</td>
<td></td>
</tr>
<tr>
<td>Vic. Goulburn HRWS</td>
<td>994</td>
<td>100 100 100 100 57 100 100 100 29 57 33</td>
</tr>
<tr>
<td>Vic. Murray HRWS</td>
<td>1 182</td>
<td>100 100 100 100 100 100 100 100 95 43 35</td>
</tr>
<tr>
<td>NSW Murray High Security¹</td>
<td>184</td>
<td>100 100 100 100 100 97 97 69 50 95</td>
</tr>
<tr>
<td>NSW Murrumbidgee High Security</td>
<td>357</td>
<td>100 100 100 100 95 95 95 90 90 95</td>
</tr>
<tr>
<td>SA Murray High⁴</td>
<td>672</td>
<td>100 100 100 100 95 95 95 100 60 32 18</td>
</tr>
<tr>
<td></td>
<td>Lower reliability entitlements</td>
<td></td>
</tr>
<tr>
<td>Vic. Goulburn LRWS²</td>
<td>438</td>
<td>0 0 0 0 0 0 0 0 0 0 0</td>
</tr>
<tr>
<td>Vic. Murray LRWS²</td>
<td>301</td>
<td>100 90 100 100 29 0 0 0 0 0 0</td>
</tr>
<tr>
<td>NSW Murray General Security</td>
<td>1 668</td>
<td>93 35 95 105 10 55 49 63 0 0 9</td>
</tr>
<tr>
<td>NSW Murrumbidgee General Security</td>
<td>1 908</td>
<td>85 78 90 72 38 41 40 54 10 13 21</td>
</tr>
</tbody>
</table>

There is something of a chicken-and-egg argument about why crops of particular types are associated with water entitlements of particular types. There is a trade-off between yield and reliability. Storages have been used to increase reliability and used differently depending upon the main industry, e.g. NSW Murray adopted an allocation policy that maximised yield for general security and thus reduced spills which suited the annual cropping in that region, whereas Victoria developed a more conservative approach in order to increase reliability which suited the dairy and horticulture industries. One way to think about this is to consider the interruptibility of different irrigation enterprises:

- annual crops, such as rice, are interruptible in the sense that, if there is not enough water, irrigators can choose not to grow a crop. At times of very low allocations, what little water they have available might actually earn more for them if it is sold, rather than being used to grow a crop;

- dairying is a semi-interruptible enterprise, in the sense that, to some extent, people can substitute purchased feed for water; that is, they can grow feed with their water or they can purchase feed. In a drought, however, the price of feed may increase in line with reduced water availability, so the potential trade-offs change between years;

- the non-interruptible enterprises are the perennial horticultural crops, with the main crops in south-eastern Australia being almonds and grapevines, but there are also significant plantings of evergreen crops such as olives and citrus; and

- while many grape growers are often scandalised by what they see as water being ‘wasted’ on grass and on rice, the experience of the drought is that the overall mix of crops in the southern-connected Basin is about right. During low allocation years, those people with interruptible crops were able to make more money by selling their water than they could have by growing a smaller crop. Semi-interruptible enterprises mostly managed to make the trade-offs between buying water, buying feed and growing irrigated feed. The most profitable of the non-interruptible enterprises, the perennial horticultural crops, mostly were able to buy water on the market during the drought; however there was no spare water beyond meeting the perennial horticultural crop requirement. Many irrigated vineyards were not profitable, and therefore, were not able to stay in the water market.

Historically, the reliability profiles of different entitlement types were tailored to the irrigation requirements of the dominant irrigated enterprise in the region:

- horticulture was generally provided with very high security entitlements (some water was kept in reserve for next year in the allocation process);

- dairying in Victoria was provided with a mixture of high reliability and low reliability entitlement types, giving it a secure foundation plus the potential to gain advantage from extra water if it were available; and
• rice was provided with a medium-low reliability product that maximised the yield of water at the expense of security (i.e., all water available in storages was allocated rather than saved for next year).

The intensity of use on a ML/ha basis and the number of hectares irrigated can be judged from the figures in Table 6-2. Note that NSW includes part of the northern Basin, which is mostly cotton and some broad acre.

