

IRRIGATION FUTURES OF THE GOULBURN BROKEN CATCHMENT



**Milestone 4
June 2006**

**Primary Industries Research Victoria (PIRVic) - Tatura
Department of Primary Industries**

in collaboration with

**Community Engagement Network
Department of Sustainability and Environment**



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The National Program for Sustainable Irrigation focuses research on the development and adoption of sustainable irrigation practices in Australian agriculture. The aim is to address critical emerging environmental management issues, while generating long-term economic and social benefits that ensure irrigation has a viable future. The Program has 14 funding partners who are: Land & Water Australia (Managing Partner); Sunwater, Queensland; Horticulture Australia Limited; Goulburn-Murray Water, Victoria; Cotton Research and Development Corporation; Harvey Water, Western Australia; Lower Murray Water Authority, Victoria; Wimmera Mallee Water, Victoria; Ord Irrigation Cooperative, Western Australia; Australian Government Department of Agriculture, Fisheries and Forestry; Department of Natural Resources and Mines, Queensland; Department of Primary Industries and Resources South Australia; Department of Environment Water and Catchment, Western Australia; and Department of Agriculture, Western Australia.



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Analysis Team: Bruce Anderson, David Bourke, John Dainton, Lyn Gunter, Shane Hall, Peter Langley, Derek Poulton, Kevin Preece, Durham Prewett, Ross Wall, Gordon Weller.

Project Funded By:

Department of Primary Industries
Department of Sustainability and Environment
Goulburn Broken Catchment Management Authority
National Action Plan for Salinity and Water Quality
Goulburn-Murray Water
National Program for Sustainable Irrigation, Land and Water Australia

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Milestone 4 Report

Project:	Irrigation Futures of the Goulburn Broken Catchment (VPI3)
Principal investigator:	Dr QJ Wang
Project duration:	1 July 2003 – 30 June 2007
Report due date:	1 July 2006

Project Objectives

The objectives of the Irrigation Futures project are to:

- Facilitate key stakeholders to develop a shared vision on the future of irrigation in the Goulburn Broken catchment, and to identify scenarios of major constraints and opportunities and of regional response options.
- Understand the social, economic and environmental consequences of various scenarios through impact assessment based on an integration of the best available knowledge.
- Facilitate key stakeholders to build consensus on preferred regional options for future irrigation, and recommend regional follow-up actions.
- Develop a methodology that can be applied elsewhere in Australia for sustainable irrigation planning at a catchment scale.

Context for Milestone 4 Report

The background, underlying philosophy and methodology for this project are outlined in Milestone 1b Report. In particular, that Report includes the:

- Stakeholder Participation Plan (and its external review),
- Communication Plan,
- Evaluation Plan.

Milestone 2 Report provides details of the:

- Planning, recruitment and running of the stakeholder engagement processes,
- Capture, synthesis, review and dissemination of the outputs from those engagement processes,
- The literature review for, and subsequent development of, the assessment process to be used in Stage 3 of the project.

Milestone 3 Report provides:

- A compilation of the synthesised outputs from Stage 2. This comprises the:

- Aspirations of stakeholders for irrigated agriculture in the region,
 - Four External Scenarios describing the evolution of alternative plausible futures within which the region may have to operate over the next 30 years,
 - A suite of Regional Strategies to guide future regional actions,
 - A list of the assets within the region, and
 - A consolidated list of response options from all Workshops from which the suite of Regional Strategies were synthesised.
- The final version of the assessment process to be used in Stage 3.
 - Comments from the external reviewers on the proposed assessment process for Stage 3, and responses from the project team.
 - Details of the communication activities undertaken by project team from Jan – June 2005.

The Attachment to Milestone 4 Report provides:

- A summary of the Stage 3 method and implementation for scenario assessment and implication investigation.
- Stage 3 outputs including:
 - A snapshot of irrigation in the Goulburn Broken Region,
 - Four Scenarios describing plausible futures of irrigation in the region: the evolution of interplay between external operating environments, regional responses, and regional consequences,
 - Broad implications of the scenarios for the region and strategies,
 - Specific implications of the scenarios for irrigation infrastructure planning.
- Details of the communication activities undertaken by project team from July 2005 – June 2006.

Progress Against Milestone 4

The contract requirements for Milestone 4 are as follows:

- Data required for assessment assembled and documented.
- Assessment of scenarios completed, and results analysed and documented.
- Assessment results endorsed by Stakeholder Reference Committee.
- Attendance including presentation and poster display by Principal Investigator at annual Sustainable Irrigation Program Forum.
- Milestone Report 4 submitted for approval.

The work completed against each of these specific requirements is as follows:

Data required for assessment assembled and documented.

Status: Completed

The data for the assessment has been assembled and documented, and is embedded in the Attachment:

- Section 3 - A snapshot of irrigation in the Goulburn Broken Region,
- Section 7 - Specific implications of the scenarios for irrigation infrastructure planning,
- Appendix - Scenarios (Detailed)

Assessment of scenarios completed, and results analysed and documented.

Status: Completed

The process used for and outputs from the scenario assessment are presented in the Attachment.

Assessment results endorsed by Stakeholder Reference Committee

Status: Completed

The assessment results were endorsed by the Stakeholder Reference Committee at its meeting on 23 June 2006, with the following motion:

The SRC endorses that:

- *the process used during Stage 3 of the Irrigation Futures project to generate the assessment results is sound,*
- *the results are therefore likely to be plausible alternatives,*
- *which are worthy of further consideration and debate, and*
- *which can be used to inform decision-making within the regional community.*

Presentation and poster display at Annual Sustainable Irrigation Forum

Status: Completed

In addition, Dr QJ Wang presented a keynote paper on the Irrigation Futures project at the ANCID 2005 Conference, an invited plenary paper at the International Symposium on Sustainable Water Resources Management in Beijing 2005, and an invited paper at ABARE Outlook 2006 Conference. Mr Robert Chaffe presented a paper at the APEN 2006 International Conference.

Milestone 4 Report submitted for approval

Status: Completed

This Milestone 4 Report is submitted for approval.

IRRIGATION FUTURES OF THE GOULBURN BROKEN CATCHMENT



Milestone 4 Attachment Scenarios and Implications June 2006

**Primary Industries Research Victoria (PIRVic) - Tatura
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1. Introduction

Project Overview

Irrigation is a fundamental driver of the regional economy in the Goulburn Broken catchment. The regional farm-gate gross value of production from irrigated agriculture in 2000 was \$1.35 billion. Investment in on-farm and processing infrastructure is about \$100 million per annum.

However, irrigation is facing enormous challenges. As one of the oldest gravity irrigation systems in Australia, Goulburn-Murray Water's irrigation system needs substantial renewal in the next 20 years. Initiatives to increase environmental flows and potential climate changes will have major impacts on the amount of water available for irrigation. In addition, there are increasingly stringent demands for natural resources management to meet social, economic, environmental and cultural outcomes. It is obvious that the region will have to prepare for the future, if it wishes to remain prosperous.

Project Objectives

The Goulburn Broken Irrigation Futures project has been established to assist the regional community to plan for the future. It is a regional initiative, funded by the Goulburn Broken CMA (GBCMA), National Action Plan for Salinity and Water Quality (NAP), Goulburn-Murray Water (G-MW), Department of Primary Industries (DPI), Department of Sustainability and Environment (DSE), and Land and Water Australia (LWA).

The objectives of the project are to:

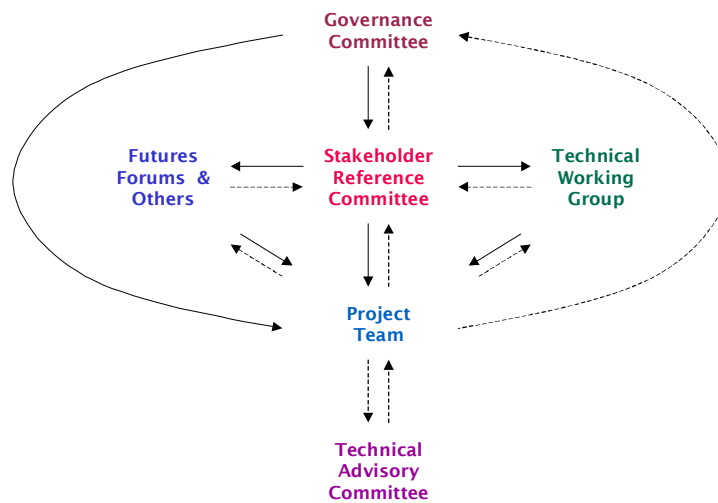
- Facilitate key stakeholders to develop a shared vision for the future of irrigation in the Goulburn Broken catchment over the next 30 years, and to identify scenarios of major constraints and opportunities and of regional response options.
- Understand the social, economic and environmental consequences of various scenarios through impact assessment that integrates the best available knowledge.
- Facilitate key stakeholders to build consensus on preferred regional options for future irrigation, and recommend regional follow-up actions.
- Develop a methodology that can be applied elsewhere in Australia for sustainable irrigation planning at a catchment scale.

Timetable

Project Stage	Timeframe
Stage 1: Project development	Jun 2003 – Dec 2003
Stage 2: Vision, scenarios and options	Jan 2004 – Dec 2004
Stage 3: Assessment of consequences	Jan 2005 – Jun 2006
Stage 4: Enabling changes	July 2006 – Jun 2007

Organisation

Project organisation, and the roles of each of the project organisational groups, are given below.



Project organisation

Roles of project organisational groups

Organisational Group	Key Roles
Governance Committee (GC)	Set broad directions Review project progress and performance Make investment decisions
Stakeholder Reference Committee (SRC)	Provide guidance on processes for wider stakeholder participation Consolidate ideas from wider stakeholders Generate confidence in the regional community
Futures Forums and Others	Provide input from the community and other key stakeholders, including contributing ideas on values and aspirations, future scenarios and regional response options.
Technical Working Group	Further develop details of ideas generated by Futures Forums Contribute knowledge and expertise to the assessment process.
Project Team	Facilitate the stakeholder participation process Provide scientific input.
Technical Advisory Committee	Provide expert advice as required

Stage 2 - Vision, Scenarios and Options

Stage 2 used an extensive program of stakeholder engagement to capture perspectives on the visions, external scenarios and response options.

About 120 stakeholders participated in a series of 4 full-day workshops held throughout the region (Echuca, Kyabram, Shepparton, Cobram, Benalla and Seymour). A diverse range of stakeholders were involved to ensure a wide spectrum of views were captured. Stakeholders included primary producers, major processors, business and community groups, local government and agencies responsible for land and water management. Input from women and young people was specifically targeted.

The outputs from the engagement process have been synthesised and documented (Output & Recommendations from the Stage 2 Community Engagement). The output from Stage 2 includes:

- Aspirations for irrigated agriculture in the region, (See Section 2)
- Four external scenarios describing alternative sets of the challenges and opportunities that the region may have to face during the next 30 years, and
- A suite of regional strategies for dealing with those challenges and opportunities.

These outputs were distributed to regional agencies and interest groups. They provide an important resource for future planning within the region.

Stage 3 - Assessment of Scenario Implications

Stage 3 involved conducting a detailed assessment of how the region would manage the alternative scenarios developed in Stage 2. The assessment considered:

- The responses of individuals, businesses, groups and organisations to the challenges and opportunities within the four scenarios developed in Stage 2,
- The likely consequences of the external scenarios and region's responses for the economic, community and environmental wellbeing of the region,
- The broad implications of the scenarios for the region and strategies to address these implications, and
- Specific implications of the scenarios for individual organisations and groups.

Stage 4 - Enabling Changes

Stage 4 will involve assisting regional organisations and groups build the learning from the project into their business and strategic plans. Three levels of output will be produced from the overall project:

- Four full scenarios describing the evolution of plausible alternative futures for the regions,
- Broad implications of the scenarios for the region describing the major strengths and weaknesses of the region, opportunities and challenges the region may face and regional strategies to realise the opportunities and manage the challenges, and
- Implications of the scenarios for specific issues that will involve in-depth analysis of particular issues and tailoring recommendations to individual organisations in the region.

The main activities of Stage 4 will be to communicate the full scenarios and broad implications widely throughout the region and to work with individual organisations and groups to develop the implications for specific issues.

About This Document

This document includes a summary of the Irrigation Futures Forum Aspirations and a snapshot of irrigation in the Goulburn-Broken Region. It gives a summary of the Stage 3 process and outputs of the Irrigation Futures project. Section 2 describes the methods and processes used for the assessment of the scenarios and the investigation of the implications of the scenarios. Sections 5 to 7 and Appendix 1 contain the outputs of the assessment of the scenarios and their implications including

- Four Scenarios describing plausible futures of irrigation in the region: the evolution of interplay between external operating environments, regional responses, and regional consequences,
- Broad implications of the scenarios for the region and strategies, and
- Specific implications of the scenarios for irrigation infrastructure planning.

The document also includes a list of the communication activities undertaken by the project team between July 2005 and June 2006 (Section 8).

2. A Summary of the Irrigation Futures Forum Aspirations

In 2035 we want the community of the Goulburn Broken Catchment to be:

- Seen as a world leader in food production (clean and green, export markets, growth)
- Efficient users of water, and have appropriate water distribution systems
- Recognised and valued as stewards of the land (proud to be farmers/irrigators, recognised for contribution to economy and community, keep natural resource condition in good shape for future generations)
- Achieving a balance between environmental, social and economic demands (industry exists in harmony with environment and community)
- A vibrant, prosperous (businesses, region, employment, eco/ag tourism, service industries) and diverse community
- A great place to live (community well-being, social networks, well-serviced, appropriate/maintained infrastructure, amenities)
- Happy people who have time for leisure
- Creating all kinds of opportunities for all (in particular young people and new farmers)
- Embracing new and existing technology
- Investing in the environment (biodiversity, healthy rivers, native vegetation, etc.)
- Continuing to have access to water resources for irrigation
- Planning strategically and making collaborative decisions (displaying community leadership, cooperation, working together as a wider community)
- Actively participating in decision making processes and implementation programs
- Managing change (preparedness, adaptability, innovation, learning culture).