**Table 6-2. Water use in the Murray-Darling Basin.**

<table>
<thead>
<tr>
<th></th>
<th>Agricultural businesses irrigating</th>
<th>Area under pasture or crop (a)</th>
<th>Area irrigated</th>
<th>Volume applied</th>
<th>Application rate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>no.</td>
<td>no.</td>
<td>ha</td>
<td>ha</td>
<td>ML</td>
</tr>
<tr>
<td>TOTAL</td>
<td>59481</td>
<td>15120</td>
<td>95,194,851</td>
<td>975,600</td>
<td>3,564,481</td>
</tr>
<tr>
<td>2009-10</td>
<td></td>
<td></td>
<td>24,998</td>
<td>5,973</td>
<td>25,057,180</td>
</tr>
<tr>
<td>Pasture for grazing</td>
<td></td>
<td></td>
<td>13,993</td>
<td>2,273</td>
<td>652,029</td>
</tr>
<tr>
<td>Pasture for silage</td>
<td></td>
<td></td>
<td>2,964</td>
<td>570</td>
<td>127,296</td>
</tr>
<tr>
<td>Rice</td>
<td>300</td>
<td>np</td>
<td>np</td>
<td>np</td>
<td>np</td>
</tr>
<tr>
<td>Other cereals for grain or seed</td>
<td>19,894</td>
<td>1,741</td>
<td>9,966,163</td>
<td>188,758</td>
<td>468,044</td>
</tr>
<tr>
<td>Cotton</td>
<td>412</td>
<td>412</td>
<td>157,556</td>
<td>76,024</td>
<td>76,024</td>
</tr>
<tr>
<td>Sugar cane</td>
<td>3</td>
<td>np</td>
<td>*103</td>
<td>np</td>
<td>np</td>
</tr>
<tr>
<td>Other broadacre crops</td>
<td>7,194</td>
<td>325</td>
<td>1,478,291</td>
<td>27,479</td>
<td>46,795</td>
</tr>
<tr>
<td>Fruit trees, nut trees, plantation or berry fruits</td>
<td>3,132</td>
<td>2,416</td>
<td>149,513</td>
<td>78,426</td>
<td>449,902</td>
</tr>
<tr>
<td>Vegetables for human consumption</td>
<td>1,041</td>
<td>734</td>
<td>32,394</td>
<td>25,339</td>
<td>120,403</td>
</tr>
<tr>
<td>Nurseries, cut flowers and cultivated turf</td>
<td>332</td>
<td>267</td>
<td>3,128</td>
<td>1,856</td>
<td>8,242</td>
</tr>
<tr>
<td>Grapesvines</td>
<td>3,965</td>
<td>3,759</td>
<td>101,865</td>
<td>96,050</td>
<td>427,580</td>
</tr>
</tbody>
</table>

6.2 **Usage in a normal year versus drought**

Table 6-3 compares water use in 2005/6 with that in 2008/9 (it is important to note here that 2005/6 was below average in terms of water availability, while 2008/9 was an extreme drought year). The key point coming out of the table is that there was a 63% difference in total water availability between the two years, but the impact played out differently for different crop types. The dramatic drop in water availability resulted in:

• 65% reduction in irrigated area;

---

22 Table 2.9 (pastures and crops irrigated, Murray–Darling Basin, 2005-06 to 2009-10) in ABS, 2010, *Water Use on Australian Farms*, catalogue No. 4618.0
• 97% reduction in rice (interruptible);
• 75% reduction in pasture (semi-interruptible);
• 20 to 35% reduction in grapes (non-interruptible) – much of this was due to low wine grape prices and industry adjustment at the time; and
• 15% reduction in other horticulture (non-interruptible).

The change within each valley was similar, illustrating that the valleys of the southern Basin effectively behave as one unit, because they are inter-connected.

### Table 6-3. Water use by crop type and region for 2005-6 and 2008-9.\(^\text{23}\)

<table>
<thead>
<tr>
<th>Valley</th>
<th>Ha (’000)</th>
<th>GL</th>
<th>pasture</th>
<th>rice</th>
<th>grape s</th>
<th>horticulture</th>
<th>cereal grain</th>
<th>veget ables</th>
<th>cereal hay</th>
<th>other broad acre</th>
<th>cotton</th>
<th>fall in water use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Murray</td>
<td>700</td>
<td>2750</td>
<td>48%</td>
<td>19%</td>
<td>14%</td>
<td>9%</td>
<td>6%</td>
<td>3%</td>
<td>2%</td>
<td>1%</td>
<td>0%</td>
<td>74%</td>
</tr>
<tr>
<td>Murrumbidgee</td>
<td>275</td>
<td>1500</td>
<td>15%</td>
<td>46%</td>
<td>6%</td>
<td>4%</td>
<td>19%</td>
<td>2%</td>
<td>2%</td>
<td>4%</td>
<td>2%</td>
<td></td>
</tr>
<tr>
<td>Goulburn</td>
<td>225</td>
<td>900</td>
<td>88%</td>
<td>1%</td>
<td>1%</td>
<td>7%</td>
<td>1%</td>
<td>1%</td>
<td>1%</td>
<td>0%</td>
<td>0%</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>1,200</td>
<td>5,150</td>
<td>2,282</td>
<td>1,222</td>
<td>484</td>
<td>371</td>
<td>459</td>
<td>122</td>
<td>94</td>
<td>88</td>
<td>30</td>
<td></td>
</tr>
</tbody>
</table>

| % of water use | 44%   | 24%  | 9%    | 7%   | 9%    | 2%          | 2%           | 2%          | 2%         | 1%              |

<table>
<thead>
<tr>
<th>Valley</th>
<th>Ha</th>
<th>GL 24</th>
<th>pasture</th>
<th>rice</th>
<th>grape s</th>
<th>horticulture</th>
<th>cereal grain</th>
<th>veget ables</th>
<th>cereal hay</th>
<th>other broad acre</th>
<th>cotton</th>
<th>fall in water use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Murray</td>
<td>250</td>
<td>900</td>
<td>7%</td>
<td>1%</td>
<td>9%</td>
<td>7%</td>
<td>2%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>70%</td>
</tr>
<tr>
<td>Murrumbidgee</td>
<td>100</td>
<td>610</td>
<td>5%</td>
<td>1%</td>
<td>4%</td>
<td>4%</td>
<td>13%</td>
<td>1%</td>
<td>1%</td>
<td></td>
<td>1%</td>
<td></td>
</tr>
<tr>
<td>Goulburn</td>
<td>75</td>
<td>410</td>
<td>24%</td>
<td>7%</td>
<td></td>
<td>1%</td>
<td>2%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>425</td>
<td>1,920</td>
<td>484</td>
<td>43</td>
<td>308</td>
<td>316</td>
<td>195</td>
<td>79</td>
<td>18</td>
<td>15</td>
<td></td>
<td>15%</td>
</tr>
</tbody>
</table>

| % of water use | 9%    | 1%   | 6%    | 6%   | 4%    | 2%          | 0%           | 0%          | 0%         | 71%             |
| Reduction %    | 65%   | 63%  | 79%   | 97%  | 36%   | 15%         | 58%          | 35%         | 81%        | 83%             | 50%    |

The level of inter-dependence between interruptible, semi-interruptible and non-interruptible crops needs to be recognised and understood. The relativity between them is a key feature of the resilience of the southern-connected Basin. In like fashion, the relativity between the volumes of the different entitlement types is also important to the resilience of irrigation industries in the southern-connected Basin.

Low security entitlements generally are not reliable enough for dairying and horticulture, but they are suitable for interruptible crops such as rice. Nonetheless it is unlikely that horticulture will increase to make use of all the high security entitlements. That is because high security entitlements can be thought of as having two components:

---


\(^{24}\) Volumes of use for 2008/9 do not reconcile with % of 2005/6 due to the methodology of assigning water use, which may have been area based. Nevertheless, the data is robust enough for demonstrating the impact on crops.
• a very high security component, the water that is available in the 5 to 10 driest years in a hundred. As revealed in the recent drought, this is generally only 30% to 50% allocations; and

• the high security component that generally provides 100% allocations of water in 90-95% of years, which is suitable for dairying.

Therefore, if perennial horticultural crops increase to make use of more than 50% of the total volume of high reliability entitlements, they will be exposed to the potential for catastrophic loss in the event of the next drought.

6.3 Water trade patterns also show increasing connectivity in the southern-connected Basin

The graphs shown below in Figure 6-1 through to Figure 6-4 show interregional water trade has increased in the face of water shortage. They also show that the southern-connected Basin now responds as a single integrated region in response to reductions in water availability.

![Figure 6-1. Allocation trade volumes](source: MOBA WAM report data.)
Figure 6-2. Entitlement trade volumes.\textsuperscript{26}

Figure 6-3. Interstate allocation trade volumes.\textsuperscript{27}

\textsuperscript{26} Source: Figure 13 (intraregional and interregional entitlement trading, 1998–99 to 2007–08) in NWC, 2010, \textit{The impacts of water trading in the southern Murray–Darling Basin: an economic, social and environmental assessment}.