3. A Snapshot of the Goulburn Broken Region

Administrative Boundaries

Within the Goulburn Broken region, several administrative agencies collect and report data describing the region. The boundaries used by these agencies to report data do not all align. The administrative boundaries introduced in this section are subsequently used to provide a snapshot of the region and the changes that have occurred over the last 10 years.

Figure 1 shows the catchment management zones and irrigation delivery areas in the Goulburn Broken region. The Goulburn Broken Catchment Management Authority administers the catchment in three regions, the Shepparton Irrigation Region, the Mid Goulburn region and the Upper Goulburn region. The boundary of the Shepparton Irrigation Region is defined by the boundaries of the irrigation delivery areas and extends beyond the boundary of the Goulburn Broken catchment to the west to include all of the Rochester Irrigation Area. In the Shepparton Irrigation Region, irrigation water is delivered primarily through constructed infrastructure, whereas throughout the remainder of the region irrigation water is predominantly diverted from water bodies.

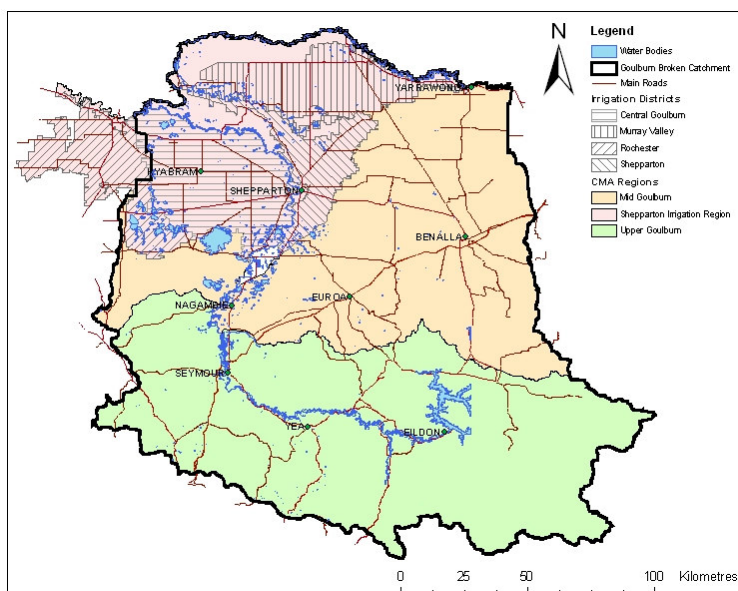


Figure 1 Catchment Management and Irrigation Delivery Districts within the Goulburn Broken Catchment.

Figure 2 shows the municipal and statistical areas for the Goulburn Region. The statistical areas are used by the Australian Bureau of Statistics and consist of several municipalities. The boundaries for both the municipalities and statistical areas do not align with catchment management boundaries. For the purposes of the information presented in this document, the North Goulburn statistical area has been equated to the Shepparton Irrigation Region, and the balance of the catchment to the South Goulburn statistical area. The combination of the North Goulburn and South Goulburn statistical areas is Goulburn Statistical Division.

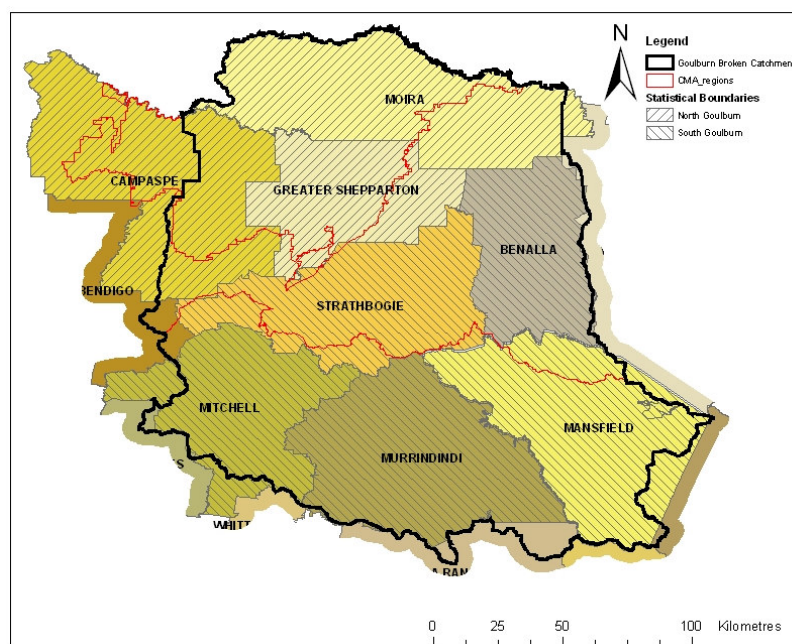


Figure 2 Municipal and Statistical Areas in the Goulburn Broken Catchment

Changes over the Last 10 years

Regional Demographics

Between 1996 and 2001, the population of the Goulburn statistical division increased from 178,000 people to 194,000 and was expected to increase to 206,000 by 2006. In the North Goulburn statistical area, the population increased from 110,000 in 1996 to 121,000 in 2001 and was expected to increase to 128,000 by 2006.

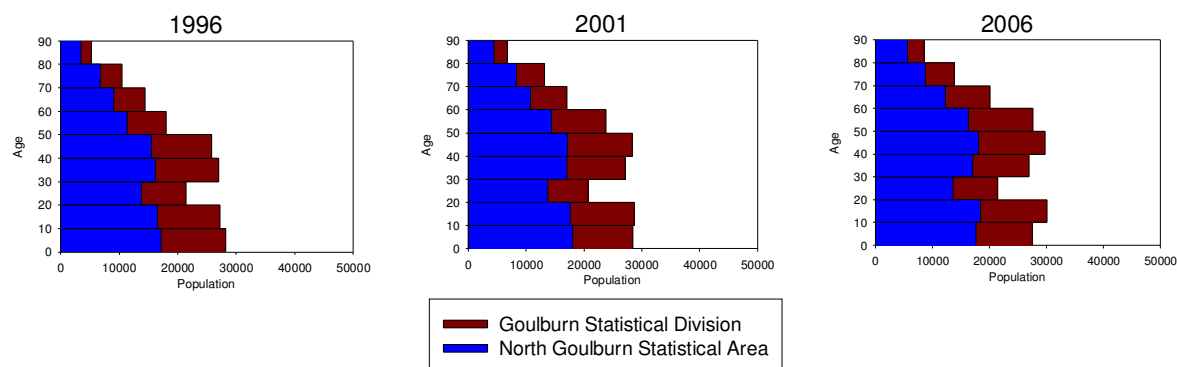


Figure 3 Population profiles for the Goulburn statistical division (Source: DSE, 2005)

Figure 3 shows the population profiles for the Goulburn statistical division for 1996, 2001 and 2006. These profiles show that the population of the region aged between 20 and 30 years is lower than the adjacent age cohorts. The profiles also show that the population aged 40 and over has increased between 1996 and 2006, with the largest increases in those aged between 40 and 60 years.

Contribution of Agriculture to the Regional Economy

Agriculture is a significant contributor to the economy of the Goulburn Region. Between 1996 and 2005, the farm gate value of agricultural production increased 42%, or approximately 4% pa, from \$1.17 billion to \$1.67 billion (Table 1). The dairy production is the largest single contributor to the economy, followed by livestock slaughter and

fruit production. All industries, with the exception the dairy and wool industries have experienced growth between 1996 and 2005. The wool industry has been influenced by demand and prices for wool decreasing internationally since 1990 (ABARE, 2006). The dairy industry in the region contracted significantly in 2002/03 due to low irrigation water availability and has been slowly recovering since.

Table 1: Farm Gate Gross Value of Production for Goulburn Statistical Division (\$ million)
Source: ABS 1996, ABS 2002, ABS 2005)

Activity	1995/96			2001/02			2004/05
	North Goulburn	South Goulburn	Goulburn Statistical Division	North Goulburn	South Goulburn	Goulburn Statistical Division	Goulburn Statistical Division
Dairying	440.8	12.5	453.4	512.2	9.4	521.6	388.6
Livestock slaughter	145.9	65.0	210.9	223.7	102.2	325.9	307.9
Fruit (not grapes)	167.7	1.6	169.2	188.2	8.1	196.2	280.2
Timber	0.0	85.6	85.6	0.0	135.8	135.8	135.80*
Hay production	49.6	12.3	61.9	64.8	16.8	81.6	184.6
Wool	15.7	33.7	49.4	16.1	38.4	54.5	49.4
Cereal Grain	41.1	10.8	51.9	74.6	15.5	90.1	104.3
Vegetables	24.2	3.7	27.9	72.3	4.3	76.6	89.6
Other	13.2	46.1	59.4	41.1	74.1	115.2	125.2
Total	898.2	271.3	1169.5	1192.9	404.5	1597.4	1665.6

* estimated

Land Use

Table 2 shows the major land uses in the Shepparton Irrigation Region. The dairy industry uses the most land, followed by fodder and grain production and livestock production. The available data suggest that the area of fodder and grain production grew between 1996/97 and 2004/05, while the area of land used by other industries decreased.

Table 2: Land use of the Shepparton Irrigation Region (ha)^
(Source: Douglass et al 1997, McAllister 2005)

Industry	1996/97	2004/05
Dairy	210,997	185,883
Horticulture	21,144	16,707
Livestock production	99,102	74,384
Fodder and grains	115,158	166,498
Lifestyle*		21,805
Total	446,401	465,277

*Category introduced in 2004/05

^Different data collection methods used

Climate

Rainfall varies considerably across the catchment, with average annual totals varying from 430 mm in the far north west of the catchment to 1700 mm in the south east. Inter-annual rainfall variation is also significant. Figure 4 illustrates the variability of rainfall for Tatura, in the north west of the catchment and Lake Eildon, in the south east. Pan evaporation is less variable than rainfall, with average annual pan evaporation varying from 1000 mm in the south to 1500 mm in the north of the catchment. Over the past decade, the region has experienced below average annual rainfall and above average pan evaporation in the majority of years.

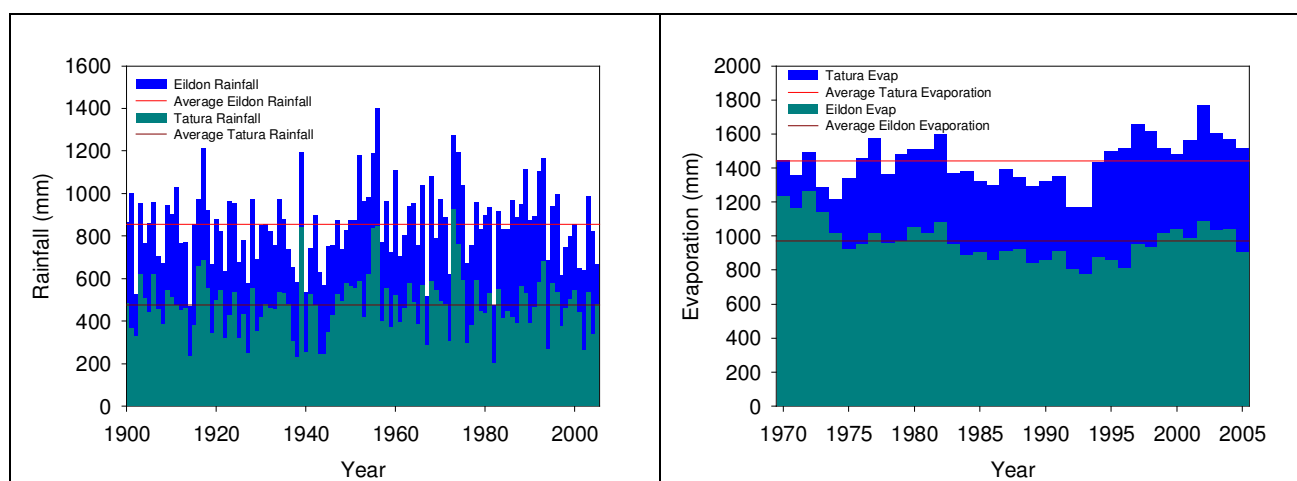


Figure 4 Historical Rainfall and Pan Evaporation for the Goulburn Broken Catchment
(Source: Bureau of Meteorology)

Irrigation Water

Irrigation water underpins the prosperity of much of the Goulburn Broken region. The historical irrigation entitlement for the Goulburn Broken region is approximately 1100 GL. Historically individual irrigators have had access to up to 200% of their entitlement when 'sales' water was available, resulting in regional use of up to 1.6 times the regional entitlement. Table 3 shows the water use by industry for the 1996/97 and 2004/05 irrigation seasons. The 1996/97 irrigation season was the most recent time when full (200%) sales allocations were available across the entire Goulburn Broken region. The majority of water (>60%) is used by the dairy industry, with livestock and fodder and grains also using large volumes.

Table 3 Irrigation Water Use, Entitlement and Allocations in the Goulburn Broken region[^]
(Source: Douglass et al 1997, McAllister 2005, Goulburn-Murray Water Annual Reports)

Industry	1996/97	2004/05
Dairy	959,821	692,038
Horticulture	70,765	62,141
Livestock production	299,362	92,720
Fodder and grains	175,860	195,538
Lifestyle*	-	47,703
Total	1,505,808	1,090,140
Entitlement	1,103,657	1,066,568
Allocation	200%	100%

* Category introduced in 2004/05

[^] Volumes of water in ML

Water trade commenced in Victoria in 1989. Figure 5 shows the volumes of temporary and permanent water trade moving into the Goulburn Broken region since 1994. Until 1999, irrigation water was traded into the Goulburn Broken region, both permanently and temporarily. Temporary trade has always resulted in water moving into the region, and volumes have always been greater than volumes of permanent trade. Since 2000, irrigation entitlement has been permanently traded out of the region, with the maximum allowable volume of permanent trade out of the region being realised in 2003/04 and 2004/05.

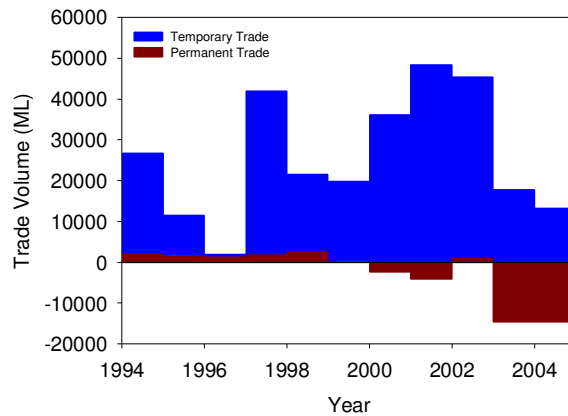


Figure 5 Water Trade into the Goulburn Broken region
(Source: Goulburn-Murray Water Annual Reports)

Salinity and Watertables

In the irrigated areas of the region, salinity and water logging is a threat to agricultural production. In the Shepparton Irrigation Region, the area of shallow water tables has been used to estimate the risk of salinity and water logging. Figure 6 shows the extent of shallow water tables in the Shepparton Irrigation Region in August 1995 and August 2005. Between 1995 and 2005 the area with a water table nearer than 2 metres to the surface has decreased from approximately 50% of the region to less than 20%. There are many possible causes of this decrease, of which low water allocations and low rainfall are major contributors

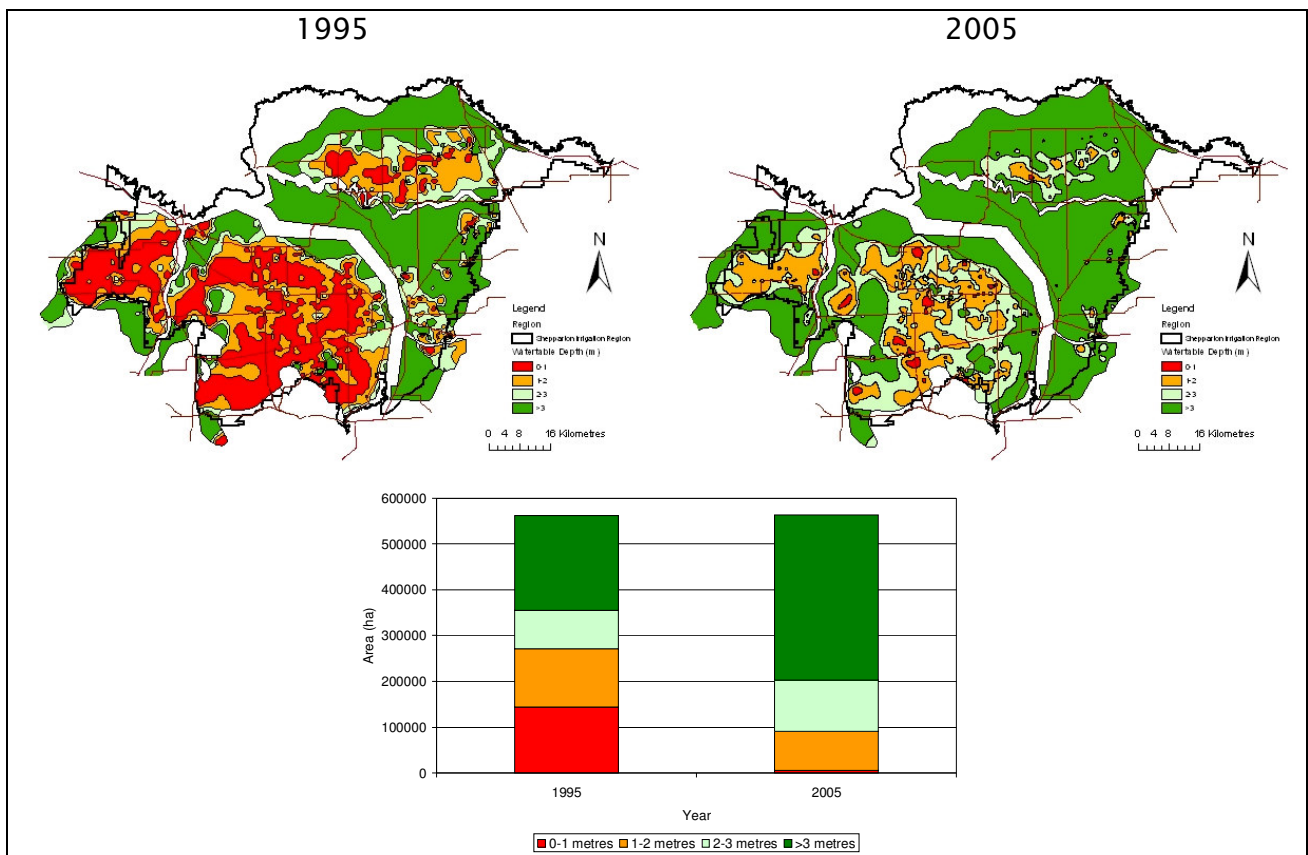


Figure 6 Watertable depths for the Shepparton Irrigation Region

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- McAllister, A. (2005) Integrating Information Systems – Information Needs & Information Framework. (Department of Primary Industries (DPI), Tatura, Victoria.)

4. Stage 3 Scenario Assessment Process

Method

Four external scenarios were developed by the Irrigation Futures Forums at Stage 2 of the project. They represent a range of plausible future operating environments for the region in the next 30 years. During Stage 3, we constructed a response scenario corresponding to each of the external scenarios, describing how the players in the region may respond to the external developments and the social, economic and environmental consequences of the external factors and regional actions. We then examined the broad implications of the scenarios for the region and recommended strategies for the region to effectively deal with future opportunities and challenges. We also examined in greater depth implications of the scenarios for specific aspects of the region.

Technical Working Group

A Technical Working Group (TWG) was formed to work with the project team to undertake scenario assessment and investigate scenario implications. The TWG provided a forum for the stakeholders to contribute their significant knowledge and rich experience to this project. It also supported a largely qualitative assessment and investigation, complemented by quantitative analysis where necessary. The TWG provided inputs through a series of workshops.

Constructing response scenarios

Scenario assessment was carried out through the construction of a response scenario corresponding to each of the four external scenarios developed at Stage 2. The construction began by understanding the plausible operating environment embedded in an external scenario. The TWG then described what the regional responses might be. The responses included that of individuals, businesses, groups, organisations and the community in general. Some of the underlying factors considered included the changing nature of demographics, culture and technology. The TWG then explored the consequences of the external operating environment and regional responses on the economic, community and environmental wellbeing of the region.

Broad implications of the scenarios

The TWG identified a number of major areas of regional competencies that need to be addressed for the region to be successful in the future. The areas were identified by considering what would make the region an attractive place for investment and for living. For each of the competency areas, the current strengths and weaknesses of the region were identified. The opportunities and threats presented by scenarios were analysed. Strategies were then developed for the region to realise future opportunities and manage threats, building on current strengths and addressing weaknesses.

Through the Irrigation Futures Forums, Stage 2 of the project produced a set of regional strengths and weaknesses, and also a preliminary set of regional strategies. These materials were incorporated into the final outputs of this part of the Stage 3 investigation.

Specific implications of the scenarios

The broad implications of the scenarios develop a series of regional strategies that will increase the ability of the region to prosper under a range of plausible futures. Some specific aspects of these strategies need further development to understand in greater depth and detail the issues or options available, and to increase the relevance of the strategies for particular organisations. Further development of these strategies will occur through focused investigations.

The areas for focussed investigations were identified by the TWG and by organisations indicating their willingness to be involved. The details of the focussed investigations have been developed in conjunction with the lead organisation responsible for managing the specific issue. The focussed investigations have been undertaken by the project team in collaboration with organisations in the region and supported by the TWG and by consultants when appropriate.

Implementation

Technical Working Group

The TWG was formed by seeking nominations from the Stakeholder Reference Committee (SRC) and from members of the Irrigation Futures Forums. Nominees were requested to describe their skills in a number of areas considered important for Stage 3. Forty-four nominations were received.

The project team prioritised nominations to ensure that the group incorporated a broad range of skills and experience, that it was a manageable size, and that it had representation from women and young people. The prioritised list of nominees was presented to the SRC for approval, and twenty-three people were accepted. This provided a team of local stakeholders with considerable experience across most areas of irrigated agriculture.

For the construction of the response scenarios, the TWG was separated into a Narrative Team and an Analysis Team, according to their preferred thinking style. Members of the Narrative Team preferred a right-brain style of thinking, which tends to be holistic and rely on intuition. Members of the Analysis Team preferred a left-brain thinking style, which tends to be logical and rational. For other investigations, the two teams worked as a group.

The TWG met on 18 occasions in total (team workshops and whole group workshops) during Stage 3. These were usually full-day workshops (ie 10am - 3pm). It was a demanding task, with some members attending up to 12 meetings (ie roughly one per month).

The project team supported the TWG by facilitating and contributing at the workshops, and by synthesising workshop outputs. When necessary and appropriate, the project team developed initial ideas and material, and the TWG then provided comments and suggestions.

Constructing response scenarios

Scenarios 1 and 3 were constructed by the TWG at workshops supported by the project team. Scenarios 2 and 4 were constructed by the project team and then checked by the TWG.

In constructing Scenarios 1, The Narrative Team and the Analysis Team worked in sequence. The Narrative Team came up with ideas on the plausible evolution of the interplay between external factors, regional actors and their actions. The Analysis Team would then critique the scenario ideas, and provided an assessment of the plausible regional consequences for businesses, the environment and communities.

“Taking a journey into the future” can be a challenging task. To help the teams to do so, they were initially asked to consider the last 5 years (ie 2000 – 2005), so that they could identify the important issues being carried forward into the scenario. Then, to help teams imagine that they were in the future, they were taken through a scenario internalisation process. This involved physically putting on a ‘writers cloak’, considering the key elements shaping a period within the scenario (eg the first 5 years), drawing a picture (or writing about) what it was like in that period, and then articulating their thoughts.

The Narrative Team was then asked to identify a number of ‘actors’, and to consider what they might be doing. These ‘actors’ included obvious stakeholders such as primary producers, processors, and agencies. They also included ‘actors’ such as industry associations, seasonal workers, service industries, community and environment groups, and lifestyle farmers. To further extend their thinking, team members were asked to identify young persons whom they knew, and to imagine what they might be doing within the particular time period.

The Analysis Team provided comments on the outputs from the Narrative Team. The Analysis Team was also asked to consider themselves as a consultancy group. Their consultancy brief was to produce a series of ‘State of the Region’ reports. The reports would describe the consequences for regional business, the environment, community groups and infrastructure systems, given this period within the external scenario and the actors and actions predicted by the Narrative Team.

A similar process was followed when constructing response Scenario 3. However, more focus was given to the competitiveness of future agribusinesses in the region. The Narrative Team was asked to consider themselves as the Goulburn Valley Economic Development Authority. Their role was to attract business investment into the region. They were asked to identify those regional features attractive to investors now, and the businesses that they would recommend to investors under Scenario 3. They were then asked to predict the nature of those future businesses (products, customers, competitive advantage, etc), the concerns that the scenario might create for those investors, and how those concerns might be managed.

The Analysis Team were asked to expand on the Narrative Team’s ‘wealth generating’ businesses in the region, by defining the underlying distinctive regional competencies of those businesses, and in the light of Scenario 3, consider how those businesses might evolve into the future, the new competencies required, how those competencies might come under threat, what actions the region could take to respond to the threats.

The experience and ideas gained from constructing response Scenarios 1 and 3 helped the project team to construct relatively quickly the response Scenarios 2 and 4. This helped reducing the time demand on the TWG. These scenarios were commented on and approved by the TWG.

Broad implications of the scenarios

The TWG and the project team identified six major areas of regional competencies. These were based on the distinctive competencies for agribusinesses identified by the TWG when constructing response Scenario 3 and on the consideration of regional aspirations developed by the Irrigation Futures Forums at Stage 2. These major areas of regional competencies are land, water, agribusinesses, environment, communities, and institutional support.

For each of these regional competency areas, the project team developed a list of current strengths and weaknesses of the region. These were based on the strengths and weaknesses identified by the Irrigation Futures Forums at Stage 2 and also the details of the distinctive regional competencies for agribusinesses identified by the TWG when constructing response Scenario 3.

The TWG revisited all the four scenarios and identified the major opportunities and threats that the four scenarios present to the region. They were then asked how to get the fundamentals right for the region to deal with the opportunities and threats, considering the region's strengths and weaknesses. The project team subsequently updated the preliminary regional strategies developed by the Irrigation Futures Forums at Stage 2 by incorporating the TWG ideas as well as the learnings from the focused investigations on specific implications of the scenarios.

Specific implications of the scenarios

The TWG identified a number of aspects requiring focussed investigations, including:

- Irrigation infrastructure planning
- Catchment management
- Land use planning
- Retention of young people in the region
- Development of differentiated products
- Economic impacts of change on small towns and communities

Several of these focussed investigations have commenced, while others will commence as Stage 4 of the project progresses.