\textsuperscript{27} Source: NWC, 2010, \textit{The impacts of water trading in the southern Murray–Darling Basin: an economic, social and environmental assessment}.
The graphs above illustrate that, over the period 1998/99-2007/08:

- entitlement moved to SA from Victoria as part of the shift from dairying and mixed farming to horticulture;

- allocation moved from NSW to Victoria and SA; this was especially from the Murrumbidgee that had higher allocations during the drought;

- in the southern-connected Basin, where the water market is ‘deeply liquid’, both entitlements and allocations can be sold rapidly, with minimal loss of value, any time within market hours. There are large numbers of ready and willing buyers and sellers at all times, and there is a high probability that the next trade will be executed at a price equal to the last one; and

- at the farm scale, irrigators concentrate their available water. In the first year of reduced water availability, many irrigators were inclined to treat it as a once-off event. Accordingly, many redevelopment plans were brought forward and some water saved over two or three years. Some people considered mothballing parts of their property, but in doing so they had to contemplate a variety of risks and costs. Many irrigators also considered sacrificing parts of the farm or selling up, but in many cases it was only the water entitlement that was sold.

---

The NWC *Impacts of Water Trade* report states: 29 “Economic modelling commissioned for this study estimated that water trading in the sMDB increased Australia’s gross domestic product by $220 million in 2008–09 through reallocations of water used in agriculture. The total production benefits were even greater within the sMDB (more than $370 million in 2008–09), indicating that water trading maintained productive capacity within the sMDB, which would otherwise have moved to other parts of Australia (outside the sMDB). The modelling estimated that all sMDB states benefited from trading: net benefits were $79 million for New South Wales, $16 million for South Australia and $271 million for Victoria in 2008–09.”

6.4 Comparison of proposed SDLs with the Drought

An examination of the actual diversions in each valley (net of trade) for each year since 1997/98 to 2008/09 provides data on what happened in the 5-year pre-drought period. That is, before 2002/03 and the 7 years of drought. Unfortunately the data is not split by commodity use, but it is still very instructive. By providing the basis for looking back, this data can inform the future.

Of course, it is important to understand that behaviour following buy-back may be different than what happened in the drought because people adapt temporarily to drought, rather than adapting in a longer term sense (that is, they tend to adopt short-term coping tactics rather than making long-term strategic adaptive changes). Furthermore, the drought affected all farmers who experienced reduced allocations, whereas the Commonwealth Government has committed to implement the Basin Plan through ‘bridging the gap’, primarily through buyback and modernisation, so would affect farmers differently depending on whether or not (among other things) they decide to sell water entitlement. Given these qualifications, however, the length of the drought period certainly provided some indications of longer-term adaption that may be similar to a permanent reduction in diversions for irrigation.

Figure 6-5 shows the pattern of decreased water diversions over the course of the drought.

---

Figure 6-5. Total diversions in the southern-connected Basin.  

Table 6-4 was compiled from data provided by MDBA. It is sourced from the Water Audit monitoring report 2008-2009. It includes losses, which is a higher number than that allocated to irrigation.