Specific implications for irrigation infrastructure planning

The focussed investigation looking at the implications for irrigation infrastructure planning was initiated to coincide with the commencing of Goulburn-Murray Water's irrigation reconfiguration planning. The project team, in conjunction with a consultant and the TWG, developed a chapter providing perspectives of future irrigation for a strategic overview of service needs for the Shepparton Irrigation Region. The chapter summarised the scenarios and their implications for irrigation and recommended some issues that should be considered as part of the reconfiguration process and is included in Section 7 of this report.

One of the recommendations was to incorporate flexibility into the irrigation infrastructure configuration, design, ownership and management. To assist Goulburn-Murray Water in adopting this recommendation, further work was commissioned to investigate the options for increasing the flexibility of irrigation infrastructure. Currently a handbook for flexible irrigation technologies is being developed by consultants to

assist irrigation infrastructure designers to increase the flexibility of irrigation infrastructure.

Specific implications for catchment management

The specific implications of the scenarios for catchment management are being developed as a part of the five-year review of the Regional Catchment Strategy for the Shepparton Irrigation Region. A program of workshops was developed by the project team in collaboration with the Catchment Strategy Review team.

The first workshop involved the teams undertaking the review of the six Catchment Strategy programs. This workshop introduced scenario planning to the participants and examined the implications of one scenario for management of the catchment and individual programs. Individual programs subsequently examined the implications of the remaining scenarios with support from the project team. A second combined workshop is planned to draw together the work of the program teams and examine the implications for the Catchment Strategy as a whole.

Specific implications for land use planning

The third focused investigation, currently under development, will assess the implications of the scenarios for land-use planning and economic development. This investigation will be led by the project team in conjunction with three Local Governments (Campaspe, Greater Shepparton and Moira) and also involve water service providers, the Catchment Management Authority and State Government Departments. The process will involve two workshops. The first will introduce scenario planning and consider the implications of one scenario. The second workshop will consider implications of the remaining scenarios and identify strategies and processes to address the implications.

5. Scenarios (Summary Slides)

Introduction

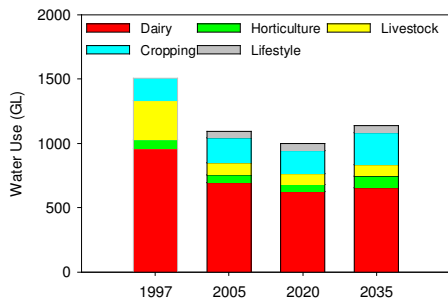
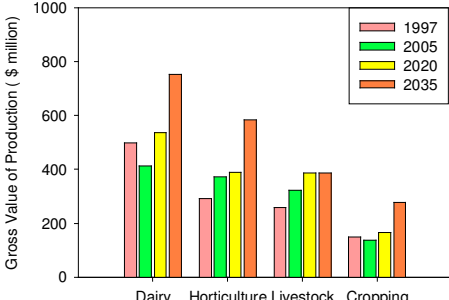
This section presents a summary of the four scenarios, describing plausible alternative futures of irrigation in the Goulburn Broken region. The four scenarios, Moving On, New Frontiers, Pendulum, and Drying Up, summarise external driving forces and the follow-on effects of those driving forces resulting from the region's response to those driving forces.

Detailed descriptions of the scenarios are presented in Appendix 1. The detailed scenarios are presented in two periods, 2005-2020 and 2020-2035. For each period the scenario is described in three main sections, *Primary Drivers*, *Our Industries* and *Our Community and Environment*. *Primary Drivers* describe the forces that influence the region but are primarily beyond the control of individuals and organisations in the region. *Our Industries* describes the specific drivers for industry in the region, how industry responds and the overall impacts of the drivers and responses on industry. The section considers industry as a whole as well as the main irrigated agricultural industries present in the region. *Our Community and Environment* describes the specific drivers for the community and environment, how individuals, agencies and community groups respond and the overall impacts of the drivers and responses on the community and environment. Responses are categorised using the responsible agency, organisation or community group.

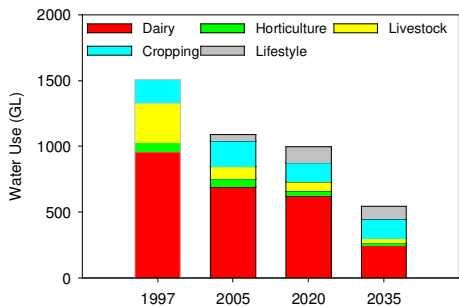
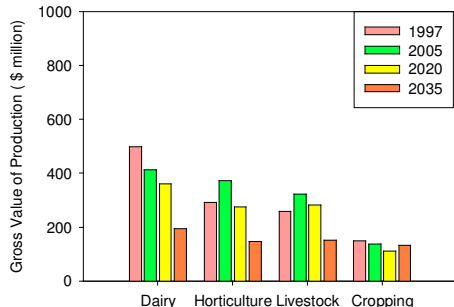
The four scenarios are not predictions of the future. They are intended to represent a range of possible opportunities and challenges that the Goulburn Broken region may face over the next 30 years. Many elements of the scenarios can be interpreted as metaphors or examples of possible events that may occur. For example, the outbreak of fire blight described in Scenario 2 has been used to depict a bio-security threat. Alternative bio-security threats such as foot and mouth disease or avian influenza could have been used. Similarly, government policies described in the scenarios should be considered as plausible, but should not be interpreted as a statement of future government policy or intent.

The scenarios are intended to stimulate discussions on strategies that organisations, agencies and individuals may take to ensure they and the region is resilient under a range of possible futures. The broad implications of the scenarios for the region are described in Section 6 of this document. Implications for specific aspects of the region are progressively being developed in collaboration with regional agencies and organisations. The specific implications for irrigation infrastructure planning are reported in Section 7 of this document. The specific implications for other aspects will be reported in subsequent publications.

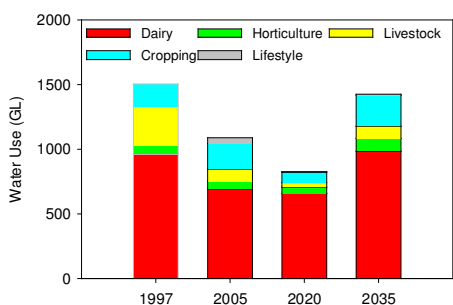
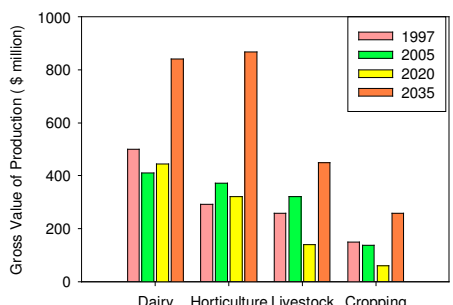
Scenario 1: Moving On

<h3>Primary Drivers 2005-2020</h3> <ul style="list-style-type: none">• Freer international trade• Increasing agricultural production costs• Genetically modified organisms permitted• Rural living and tourism• Climate change• Energy shortages• Decreasing volunteerism• Governments favour markets and individual responsibility	<h3>Follow-on Effects</h3> <ul style="list-style-type: none">• Agriculture<ul style="list-style-type: none">- Fewer, larger and more efficient farms- Adapt to cost pressures- Increased value of production- Multinational control of processing• Lifestyle properties<ul style="list-style-type: none">- Small increase• Irrigation infrastructure reconfiguration• Decline of small towns• Region prospers																																																							
<h3>Primary Drivers 2020-2035</h3> <ul style="list-style-type: none">• International trade opportunities improve• Consumer concern for health and animal welfare• Competitive marketing environment• Electronic communication and trade• Water delivery infrastructure privatised• Dry climate• Low land prices• Highly valued leisure time	<h3>Follow-on Effects</h3> <ul style="list-style-type: none">• Agriculture<ul style="list-style-type: none">- Traditional industries- Highly controlled- Increased value of production• Land and environment management tension• Rationalised infrastructure• Decreased influence of agriculture• Lower salinity risk																																																							
<h3>Water Use</h3>  <p>The chart shows water use in GL for five categories: Dairy (red), Horticulture (green), Livestock (yellow), Cropping (cyan), and Lifestyle (grey). The y-axis ranges from 0 to 2000 GL. The x-axis shows years 1997, 2005, 2020, and 2035. Dairy is the largest user in 1997, but its share decreases significantly by 2035. Horticulture and Livestock show increasing trends. Cropping and Lifestyle remain relatively stable.</p> <table><caption>Estimated Water Use (GL)</caption><thead><tr><th>Year</th><th>Dairy</th><th>Horticulture</th><th>Livestock</th><th>Cropping</th><th>Lifestyle</th></tr></thead><tbody><tr><td>1997</td><td>1000</td><td>100</td><td>400</td><td>500</td><td>0</td></tr><tr><td>2005</td><td>700</td><td>100</td><td>100</td><td>300</td><td>100</td></tr><tr><td>2020</td><td>600</td><td>100</td><td>100</td><td>200</td><td>100</td></tr><tr><td>2035</td><td>650</td><td>100</td><td>100</td><td>200</td><td>100</td></tr></tbody></table>	Year	Dairy	Horticulture	Livestock	Cropping	Lifestyle	1997	1000	100	400	500	0	2005	700	100	100	300	100	2020	600	100	100	200	100	2035	650	100	100	200	100	<h3>Value of Production</h3>  <p>The chart shows the gross value of production in \$ million for four categories: Dairy, Horticulture, Livestock, and Cropping. The y-axis ranges from 0 to 1000 \$ million. The x-axis shows the categories. For each category, four bars represent the years 1997 (pink), 2005 (green), 2020 (yellow), and 2035 (orange). Dairy shows a general decline from 1997 to 2035. Horticulture and Livestock show significant increases over time. Cropping remains relatively stable.</p> <table><caption>Estimated Gross Value of Production (\$ million)</caption><thead><tr><th>Category</th><th>1997</th><th>2005</th><th>2020</th><th>2035</th></tr></thead><tbody><tr><td>Dairy</td><td>500</td><td>400</td><td>550</td><td>750</td></tr><tr><td>Horticulture</td><td>300</td><td>350</td><td>400</td><td>600</td></tr><tr><td>Livestock</td><td>250</td><td>300</td><td>350</td><td>400</td></tr><tr><td>Cropping</td><td>150</td><td>150</td><td>150</td><td>250</td></tr></tbody></table>	Category	1997	2005	2020	2035	Dairy	500	400	550	750	Horticulture	300	350	400	600	Livestock	250	300	350	400	Cropping	150	150	150	250
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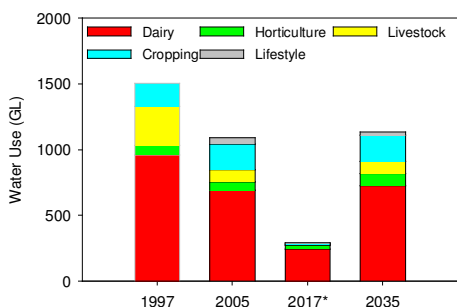
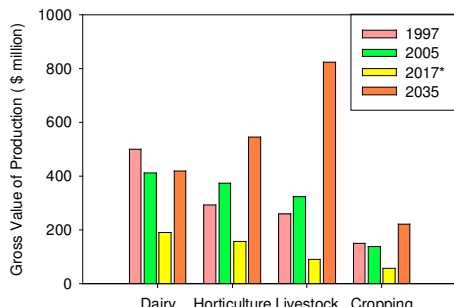
Scenario 2: New Frontiers

<h3>Primary Drivers 2005-2020</h3> <ul style="list-style-type: none">• Demand for rural lifestyle properties• Improved communication technologies• Regulation of agricultural practice• Freer international trade, but loss of markets• Price of oil doubles• More water reform• Drier climate• Fireblight outbreak	<h3>Follow-on Effects</h3> <ul style="list-style-type: none">• Agriculture<ul style="list-style-type: none">- Fewer, larger and more efficient farms- Highly focused on production- Lower value of production- Regulated practice• Lifestyle residents<ul style="list-style-type: none">- Buy land and water, increasing its value- Demand aesthetically pleasing environments- Bring money, ideas and energy into region- Strongly influence local agencies																																																							
<h3>Primary Drivers 2020-2035</h3> <ul style="list-style-type: none">• Laboratory-based food production• Genetically modified organisms permitted• All agricultural production subsidies removed• Climate dries further• Removal of barrages at mouth of Murray River• Government purchase of agricultural land for environmental purposes	<h3>Follow-on Effects</h3> <ul style="list-style-type: none">• Agriculture<ul style="list-style-type: none">- Traditional industries decline substantially- Cropping industry expands as feedstock for laboratory-based food and biofuel production- Irrigation water trades out of region• Limits on salt disposal to Murray river lifted• Decreases salinity risk• Population continues to grow• Region continues to be prosperous																																																							
<h3>Water Use</h3>  <table><caption>Water Use (GL) Data (Estimated)</caption><thead><tr><th>Year</th><th>Dairy</th><th>Horticulture</th><th>Livestock</th><th>Cropping</th><th>Lifestyle</th></tr></thead><tbody><tr><td>1997</td><td>1000</td><td>100</td><td>200</td><td>300</td><td>100</td></tr><tr><td>2005</td><td>700</td><td>100</td><td>100</td><td>200</td><td>100</td></tr><tr><td>2020</td><td>600</td><td>100</td><td>100</td><td>150</td><td>100</td></tr><tr><td>2035</td><td>300</td><td>100</td><td>100</td><td>100</td><td>100</td></tr></tbody></table>	Year	Dairy	Horticulture	Livestock	Cropping	Lifestyle	1997	1000	100	200	300	100	2005	700	100	100	200	100	2020	600	100	100	150	100	2035	300	100	100	100	100	<h3>Value of Production</h3>  <table><caption>Gross Value of Production (\$ million) Data (Estimated)</caption><thead><tr><th>Sector</th><th>1997</th><th>2005</th><th>2020</th><th>2035</th></tr></thead><tbody><tr><td>Dairy</td><td>500</td><td>400</td><td>350</td><td>200</td></tr><tr><td>Horticulture</td><td>300</td><td>350</td><td>250</td><td>150</td></tr><tr><td>Livestock</td><td>250</td><td>300</td><td>250</td><td>150</td></tr><tr><td>Cropping</td><td>150</td><td>150</td><td>100</td><td>100</td></tr></tbody></table>	Sector	1997	2005	2020	2035	Dairy	500	400	350	200	Horticulture	300	350	250	150	Livestock	250	300	250	150	Cropping	150	150	100	100
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Scenario 3: Pendulum