---

30 Source: EBC Consortium analysis of data provided by the MDBA
Table 6-4. Diversions versus SDLs

<table>
<thead>
<tr>
<th>Background data for each catchment</th>
<th>Seven Year Drought comparison average</th>
<th>12 years - pre and post drought comparison average</th>
<th>Pre drought comparison average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cap Valley</td>
<td>CDL</td>
<td>SDL</td>
<td>SDL</td>
</tr>
<tr>
<td>New South Wales</td>
<td>guide figure table 8.3 p132</td>
<td>3000</td>
<td>4000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>GL actual diversions</td>
<td></td>
</tr>
<tr>
<td>Lower Darling</td>
<td>55</td>
<td>39</td>
<td>34</td>
</tr>
<tr>
<td>Murrumbidgee</td>
<td>2061</td>
<td>1396</td>
<td>1169</td>
</tr>
<tr>
<td>Murray (NSW)</td>
<td>1721</td>
<td>1247</td>
<td>1086</td>
</tr>
<tr>
<td>Victoria</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Goulburn</td>
<td>1593</td>
<td>1151</td>
<td>1000</td>
</tr>
<tr>
<td>Broken</td>
<td>14</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Loddon</td>
<td>95</td>
<td>57</td>
<td>52</td>
</tr>
<tr>
<td>Campaspe</td>
<td>115</td>
<td>75</td>
<td>63</td>
</tr>
<tr>
<td>Ovens</td>
<td>25</td>
<td>18</td>
<td>14</td>
</tr>
<tr>
<td>Kiewa</td>
<td>11</td>
<td>7</td>
<td>6.1</td>
</tr>
<tr>
<td>Victorian Murray</td>
<td>1656</td>
<td>1214</td>
<td>1064</td>
</tr>
<tr>
<td>South Australia</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total AOP and Swamps</td>
<td></td>
<td>426</td>
<td>454</td>
</tr>
<tr>
<td>Country Towns</td>
<td></td>
<td>38</td>
<td>37</td>
</tr>
<tr>
<td>Metro Adelaide</td>
<td></td>
<td>119</td>
<td>122</td>
</tr>
<tr>
<td>Total South Australia</td>
<td>665</td>
<td>492</td>
<td>433</td>
</tr>
<tr>
<td>Southern-connected system (excluding Lower Darling)</td>
<td>7956</td>
<td>5662</td>
<td>4895</td>
</tr>
</tbody>
</table>
The southern-connected Basin and the drought

For the 7 years from 02/03 to 08/09 the average diversion in the southern-connected Basin is shown below.

Table 6-5. Average 7 year diversions versus 3000 GL SDL scenario

<table>
<thead>
<tr>
<th>Catchment</th>
<th>CAP</th>
<th>3000GL SDL</th>
<th>Drought diversions</th>
<th>% drought diversions cf. 3000 GL SDL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Southern connected</td>
<td>8820</td>
<td>5662</td>
<td>5320</td>
<td>94%</td>
</tr>
<tr>
<td>Victoria</td>
<td>3858</td>
<td>2527</td>
<td>2486</td>
<td>98%</td>
</tr>
<tr>
<td>Vic Murray</td>
<td>1702</td>
<td>1236</td>
<td>1335</td>
<td>108%</td>
</tr>
<tr>
<td>Vic Goulburn</td>
<td>2034</td>
<td>1216</td>
<td>1111</td>
<td>91%</td>
</tr>
<tr>
<td>NSW Murrumbidgee</td>
<td>2358</td>
<td>1396</td>
<td>1352</td>
<td>97%</td>
</tr>
<tr>
<td>NSW Murray</td>
<td>1880</td>
<td>1247</td>
<td>898</td>
<td>72%</td>
</tr>
<tr>
<td>SA</td>
<td>724</td>
<td>492</td>
<td>584</td>
<td>119%</td>
</tr>
</tbody>
</table>

From Table 6-5 it can be seen that:

- the drought period represents the same amount of water as is proposed for the SDLs, so what happened in the drought is a good comparison\(^\text{32}\) (the drought diversions were 94% of the 3000 GL SDL and 109% of the 4000 GL SDL);
- Murrumbidgee and Victoria on average used their share (98%);
- SA used relatively more compared to SDL (119%) but still only 86% of the pre-drought diversions; and
- NSW Murray used less than their share (72%).

Interpolating from the table also suggests that:

- Victoria’s Goulburn used slightly less than their share, that is, dairy was a net seller of diversions;
- The Victorian Murray used slightly more than the Goulburn because Sunraysia horticulture used more (like SA), but this usage was kept down overall because dairy in Victorian Murray sold, i.e., the valley averaged 108% of drought diversions compared with a 3,000 GL SDL; and
- it is also likely that the Murrumbidgee average of 98% was made up of 72% for rice (like NSW Murray) and 119% for horticulture like SA.

\(^{32}\) Note that even once the Basin Plan is fully implemented, a drought could still occur which could result in even greater impact.
This suggests that, if the practices that occurred within the drought were repeated under SDLs:

- rice would lose a lot of water. Horticulture would effectively lose a smaller amount but it would still be significant, and dairying would lose substantive volumes; and

- overall Victoria would lose proportionally the same as Murrumbidgee, but NSW Murray would lose proportionally more.