<div>Primary Drivers 2005-2020</div> <ul style="list-style-type: none">• Large water purchase for the environment• Land and infrastructure restructure• Environmental credit markets• Energy shortage• Freer trade, multinational takeovers• Genetically modified organisms prohibited• Increase in interest rates• Rural resentment of urban attitudes	<div>Follow-on Effects</div> <ul style="list-style-type: none">• Agriculture<ul style="list-style-type: none">- Large dryland farms- Decrease in confidence- Lower value of production• Contraction of irrigation infrastructure• Decreased salinity risk• Improved environmental health• Decline of rural communities																																																							
<div>Primary Drivers 2020-2035</div> <ul style="list-style-type: none">• Auction of water entitlement• Irrigation infrastructure rebuilt• High rainfall• Weaker Australian dollar• Genetically modified organisms prohibited• Consumer concern about genetically modified foods	<div>Follow-on Effects</div> <ul style="list-style-type: none">• Agriculture<ul style="list-style-type: none">- Expansion of irrigated agriculture- Increased diversity of production- Value of production increases substantially• Planned redevelopment of irrigation• Labour shortage• Increased salinity risk• Region is highly prosperous																																																							
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Scenario 4: Drying Up

<div>Primary Drivers 2005-2020</div> <ul style="list-style-type: none">Major recession in USAUnemployment increases nationallyAustralian dollar appreciatesFreer trade and highly competitive marketplaceGenetically modified organisms prohibitedSevere droughtDecreasing egalitarianism	<div>Follow-on Effects</div> <ul style="list-style-type: none">Agriculture<ul style="list-style-type: none">Sale of assets to make ends meetRely on government assistanceVery low value of productionDecline of infrastructureEnvironmental declineFractious community																																																							
<div>Primary Drivers 2020-2035</div> <ul style="list-style-type: none">Global economic growthNew world orderAgricultural production subsidies eliminatedConsumer demand for health and natural foodsGenetically modified organisms prohibitedGovernments assist rural revivalAbove average rainfall	<div>Follow-on Effects</div> <ul style="list-style-type: none">Agriculture<ul style="list-style-type: none">Cautious expansion and intensificationGreenfield developmentValue of production increases substantiallyLabour shortageChanged nature of communityEnvironmental recoveryRegion regains prosperity																																																							
<div>Water Use</div>  <table><caption>Water Use (GL)</caption><thead><tr><th>Year</th><th>Dairy</th><th>Horticulture</th><th>Livestock</th><th>Cropping</th><th>Lifestyle</th></tr></thead><tbody><tr><td>1997</td><td>1000</td><td>100</td><td>300</td><td>200</td><td>0</td></tr><tr><td>2005</td><td>700</td><td>100</td><td>100</td><td>200</td><td>0</td></tr><tr><td>2017*</td><td>250</td><td>50</td><td>50</td><td>0</td><td>0</td></tr><tr><td>2035</td><td>750</td><td>100</td><td>100</td><td>200</td><td>0</td></tr></tbody></table>	Year	Dairy	Horticulture	Livestock	Cropping	Lifestyle	1997	1000	100	300	200	0	2005	700	100	100	200	0	2017*	250	50	50	0	0	2035	750	100	100	200	0	<div>Value of Production</div>  <table><caption>Gross Value of Production (\$ million)</caption><thead><tr><th>Category</th><th>1997</th><th>2005</th><th>2017*</th><th>2035</th></tr></thead><tbody><tr><td>Dairy</td><td>500</td><td>400</td><td>200</td><td>400</td></tr><tr><td>Horticulture</td><td>300</td><td>350</td><td>150</td><td>550</td></tr><tr><td>Livestock</td><td>250</td><td>300</td><td>100</td><td>800</td></tr><tr><td>Cropping</td><td>150</td><td>150</td><td>50</td><td>200</td></tr></tbody></table>	Category	1997	2005	2017*	2035	Dairy	500	400	200	400	Horticulture	300	350	150	550	Livestock	250	300	100	800	Cropping	150	150	50	200
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6. Broad Implications of the Scenarios

Introduction

This section considers the broad implications of the four scenarios, developed through the Irrigation Futures project, for the region as a whole. The broad implications are structured around the areas of major regional competencies. Regional competencies are those features that make the region attractive for investment and for living.

The major areas of regional competencies are:

- Land for Agricultural Production,
- Water for Agricultural Production,
- Agribusinesses,
- Communities,
- Environment Assets, and
- Institutional Support.

For each of the major regional competency areas, the current strengths and weaknesses of the region and the future opportunities and threats that the scenarios present to the competencies are outlined. Strategies are proposed that build on the current competencies to realise the opportunities and manage the threats.

The strategies are underpinned by three key principles that describe the role of the regional organisations and community groups. These key principles are:

1. The region will initiate and coordinate actions to attain sound social and institutional arrangements and physical infrastructure, so that entrepreneurship and innovation will flourish, and environment and community wellbeing will be protected and enhanced.
2. The region will involve active participation of the community in decision making to effectively utilise local knowledge and take into account a diversity of views, so that decisions will be robust and owned by the community.
3. The region will build strong adaptive capability, continually monitor, learn, innovate and make adaptive changes to manage future uncertainties, so that the region will embrace opportunities and challenges when they arise.

This section provides a preliminary account of the broad implications of the scenarios and will be improved as the project progresses. Improvements to the content of this material will be made as the focussed investigations progress during Stage 4 of the project. The readability and structure of this material will also be improved.

Land for Agricultural Production

Current Strengths and Weaknesses

Agricultural production creates significant economic wealth for the Goulburn Broken region. The land of the region has a number of strengths and weaknesses, which include:

- The region has an abundance of good agricultural land available for use.

- The relief is relatively low, particularly within the lower and middle parts of the catchment, ensuring that land is accessible for agricultural production.
- A wide range of soil types exist throughout the region, which are suitable for a diverse range of crops and land uses.
- The land is in relatively good condition, with low levels of soil degradation, for example salinity and acidity.
- A large proportion of the land, particularly within the Shepparton Irrigation Region, is serviced by drainage and salinity control infrastructure.
- The size of land parcels is diverse, making the region attractive to a wide range of agricultural businesses. The diversity in size of land parcels also constrains the ability of some agricultural businesses to grow.

Future Opportunities and Threats

The scenarios suggest that a number of opportunities and threats that may influence the suitability of land for agricultural production in the future. These opportunities and threats include:

- Decreasing terms of trade place pressure on agricultural businesses requiring increases in business scale, require increases in farm sizes to maintain viability.
- Demand for lifestyle properties and urban development may increase the price of land and decrease its availability for agricultural production. Increasing numbers of new entrants may cause conflicts over acceptable land use and management practices.
- Restructuring of land parcels may be both possible and desirable under some conditions.
- The vulnerability of land to degradation, such as salinity, sodicity and acidity, may increase or decrease.
- Rationalisation of irrigation infrastructure will retire some land from irrigation, reducing the land available for irrigated production.

Strategies

- Investigate options for flexible land amalgamation and subdivision, including managing redundant assets, to enhance the adaptive capability of the region to respond to future land use changes.
- Develop sound land use zoning to manage the interfaces between production, urban, rural living, environmental and industrial uses of land and ensure land is available for all uses at acceptable prices.
- Further investigate the role and feasibility of prime irrigation development and re-development zones in attracting investment to the region.
- Investigate options for land retirement from irrigation or from agricultural production, based on land capability, and opportunities for enhancing the environment.

Water for Agricultural Production

Current Strengths and Weaknesses

The majority of the region's income from agricultural production comes from irrigated agriculture. The major strengths and weaknesses of the region's water supply are:

- Water entitlements and associated rights are well established.
- Robust markets for water enable temporary and permanent trading of entitlements.
- Irrigation water entitlements have high reliability in areas served by reservoirs, but low reliability in unregulated areas.
- The surface water supply is of high quality and groundwater is generally of relatively low salinity, but poor quality in some areas.
- Water tariffs and market prices are modest.
- In many areas the condition of irrigation distribution infrastructure is degrading as it nears the end of its design life.
- Irrigation infrastructure is distributed widely across the region. This enables irrigation water to be delivered to all irrigation properties within the region, but also means that more infrastructure exists than is required to deliver the region's water entitlement.

Future Opportunities and Threats

The scenarios suggest that a number of opportunities and threats that may influence the region's water supply and distribution infrastructure in the future. These opportunities and threats include:

- Climate change and variability may radically change the amount of water available to the region.
- Government policies may cause changes to the allocation and pricing of water in the region.
- Water trade may result in large volumes of water trading into or out of the region, or redistribution of water within the region.
- Irrigation infrastructure may be reconfigured or restructured by governments, water supply authorities or private companies.
- New technologies may emerge that increase water delivery efficiency or reduce the need for irrigation water in the region.
- Changes in land use may alter the demand for irrigation water or service requirements of irrigation distribution infrastructure.
- Irrigation infrastructure may be privatised and sold to investment companies or irrigator cooperatives.
- The quality of surface or groundwater may deteriorate due to salinity or other degradation processes.

Strategies

- Explore potential effects of water reform and other driving forces on the region and ways to manage these potential effects.

- Value the ability of irrigation infrastructure to adapt to future changes in land and water uses, and adopt flexible technologies and management processes where appropriate.
- Develop a sound plan for water pricing and associated services to ensure the viability of irrigation delivery services and ability of irrigation enterprises to adapt to changes, and to balance short term and long term needs.
- Periodically review water allocation policy such as water allocation to different users and level of reliability of water products.
- Review the service requirements of irrigation water users to ensure services provided meet their needs.
- Undertake irrigation infrastructure planning in conjunction with environmental and land use planning to ensure infrastructure complements current and future land uses.
- Actively lobby governments to influence water policy decisions.

Agribusinesses

Current Strengths and Weaknesses

Agribusinesses are the engine room of agricultural production in the region. The current strengths and weaknesses of agribusiness in the region are:

- A wide range of agricultural businesses exist, ensuring the region is not dependent on the fortunes of a single industry and synergies exist between businesses.
- There is a critical mass of agribusinesses for most of the commodity groups in the region, encouraging processors and secondary industries to invest.
- A wide range of service and value adding businesses exist in the region to support agribusiness.
- The majority of agribusinesses are producing commodities and are therefore not able to influence the price they receive for their produce.
- Agribusinesses in the region have a history of entrepreneurship and innovation, remaining at the leading edge of technological developments.
- Agricultural industries in the region are adaptable to a range of market and climatic pressures.
- The region and agricultural businesses within the region have a reputation for agricultural production, but do not necessarily capitalise its reputation in product marketing.
- The region is located relatively close to markets and has good transport infrastructure to transport product to markets.

Future Opportunities and Threats

The scenarios suggest that a number of opportunities and threat that may influence the region's agribusinesses in the future. These opportunities and threats include:

- The availability of labour in the region will be influenced by many factors and will influence the viability of agribusinesses. It is likely that labour will increasingly need to be highly skilled.

- New entrants into agribusiness will bring new ideas and energy into agribusiness in the region and be more open to change.
- Periods when times are difficult for individual industries and the region as a whole are likely. Retaining a critical mass within industries and the region will be crucial to the continuation of agribusinesses in the region.
- Climate change may influence the viability of agribusinesses through reductions in winter chill hours, decreases in water availability and increases in summer temperatures and changes to the seasonality of rainfall.
- International markets are changeable, and commodity producers in the region are vulnerable to such changes.
- The marketing environment may become increasingly competitive, increasing the need for business skills in the management of agribusinesses.
- Up to date information may become increasingly valuable in decision making for agricultural businesses. Without access to current information, businesses may become increasingly isolated.
- The value of agricultural products is likely to increasingly come from value adding to farm output. For agribusinesses to stay viable, they may increasingly need to have a share in value adding and supply chain, improving vertical integration.
- New crops may provide opportunity to further diversify agricultural businesses.
- New technologies for agricultural production, communication etc, may reduce production costs, improve efficiencies or provide new ways for doing business.
- Competition for land with other uses may change its availability or price such that agricultural production can not compete.
- Production costs may rise significantly through increases in the costs of inputs such as fuel, labour, water, etc.
- The region is vulnerable to biosecurity threats, such as fire blight and anthrax.

Strategies

- Promote a positive image of careers in the agricultural industry, through positive stories in media and involvement in schools, targeting the values and aspirations of the next generation.
- Create opportunities for new entrants into agribusiness through developing career paths within businesses and financial pathways to business ownership, such as succession planning.
- Maintain active and high quality programs for agricultural research, development and education.
- Research market potential and production systems for emerging and new products and market niches.
- Value and support diversity in businesses, agriculture enterprises, farming systems and products in the region.
- Investigate options for structural change in the agricultural businesses, including the development of businesses using private or public capital and investment in value adding and supply chain development to assist with wealth creation.
- Provide support to irrigators so that they understand and adapt to the implementation of new government policies, in particular, new water policy.