The ABARES modelling suggested that around 1,560 GL was to be the total change for the Southern connected system, and that almost all of this would come out of rice production. However, the experience from the drought suggests that a plausible alternative scenario would see (approximately):

- Victoria use of diversions reduced by 700GL;

- Murrumbidgee diversions reduced by 500GL (possibly 100GL from horticulture);

- NSW Murray diversions reduced by 400GL; and

- SA diversions reduced by 70GL.

---

33 3,000 GL SDL scenario. See Table B.21, Appendix to Volume 2 of this study.
The following graphs illustrate the interactions between the industries.

Figure 6-6. Activity range of each industry against modelled CDL.34

The above graph shows the variability of diversions modelled for the southern connected basin. The industry arrows on the graph attempt to illustrate the level of diversions required by each industry. This is further described in Table 6-6 below.

Figure 6-7. Actual recent diversions against CDL and SDL scenarios.35

Figure 6-7 shows that the 7 years of drought actual diversions were similar to what could be expected under the proposed SDLs in “average” conditions if it was all achieved by buyback.

---

34 EBC Consortium analysis
35 EBC Consortium analysis
Figure 6-8. Actual recent diversions with water trade prices and players.\textsuperscript{36}

The graphs above indicate that each industry operates at a different level of activity depending upon the total amount of water available in the southern-connected Basin. This is illustrated in Table 6-6.

Table 6-6. Relationship between water availability and industry activity

<table>
<thead>
<tr>
<th>Water availability for diversions (before losses) GL/y</th>
<th>Relative level of industry activity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Horticulture</td>
</tr>
<tr>
<td>&lt;2000 GL</td>
<td>low</td>
</tr>
<tr>
<td>2000 - 4000 GL</td>
<td>medium</td>
</tr>
<tr>
<td>4000 - 6000 GL</td>
<td>high</td>
</tr>
<tr>
<td>6000 - 8000 GL</td>
<td>high</td>
</tr>
<tr>
<td>&gt; 8000 GL</td>
<td>high</td>
</tr>
</tbody>
</table>

The key messages from the above figures and table are that:

- low security water used by rice growers cannot move to horticulture, because it does not exist when horticultural growers need it;
- only some of the dairy water can move to horticulture (around 50% as per section 6.2); and
- horticulture will not expand above the worse drought year of around 50% allocation of the high security water used by itself and dairying.

\textsuperscript{36} EBC Consortium analysis
7 Baseline trends

7.1 Horticulture

Much of the expansion in horticulture has been driven by access to water through water trade, readily available capital through managed investment schemes (which is now less available), relocation from other areas due to land-use pressures (e.g. vegetables relocating from capital city fringes) and perceived market demands.

Horticulturists aim to ensure there is sufficient water available even in a ‘worst drought’ scenario. This is a de facto limit to growth of the industry. It will buy water from all other industries to maintain profitable perennial plantings and guarantee supply of high value vegetables etc. It will also use carryover to improve its water security.

The maximum amount of water available in the ‘worst drought’ scenario is approximately equivalent to 50% of the high security entitlements. If 2008/09 is taken as this ‘worst drought’ year, this would be 1,920 GL (from Table 6-3) in the southern-connected Basin, assuming all would be used by horticulture; noting that not all water would be used by horticulture, because some allocation would not be traded. In addition, there would be some high value dairying, such as via sub-surface drip, which is competitive with horticulture.

In 2009/10, perennial horticulture in the southern-connected Basin used around 880 GL and annual horticulture 129 GL (Table 6-2 indicates that this is most of the horticulture in the MDB and thus there is little perennial horticulture in the nMDB) which equates to around 1,000 GL/y.

Given that in the long run horticulture cannot expand to consume more than 50% of high security entitlements (to cope with years when drought allocations are approximately 50% high security and nil low security), this suggests there is some scope for growth of horticulture, say to an upper limit of 1,500 GL usage, which is around 20% of long term diversions and around 50% of all high security entitlements in the southern-connected Basin.

This would take many years to realise and would represent a 50% increase over 2005/06 levels of horticulture. However, it is appropriate to note that horticulture in Sunraysia has expanded by 30 to 40% since the introduction of water trade and there has been similar growth in SA and the Murrumbidgee.

7.2 Dairy

In response to low water allocations, dairy farmers have made significant changes to their feed base. In the past, with good access to water, farms were able to fully irrigate perennial pastures and home-grown feed typically ranged from 60 to 70% of the farms total feed requirements. However, during the last ten years of reduced
water availability, there has been a move away from perennial pasture to more flexible feeding systems, with an increased focus on annual crops, lucerne and pastures.