- Build the business and technical skills of agricultural business owners, managers and technicians through training in a range of areas.
- Develop strategies to ensure the resilience of the region is maintained through tough times, including preservation of core industry requirements such as seed, stock and processing capability, by bringing resources into the region and enabling restructure.
- Encourage migration into the region from within Australia and overseas to enhance the availability of labour and skills and bring new energy and ideas into the region.
- Improve the efficiency of water use at individual and regional scales through use of technology, improved operator skill and business composition.
- Actively lobby all levels of government to provide strong support and policy certainty for agribusiness to ensure continued investment in the region.

Communities

Current Strengths and Weaknesses

The ability of the region to adapt to changes has been supported by the strengths of the regional communities. The strengths and weaknesses of the regional communities are:

- The region has a wide range of community groups that are active.
- The region has a long history of migration, which has brought new ideas and products to the region as well as a source of labour.
- Communities within the region are adaptable and have the capacity to change and reinvent themselves.
- The people of the region are generous with their time and money.
- The density of the population is high enabling a wide range of commercial facilities to exist in the region.
- A limited range of tertiary education opportunities are available in the region.
- A large proportion of young people leave the region to seek employment and educational opportunities.

Future Opportunities and Threats

The scenarios suggest that a number of opportunities and threats that may influence the region's communities in the future. These opportunities and threats include:

- Small towns and community groups may decline due to a number of causes.
- Controversial issues cause divisions and conflicts within the region's communities.
- Rising fuel costs may reduce the ability of individuals to contribute to community groups.
- Facilities for community activities may diminish as small towns and community groups decline.
- Technology developments may improve community connection through improved communication or transport systems, but may also cause some people to be more isolated.
- New entrants to the region may bring in new ideas and energy for community groups.

- The creation of employment opportunities that complement agricultural production and the provision of community support services, such as kindergartens etc, may assist in attracting new entrants to the region.
- An ageing population may provide a pool of volunteers for community groups, but may also place pressure on community facilities, such as hospitals etc.
- Active community groups require and assist in the development of strong leadership. Decline of community groups may also decrease the strength of leadership in the region.
- Lifestyle residents may enable the region to grow and reduce the dependence on the fortunes of agriculture.

Strategies

- Continually rejuvenate membership and processes of community groups and community involvement in organisations.
- Recognise and value community leaders, particularly those independent of agencies and support their development through a variety of programs.
- Facilitate community groups to discuss significant issues related to natural resources management, to explore cultural values and build strong community networks.
- Continually support community groups to take initiatives in natural resources management and celebrate their achievements.
- Actively promote, to people living both inside and outside the region, the benefits of irrigated agriculture and the opportunities that the region can offer.
- Provide support for individuals to recognise and adapt to changes.
- Actively seek support and opportunity for upgrading transport, energy and communications infrastructure, developing major regional centres, and expanding tertiary education and research facilities.
- Encourage the settlement of new residents, including lifestyle residents, to bring new ideas and money and diversify the economy of the region.

Environmental Assets

Current Strengths and Weaknesses

The region has a wide variety of environmental assets. The strengths and weaknesses of these environmental assets include:

- Parts of the landscape are aesthetically attractive for tourist and lifestyle residents.
- Large areas of the region have been cleared, but some parts, for example riparian zones and parts of the upper catchment, are well vegetated.
- Water is allocated to environmental use through the environmental reserve, through recent water reforms. However the volume of the environmental reserve is relatively small in comparison to the allocation of water to agricultural production,
- Knowledge of environmental systems and processes is in its infancy.
- The community demonstrates its concern about their local environment through involvement in LandCare and other environmental programs.

Future Opportunities and Threats

The scenarios suggest that a number of opportunities and threats that may influence the region's environmental assets in the future. These opportunities and threats include:

- Extended periods of drought and adverse climatic conditions.
- Irrigation transfer flows may result in unseasonal high river levels.
- Increased scarcity of water may place pressure on the use of environmental water allocations.
- Changes in the political environment may provide increases or decreases in environmental flow allocations.
- Defining and communicating clear and measurable objectives for environmental flows may reduce community and political pressures on environmental allocations.
- Trade between agricultural and environmental water users may provide inter-annual flexibility in water use.
- Conditions may exist where the salinity of waterways in the region may increase or decrease, which potentially has flow-on effects for both terrestrial and aquatic biodiversity.
- The creation of markets for environmental services may provide an opportunity for concentration, enhancement or establishment of environmental assets.
- The retirement of land from irrigation or agriculture may provide opportunities to develop new or enhance existing environmental assets.
- New entrants to the region and lifestyle residents may have the ability and desire to invest in environmental asset protection or enhancement.
- Redevelopment of infrastructure may provide opportunities to protect and enhance environmental assets, but may also threaten environmental assets.

Strategies

- Develop a vision of significant environmental areas and corridors for protection and enhancement, so that other land use and infrastructure planning complements the environmental vision and that tourism potential is enhanced.
- Encourage landowners to integrate environmental features, such as native vegetation, animal sanctuaries and wetlands, with agricultural production systems and rural living properties.
- Set out clear standards for environmental and natural resource management through water use licences, and through responsible land ownership guidelines to manage potential conflicts between adjoining land uses.
- Manage river flows, including the environmental water reserve, soundly to maximise the environmental benefit.
- Manage tensions between environmental and other needs and desires and develop new innovative ways for people to work together.
- Investigate the nature and requirements of environmental assets under changing climatic, and other, conditions.
- Create environmental programs that are adaptable to and capitalise on changing conditions, for example climate, politics, prosperity.

Institutional Support

Current Strengths and Weaknesses

The region has a wide range of institutions that encourage and support the development of the region. The strengths and weaknesses of the region's institutional support are:

- A network of active industry associations that provide a public voice for agricultural industries and support industry development activities.
- Many state government agencies have a local presence and active programs to support the region.
- Local governments in the region are strong and support the development of the region.
- The region has several educational institutions, but these have a relatively narrow focus.
- The region has several research and development facilities that support the development of agricultural industries.
- The institutional arrangements in the region are mature, providing certainty for investment.
- Institutions in the region work together cooperatively.

Future Opportunities and Threats

The scenarios suggest that a number of opportunities and threats that may influence the region's institutional support in the future. These opportunities and threats include:

- The future is uncertain, and large and rapid change will occur. Institutions will need to be prepared to support the region under a range of possible eventualities.
- The region may experience tough times, which will place pressure on institutions to provide support to individuals and organisations within the region.
- The diversity of views may increase as agriculture diversifies, new lifestyle residents enter the region and the region becomes less reliant on agricultural production.
- Communication, between institutions and the community, will be vital during periods of change. Technology developments may assist in with communication, but may also isolate parts of the community who do not adopt technology.

Strategies

- Develop a framework for regional adaptive management to continually monitor, learn, innovate and make adaptive changes to manage future uncertainties, so that the region will embrace opportunities and challenges when they arise.
- Review current mechanisms for knowledge generation, accumulation, communication and use, and examine ways for improvement, to ensure regional and organisational knowledge is retained in the region and transferred within and between generations, and new ideas and knowledge are available and utilised.
- Continually promote a culture of regional cooperation among organisations, sharing information and coordinating decision making.

- Maintain effective communication between organisations, community leaders and the community, to ensure strong community input to regional decision making and government policy formulation.
- Develop systems to support the region through tough times, by taking leadership and coordinating the actions of organisations.
- Encourage the active participation of the community in decision making to effectively utilise local knowledge and take into account a diversity of views, so that decisions will be robust and owned by the community.
- Provide leadership and support in implementing the recommended strategies under all of the regional competency areas.

7. Specific Implications of the Scenarios

The document included in this Section is a chapter developed by the Irrigation Futures Project as its contribution to the Goulburn-Murray Water's strategic overview of service needs for the Shepparton Irrigation Region. It summarises the scenarios and their implications for irrigation infrastructure planning.

One of the recommendations was to incorporate flexibility into the irrigation infrastructure configuration, design, ownership and management. To assist Goulburn-Murray Water in adopting this recommendation, further work was commissioned to investigate the options for increasing the flexibility of irrigation infrastructure. Currently a handbook for flexible irrigation technologies is being developed by consultants to assist irrigation infrastructure designers to increase the flexibility of irrigation infrastructure.

Perspectives of Future Irrigation

Prepared by

David Robertson, QJ Wang, Leon Soste, Robert Chaffe and Clive Lyle
on behalf of

Goulburn Broken Irrigation Futures Project

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Learning from the Scenarios

Scenario 1: Moving On

Scenario 2: New Frontiers

Scenario 3: Pendulum

Scenario 4: Drying Up



Departments of
Sustainability and Environment
Primary Industries



action
Salinity & Water
AUSTRALIA

Australian Governments and local communities
working together to prevent, repair and
manage rising salinity and declining water
quality across Australia.

Introduction

It is critical that irrigation infrastructure planning considers the needs of future irrigated agriculture. However, it is difficult to predict the future for irrigated agriculture as it will be influenced by many uncertain factors. Scenario planning is an approach to deal with the uncertainty by considering a plausible range of futures, so that the planned irrigation infrastructure will be able to service the needs of the future.

This section contains four scenarios, describing alternative plausible futures for irrigated agriculture in the Goulburn Broken catchment, and their implications for irrigated water supply. Although the scenarios have been developed for the Goulburn Broken catchment, they are also relevant to other irrigation regions in northern Victoria.

The four scenarios, Moving On, New Frontiers, Pendulum, and Drying Up, summarise the external driving forces, the region's response to those driving forces and the regional impacts that follow. The impacts focus on those factors relevant to irrigation infrastructure planning.

The four scenarios are not predictions of the future. They are intended to represent a range of possible opportunities and challenges that the Goulburn Broken catchment may face over the next 30 years. Many elements of the scenarios can be interpreted as metaphors or examples of possible events that may occur. For example, the outbreak of fire blight described in Scenario 2 has been used to depict a bio-security threat. Alternative bio-security threats such as foot and mouth disease or avian influenza could have been used. Similarly, government policies described in the scenarios should be considered as plausible, but should not be interpreted as a statement of future government policy or intent.

The four scenarios have been developed by the Goulburn Broken Irrigation Futures project. The project is a community initiative aiming to develop a shared vision for irrigated agriculture in the region. The project engaged the regional community and other key stakeholders through a series of 4 workshops held at 6 locations throughout the catchment. These workshops looked at the community's aspirations, the possible evolution of external driving forces in the future, and strategies to achieve the aspirations. The outputs of the workshops were developed further by a Technical Working Group to assess implications of the external driving forces and regional strategies.

Each scenario is presented in two forms: a summary and a more detailed description. The scenario summary provides a snapshot of the driving forces, regional impacts and implications for the distribution of water, along with illustrative graphs of land use, irrigated area, water use and farm gate gross value of production for the Shepparton Irrigation Region. The detailed scenario description contains additional information about the driving forces and impacts on different irrigation-dependent industry groups.

The scenarios are intended to stimulate discussions on strategic approaches to irrigation infrastructure planning including reconfiguration by considering what the future may hold and how the region can ensure it is robust under a range of possible futures. Further work looking at the implications of the scenarios for environmental management and the community will be reported in subsequent publications.

Scenario Presentation

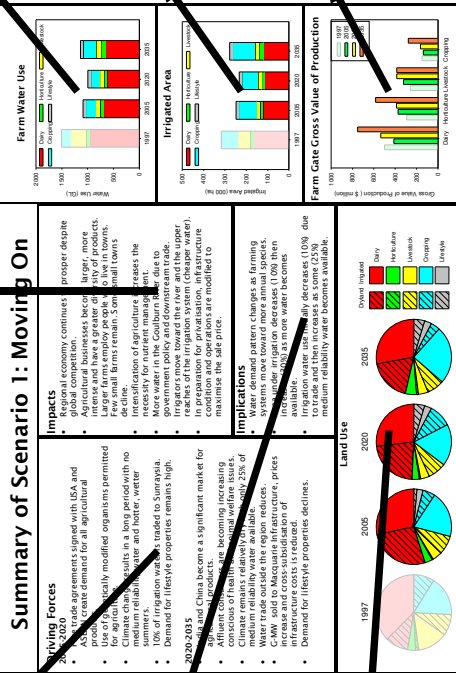
Scenario Summary

Impacts

Describes a summary of regional scale consequences of the scenario including some economic, environmental and social impacts

Driving Forces

Describes a summary of the main factors influencing the region during the scenario.



Farm Water Use

Illustrates the changes in farm water use by industry for the Shepparton Irrigation Region over the period of the scenario.

Irrigated Area

Illustrates the changes in the area of land which is irrigated in a particular year by industry for the Shepparton Irrigation Region over the period of the scenario.

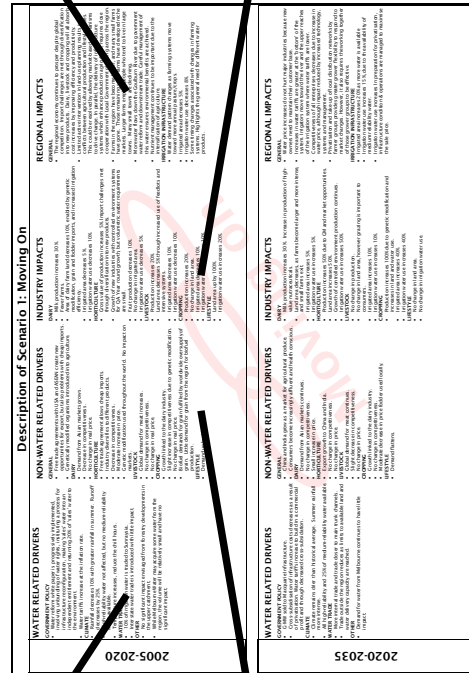
Farm Gate Gross Value of Production

Illustrates the changes in the farm gate gross value of production for the Shepparton Irrigation Region by industry over the period of the scenario in 2005 dollars.

Scenario Description

Water Related Drivers

Describes the driving forces related to the availability of water, including forces related to government policy, climate and water trade.



Regional Impacts

Describes some of the consequences of the scenario, in terms of some social, economic and environmental impacts. Specific impacts for irrigation infrastructure are also described.

Non-Water Related Drivers

Describes the non-water related driving forces and how they influence each of the major industries within the region. Price changes are real changes in price and do not include the effect of inflation.

Industry Impacts

Describes the impacts of the combination of water and non-water related driving forces on the major industries within the region. Impacts are described for each industry as a whole and do not necessarily reflect the impact on individuals within each industry.

Learning from the Scenarios

The four scenarios presented in this section describe alternative plausible futures for irrigated agriculture in the region and their implications on future irrigation water supply. Some of the drivers are common to all scenarios. For example, the emergence of new economic powers such as China and India providing both threats and opportunities for our industries. Other drivers diverge markedly, resulting in very different scenarios.

Scenario 1 “Moving on” depicts a steadily changing operating environment for the region. The industries in the region evolve successfully in response to international business conditions and moderate climate variability. In Scenario 2 “New Frontiers”, agricultural production in the region declines over time because of a number of unfavourable conditions, most notably, the rise in synthetic food production. However, there is a sharp increase in the number of people who live in rural areas and work remotely, bringing a new and significant income stream to the region. Scenario 3 “Pendulum” describes how large shifts in water policy can dramatically change the face of the region. Scenario 4 “Drying up” highlights the vulnerability of the region to global economic recession and natural disasters such as drought.

The four scenarios represent four very different futures, as highlighted by the graphs below. Even though they are not predictions of the future, they provide useful test beds for examining the effectiveness of management strategies under a range of conditions. In the context of irrigation infrastructure planning, the four scenarios highlight a number of important issues.

Flexibility of irrigation infrastructure

There is great uncertainty in the size of the irrigated area and the amount of water use in the future. There may be periods of rapid contraction and expansion of irrigation. Thus there is a need to build flexibility into irrigation infrastructure, so that it is adaptable to future demands. Flexibility may be achieved through innovative system configurations, flexible distribution technologies, a mix of infrastructure ownership, and improved management systems.

Irrigation service level requirements

One of themes that emerged strongly from the scenarios is that the competitiveness of the agricultural industries in the region will depend on generating and marketing differentiated products. The industries are thus likely to demand greater levels of service in water supply than today. On the other hand, service requirements for water use on lifestyle properties are likely to be quite varied. Water supply to lifestyle properties may become more significant in the future as indicated by Scenario 2 “New Frontiers”.

Integration with land use and environmental planning
The scenarios describe significant changes in land use over the next 30 years, within and between agricultural, lifestyle and environmental uses. These land use changes can radically alter the viability and requirements of irrigation infrastructure. Irrigation infrastructure planning needs to be closely linked with land use and environmental planning. This calls for a collaborative approach to planning by agencies, industry groups and the community.

Social and economic responsibility

The scenarios highlight the complexity of issues surrounding irrigation and the importance of involving stakeholders, including the community, in decision making. Changes to irrigation infrastructure and irrigation business viability can potentially have wide social consequences. Equity and social adjustment need to be carefully managed during periods of infrastructure change. Likewise, financial planning for infrastructure needs to make provision for industry down turns.

Large shifts in government policy on water can dramatically change the face of the region, as indicated by Scenario 3 “Pendulum”. It is critical that the region actively influences all levels of government so that regional concerns and issues are addressed in policy development.

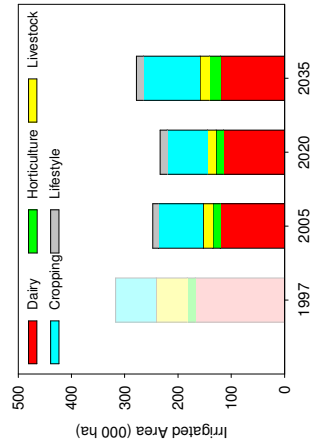
Planning for changes

The scenarios also point to some of the potential weaknesses of the region. For example, the relatively small size of irrigated land parcels makes the region uncompetitive when the market demands large-scale production systems, as indicated in Scenario 2 “New Frontiers”. Significant restructuring will be required to overcome some of these weaknesses, but it should be done under the right conditions so that changes can be made smoothly. The scenarios suggest that there are only a limited number of windows of opportunity for large-scale restructuring. In Scenario 3 “Pendulum” for example, government may be lobbied to assist in land amalgamation during periods of major water policy shifts. To seize these opportunities, there is a need for having plans and options prepared in anticipation of future conditions.

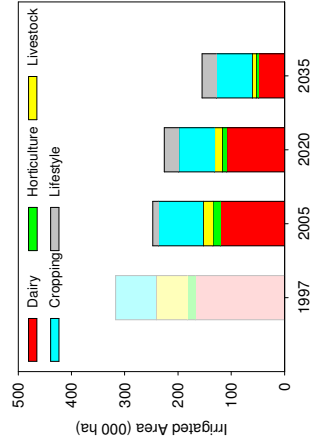
The issues highlighted above represent the learnings from the scenarios by the Goulburn Broken Irrigation Futures Project. The scenarios are intended to stimulate discussions on strategic approaches to irrigation infrastructure planning including reconfiguration. Therefore, readers are encouraged to use the scenarios to develop their own thoughts and ideas.

Comparing the Scenarios - Irrigated Area

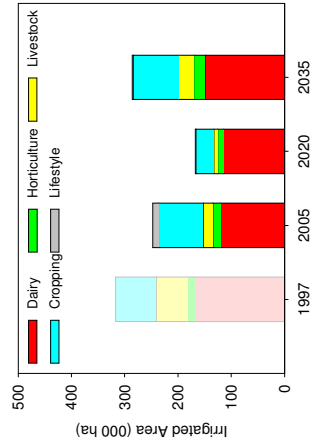
Scenario 1: Moving On



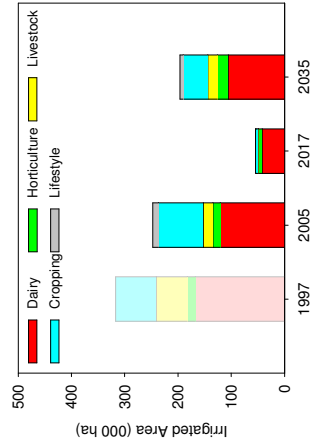
Scenario 2: New Frontiers



Scenario 3: Pendulum



Scenario 4: Drying Up



Summary of Scenario 1: Moving On

Driving Forces

2005-2020

- Free trade agreements signed with USA and ASEAN create demand for all agricultural products.
- Use of genetically modified organisms permitted for agriculture.
- Climate change results in a long period with no medium reliability water and hotter, wetter summers.
- 10% of irrigation water is traded to Sunraysia.
- Demand for lifestyle properties remains high.

2020-2035

- India and China become a significant market for agricultural products.
- Affluent consumers are becoming increasing conscious of health and animal welfare issues.
- Climate remains relatively dry with only 25% of medium reliability water available.
- Water trade outside the region reduces.
- G-MW sold to Macquarie Infrastructure, prices increase and cross-subsidisation of infrastructure costs is reduced.
- Demand for lifestyle properties declines.

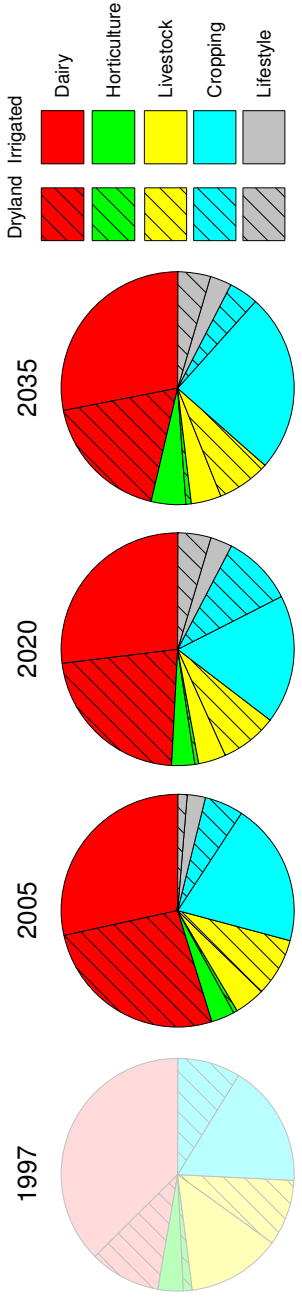
Impacts

- Regional economy continues to prosper despite global competition.
- Agricultural businesses become larger, more intense and have a greater diversity of products. Larger farms employ people who live in towns. Few small farms remain. Some small towns decline.
- Intensification of agriculture increases the necessity for nutrient management.
- More water in the Goulburn River due to government policy and downstream trade.
- Irrigators move toward the river and the upper reaches of the irrigation system (cheaper water).
- In preparation for privatisation, infrastructure condition and operations are modified to maximise the sale price.

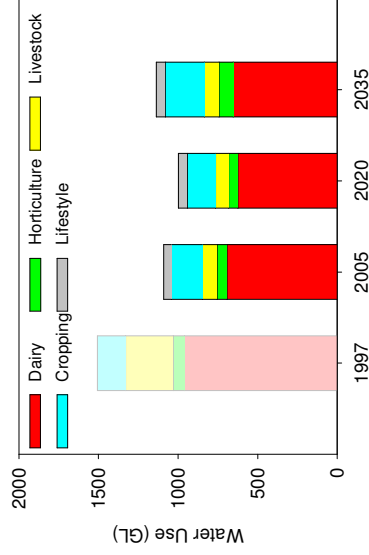
Implications

- Water demand pattern changes as farming systems move toward more annual species.
- Area under irrigation decreases (10%) then increases (30%) as more water becomes available.
- Irrigation water use initially decreases (10%) due to trade and then increases as some (25%) medium reliability water becomes available.

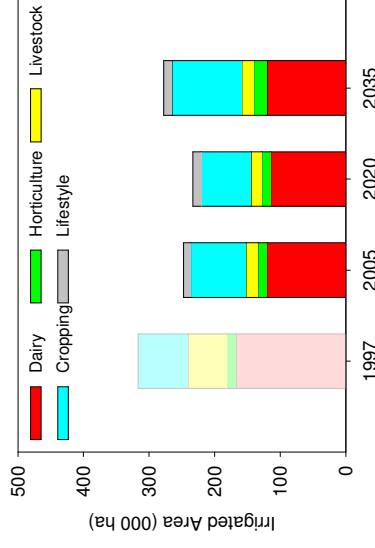
Land Use



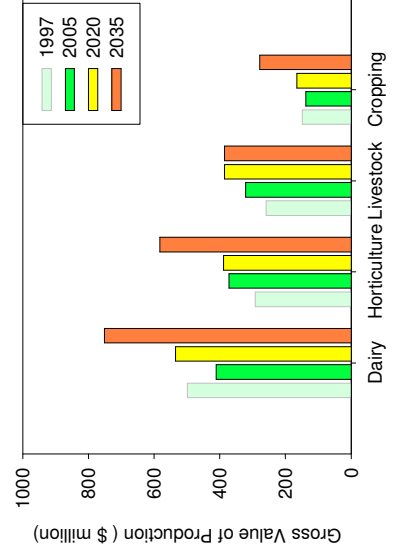
Farm Water Use



Irrigated Area



Farm Gate Gross Value of Production



Description of Scenario 1: Moving On

2005-2020	WATER RELATED DRIVERS			NON-WATER RELATED DRIVERS		INDUSTRY IMPACTS		REGIONAL IMPACTS	
	GOVERNMENT POLICY <ul style="list-style-type: none">Water reform white paper is progressively implemented, involving unbundling of water rights, instituting a process for infrastructure reconfiguration, making 'sales' water into an independent entitlement and returning 20% of 'sales' water to the environment. CLIMATE <ul style="list-style-type: none">Water tariffs increase at the inflation rate. CLIMATE <ul style="list-style-type: none">Rainfall decreases 10% with greater rainfall in summer. Runoff decreases by 25%.High-reliability water not affected, but no medium-reliability water available.Temperature increases, reduce the chill hours. WATER TRADE <ul style="list-style-type: none">10% of irrigation water is traded to Sunraysia.Interstate water trade is introduced with little impact. OTHER <ul style="list-style-type: none">No significant impact envisaged from forestry developments in the upper catchment.While Melbourne Water may acquire some water from the region, the volume will be relatively small and have no significant impact.			GENERAL <ul style="list-style-type: none">Free trade agreements with USA and ASEAN create new opportunities for export, but also problems with cheap imports. DAIRY <ul style="list-style-type: none">Genetically modified organisms introduced into agriculture.Demand from Asian markets grows.Decrease in competitiveness.No change in real price. HORTICULTURE <ul style="list-style-type: none">Free trade agreement allows cheap imports.Industry diversifies to different products.Decrease in competitiveness.Moderate increase in price.Genetic modification used throughout the world. No impact on markets. LIVESTOCK <ul style="list-style-type: none">Global demand for meat increases.No change in competitiveness.No change in real price. CROPPING <ul style="list-style-type: none">Growth linked to the dairy industry.Slight increase in competitiveness due to genetic modification.No change in real price.Biofuel demands for grain fulfilled by worldwide oversupply of grain. Little demand for grain from the region for biofuel production. LIFESTYLE <ul style="list-style-type: none">Demand up by 100%.		DAIRY <ul style="list-style-type: none">Milk production increases 30%.Fewer farms.Area of dairy farm land decreases 10%, enabled by genetic modification, grain and fodder imports, and increased irrigation efficiency.Irrigated area decreases 5%.Irrigation water use decreases 10%. HORTICULTURE <ul style="list-style-type: none">Gross value of production increases 5%. Import challenges met through diversification into new products.Growth of new industries with controlled environment systems for QA. Year round growth, but volumetric water requirements are small.Fruit production decreases 10%.No change in irrigated area.Irrigation water use decreases 5%. LIVESTOCK <ul style="list-style-type: none">Production increases 20%.Land area decreases 5% through increased use of feedlots and intensive systems.Irrigated area decreases 10%.Irrigation water use decreases 10%. CROPPING <ul style="list-style-type: none">Production Increases 20%.No change in land area.Irrigated area decreases 10%.Irrigation water use decreases 10%. LIFESTYLE <ul style="list-style-type: none">Land area up by 100%.Irrigation water use increases 20%.		GENERAL <ul style="list-style-type: none">The regional economy continues to prosper despite global competition. Import challenges are met through diversification into new products. Dairy, livestock and cropping will all absorb cost increases by improving efficiency and productivity.Limited active intervention in land-use planning results in conflicts between agricultural production and lifestyle values. This could be resolved by allowing market-based mechanisms to drive change. In parallel, the delivery of infrastructure systems which enhance production agriculture, requires close co-operation with Local Government planning across the region. Farms in the region have become larger, and many small farms have gone. Those remaining small farms have developed niche markets. Larger farms employ people who tend to live in large towns. Many small towns are declining.More water flows down the Coulburn River due to government water reform and downstream trade. Careful management of this water ensures environmental benefits are achieved.Nutrient management continues to be important due to the intensification of agriculture. IRRIGATION INFRASTRUCTURE <ul style="list-style-type: none">Water demand pattern changes as farming systems move toward more annual pasture/crops.Irrigated area decreases 5%.Irrigation water use decreases 8%.Some timing changes associated with changes in farming systems. Highlights the general need for different water products.	