The change in the type of home-grown feed base has also coincided with an increase in the level of bought-in feed. Even though the change in what is grown on farm has achieved improvements in feed grown per megalitre of irrigation water used, total home feed production still has declined due to the lack water. The increased reliance on bought-in feeds and the changed home-grown fodder base has increased the complexity of the farming systems.

As the dairy industry moves to more capital-intensive irrigation systems such as sprinklers and sub-surface drip it becomes more like horticulture in its behaviour in the water market; the capital investment makes it more like a non-interruptible crop and the requirements for water security tend to increase. If milk prices increase relative to horticultural prices, there will be a lower proportion of the high security entitlement moving to horticulture.

7.3 Rice and mixed farms

The level of production from water availability will be dependent upon alternative grain and livestock commodity prices and the price of seasonally traded water. Experience from recent years suggests that the decline in the level of rice production tends to be greater than the respective decline in water availability. That is, a 40% reduction in water availability has led to rice production being reduced by more than 40%. This is, in part, due to:

- high market prices for allocations resulting in some farmers selling their allocated water;
- lower early-season allocations providing uncertainty about seasonal water supplies at sowing time in October; and
- available water used to irrigate winter crops sown the previous autumn.

Circumstances specific to individual irrigation farms will determine whether a grower uses available water to grow rice. These include the relative viability and risk of growing other enterprises and the skills and resources available to the farm business. Minimal quantities of rice were grown in the Murray Valley during the drought years when water allocations were below 20%, and only relatively small quantities of rice were grown in the Murrumbidgee Valley when water allocations were below 20%. Murrumbidgee Valley irrigation farms generally have a higher number of water entitlements per hectare.

It is likely that during periods of low allocation or reduced water availability, rice will tend to be grown by larger farm businesses that have the capacity to consolidate small water allocations from a number of landholdings. There have been examples
during the past three years of groups of growers combining small volumes of allocated water to produce a single larger area of rice.

It is likely that a larger area of rice will be grown in the Murrumbidgee Valley compared to the Murray Valley at times of lower water availability. This is due to:

- a higher number of water entitlements historically issued and held per hectare;
- more favourable growing conditions which lead to higher average crop yields; and
- generally relatively higher early season allocations.

The water market has been, and is expected to continue to be, used by growers as a source of water to complement seasonal allocation levels. The extent to which the trade market is used to supplement allocations will be dependent upon assumed crop profitability per megalitre and the price of water. In 2009/10 many growers assessed that a crop grain price of approximately $400/tonne would lead to a gross margin return of around $200. The water price at the time of sowing was in the range of $180 – 220/ML. Approximately 345 growers grew rice, while many others chose to sell their allocated water.

A number of growers have expressed the view that they will only purchase water if they feel they can increase the return by around 50%. This is to accommodate production risk and the staged crop payment, which occurs over a 14-month period.

### 7.4 Conclusions

The baseline trends will be determined by the relative profitability of each industry. Market demands and the Australian dollar will influence commodity returns and costs of production. Nonetheless, if existing trends continue and the current suite of water products remain as per historic volumes and reliability then it would be expected that over the long term:

- horticulture will continue to grow on greenfield sites in SA, Sunraysia and the Murrumbidgee valley, and perhaps move to more labour intensive enterprises or remain as dryland/rural residential on smaller properties; up to an absolute upper limit of around 1,500 GL of annual usage;
- all regions will need to readjust with pressures on the community-supplied districts due to small property scale resulting in a search for profitable small-scale enterprises that will be highly reliant on skilled labour. Many properties have become rural residential;
- the GMID will be dependent upon dairying and horticulture;
- southern NSW will be dependent upon opportunistic cropping and rice;
- the Murrumbidgee valley will be dependent upon horticulture, rice and cropping;
• processing will be located in the larger regional centres where economies of scale, labour and services can be achieved. Processing investment can be anywhere with transport links taking wine and milk between regions;

• opportunistic rice and cropping will expand and contract with water availability and price; and

• over the long term the population of the southern-connected Basin will move with the water to where water is used every year (horticulture & dairying) and where there is processing (regional centres).
8 Potential impacts of the Guide’s proposed SDLs

8.1 Horticulture

A reduction in horticulture high security entitlements will see inefficient horticulture growers leave the industry. These entitlements normally would have been expected eventually to be traded to other expanding horticulture properties as part of the natural restructure and growth. The sale of these entitlements to the environment will have a dampening effect on the growth of existing and remaining growers.

Any reduction in (non horticultural) high security entitlements will result in a cut to the potential area for horticulture. Given that:

- there is around 3,300 GL of high reliability entitlement in the southern-connected Basin;
- over the long term horticulture will grow to an upper limit of 50% of this volume (it is already at 1,000 GL/y usage), but no more due to lack of water security; and
- horticulture is almost entirely dependent upon allocations from high reliability entitlements,

it can be expected that for every 1 ML of high reliability entitlement purchased in the Government buyback there will be an approximate 0.5 ML reduction in the potential water available for horticulture. The social and economic implications of this would be significant.

8.2 Dairy

Any reduction in entitlements (particularly high security entitlements) will have a directly proportional impact on the dairy industry, which may be offset by feed purchases, depending upon the mix of milk price, feed price and water price. If the dairy industry maintains its current level of water use, it will buy water from rice and broad acre mixed farms. However the extent to which it can do this is limited by the security of the water.

8.3 Rice and mixed farms

It is likely that during periods of low allocation or reduced water availability, rice will tend to be grown by larger farm businesses that have the capacity to consolidate small water allocations from a number of landholdings. There have been examples during the past three years of groups of growers combining small volumes of allocated water to produce a single larger area of rice.

Any reduction in entitlements (particularly low security) available for irrigation will have a disproportionately larger impact on rice production than other industries, because dairy in particular will buy water from rice growers.
8.4 A new equilibrium of industries

As discussed earlier (section 4), the current balance of industries has resulted from a range of factors including climate, soils, history and access to water and infrastructure, and appears - given the recent drought experience - to have approximately reached a dynamic equilibrium for the current diversion limit, i.e., horticulture survived the drought, dairy adjusted and implemented alternative risk management tactics, and rice responded adaptively by substantially reducing production (reaching zero in the worst year).

The imposition of SDLs will see a new equilibrium evolve which will (likewise) be dynamic as commodity prices and the climate changes (with change likely to include the frequency, intensity and duration of droughts). A key factor in determining the new equilibrium for the southern connected basin will be the level of security of the available water that remains for irrigators to access.

If the available water maintains the current mix of security levels then the impact will most likely be a pro-rata reduction of the current equilibrium. However, if the environment takes a greater proportion of high security water, then the new equilibrium will have less dairy and horticulture proportionally than rice; the converse would occur if the environment were to take a greater proportion of lower security water.
Community resilience and the ability to adapt to SDLs

As discussed in the previous sections, each industry has a different level of exposure to reduced water availability and adaptive capacity.

Water trading is the most important component of adaptive capacity for all industries where it is profitable to do so. At some price point, buying water becomes unprofitable. The price point from lowest to highest is generally broad acre grazing, then rice and mixed cropping, then dairying and finally horticulture.

Other approaches to adaptation include:

- water substitution for dairying, with water being replaced by bought in feed such as dryland produced grain and hay; and

- on mixed farms that have sufficient scale, dryland farming can be used to maintain some production, but this is usually at a much lower income and much larger scale farms are needed to support family units and achieve economies of scale.

However, perennial horticulture is dependent on the market in periods of low allocations, when (largely) allocations can only be bought from other high security entitlement holders.

Farm modernisation can provide some water savings, but this generally is limited to those industries that have not already modernised, horticulture for the most part has already modernised. Much of the rice industry and mixed farming cannot afford to overcapitalise. There still is scope for improvements in efficiency in the dairy industry and higher value broad acre that are now possible due to a better supply system through the modernised supply to farms enabled by NVIRP in the GMID and Coleambally in the Murrumbidgee. Continued investment in irrigation infrastructure to achieve water savings, both in the delivery system and on farm, is seen by many as a high priority. They believe productivity in the region can be enhanced while at the same time delivering water to the environment. This will help maintain the economic base in the region and allow for rural communities to prosper.

It is important to note that in the southern connected Basin, irrigation modernisation in one region may reduce the need for buyback in all regions; in other words, the interconnectedness of the regions through water trade also means that some of the benefits of modernisation are shared throughout the interconnected regions.

For a more detailed, region-specific discussion of exposure, vulnerability, potential impacts, resilience and adaptability, please refer to the regional reports prepared as part of this study for each state (see page 1).