2020-2035	WATER RELATED DRIVERS				NON-WATER RELATED DRIVERS				INDUSTRY IMPACTS				REGIONAL IMPACTS			
	GOVERNMENT POLICY <ul style="list-style-type: none">G-MW sold to Macquarie Infrastructure.Cross-subsidisation of infrastructure costs decreases as a result of privatisation. Water tariffs increase to build in a commercial profit and through decreased cross-subsidisation. CLIMATE <ul style="list-style-type: none">Climate remains drier than historical average. Summer rainfall more intense.All high-reliability and 25% of medium-reliability water available. WATER TRADE <ul style="list-style-type: none">More internal trade and trade closer to main trunk channels.Trade outside the region reduces as limits to available land and water delivery capacity are reached. OTHER <ul style="list-style-type: none">Demand for water from Melbourne continues to have little impact.				GENERAL <ul style="list-style-type: none">China and India grow as a market for agricultural produce.Consumers become increasingly affluent and health conscious. DAIRY <ul style="list-style-type: none">Demand from Asian markets continues.No change in competitiveness.Small increase in price. HORTICULTURE <ul style="list-style-type: none">Export growth to China and India.No change in competitiveness.No change in price. LIVESTOCK <ul style="list-style-type: none">Global demand for meat continues.Slight decrease in competitiveness.No change in price. CROPPING <ul style="list-style-type: none">Growth linked to the dairy industry.No change in competitiveness.Moderate decrease in price fodder used locally. LIFESTYLE <ul style="list-style-type: none">Demand flattens.				GENERAL <ul style="list-style-type: none">Water price increases do not hurt major industries because new owners need to maintain their customer base.Increases in water tariffs are greater at the 'bottom' of the system. Irrigators move toward the river and the upper reaches of the irrigation system where water tariffs are lower.Competitiveness of all enterprises decreases due to increase in water price, although impact reduced by increased technology, systems and management.Privatisation and take-up of local distribution networks by farmer groups provides greater grower flexibility to respond to market changes. However, it also requires the working together of those grower groups to be effective. IRRIGATION INFRASTRUCTURE <ul style="list-style-type: none">Irrigated area increases 20% as more water is availableIrrigation water use increases 15%, due to the availability of medium reliability water.Irrigation water use increases. In preparation for privatisation, infrastructure condition & operations are managed to maximise the sale price.				DAIRY <ul style="list-style-type: none">Milk production increases 30%. Increase in production of high-value nutraceuticals.Land area decreases, as farms become larger and more intense, and small farms exit.Irrigated area increases 5%.Irrigation water use increases 5%. HORTICULTURE <ul style="list-style-type: none">Production increases 50% due to GM and market opportunities.Land area increases 50%.Growth of controlled environment production continues.Irrigation water use increases 50%. LIVESTOCK <ul style="list-style-type: none">No change in production.No change in land area, however grazing is important to consumers.Irrigated area increases 10%.Irrigation water use increases 10%. CROPPING <ul style="list-style-type: none">Production increases 100% due to genetic modification and increases in land and water use.Irrigated area increases 40%.Irrigation water use increases 40%. LIFESTYLE <ul style="list-style-type: none">No change in land area.No change in irrigation water use.			

Summary of Scenario 2: New Frontiers

Driving Forces

- 2005-2020**
- Free trade agreements signed with USA and ASEAN create demand for all agricultural products. Middle East trading partners lost due to our alliance with United States.
 - Large increase in lifestyle developments.
 - Genetically modified organisms prohibited.
 - Community concern for the environment increases.
 - Environmental flow entitlement increased through deal with medium reliability entitlement.
 - Climate change results in long period with high reliability allocation of less than 100%.
 - 15% of irrigation water is traded out of the region to Sunraysia and Northeast Victoria.

2020-2035

- International free trade is introduced.
- Fireblight and regulation cause a major decline in agricultural production across all industries.
- Synthetic food production significantly reduces the demand for naturally produced foods including dairy, horticultural and meat products, but substantially increases demand for grain.
- Demand for lifestyle properties plateaus.
- Genetically modified organisms allowed.

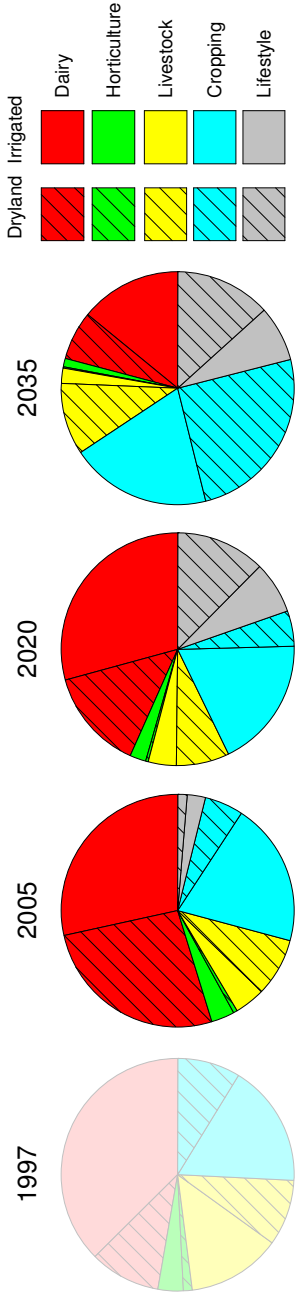
Impacts

- Initially, a small decline in agricultural activity occurs due to the loss of markets. Followed by a substantial decline due to synthetic food production. Niche agricultural industries on some small properties cater for the health food market.
- Demand for grain causes increase in annual cropping. Large quantities of water trades to New South Wales where grain production is more efficient due to larger land parcel sizes. Water trade increases infrastructure costs for remaining irrigators.
- Regional economy is maintained by new lifestyle development. Lifestyle development is unplanned causing conflicts between agricultural production and lifestyle values.
- Land is reserved for environmental purposes.

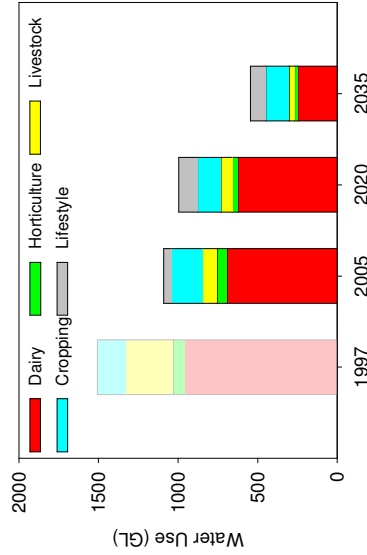
Implications

- Major contraction in most irrigated agricultural industries.
- Area under irrigation and irrigation water use decreases substantially (45%) due to water trade.
- Best areas for irrigation may change according to market demand for products and land availability.

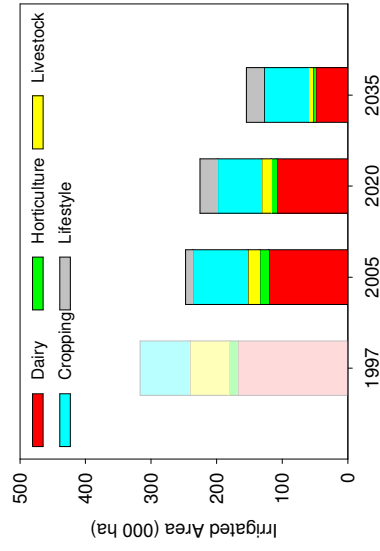
Land Use



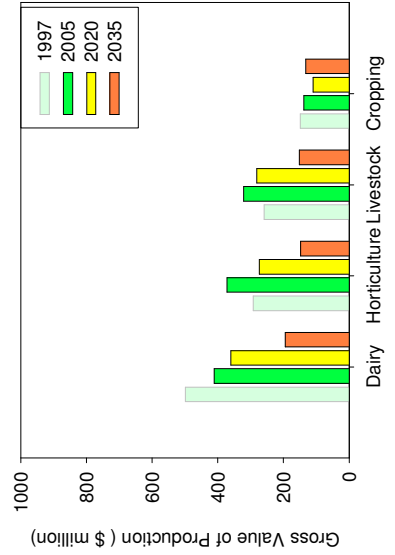
Farm Water Use



Irrigated Area



Farm Gate Gross Value of Production



Irrigation Futures Project - Milestone Report 4 Attachment

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Summary of Scenario 3: Pendulum

Driving Forces

- 2005-2020
 - Free trade agreements signed with USA and ASEAN create demand for all agricultural products.
 - Multinationals take over food processing plants.
 - Genetically modified organisms prohibited.
 - High energy costs create demand for biofuels.
 - Government returns 3500 GL of environmental water to Murray River. Victoria contributes 1500 GL through buy back of all medium reliability and 30% of high reliability water, at premium prices. Some water trades into Goulburn Valley from NSW.
 - Water buy back coupled with government purchase, amalgamation and auction of land.

2020-2035

- Chinese Yuan floated and China grows as a market for agricultural products.
- Genetically modified free status becomes a marketing advantage.
- Government reverses policy and returns water to agriculture by auction. Proceeds of auction fund development of distribution infrastructure which is transferred to irrigator cooperatives.
- Wet climate sequence causes floods.

Impacts

- Initially the regional economy declines as water is returned to the environment. Unemployment rises considerably as demand for service industries decreases.
- Perception of little additional benefit resulting from water being returned to the environment.
- Subsequently, the economy booms as international market conditions improve and policy reversal means more water is available for agriculture.
- Labour shortages occur.
- Planned adjustment of land and water resources allows infrastructure costs to be managed and leads to an improved match between land capability and use.
- Increased rainfall and floods lead to a re-emergence of water logging and salinity problems.

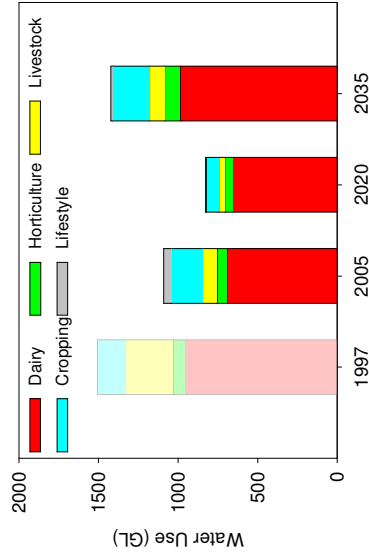
Implications

- Changes in government policy enable large changes in irrigated area and water use to be planned.

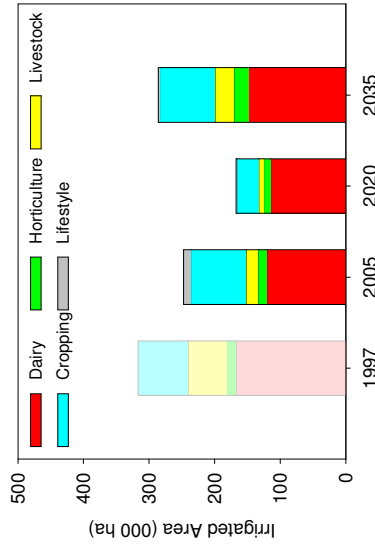
Land Use



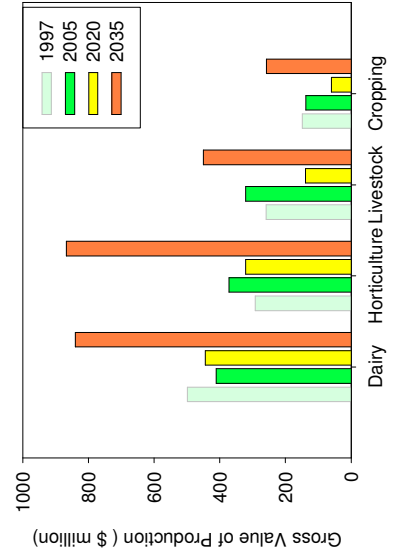
Farm Water Use



Irrigated Area



Farm Gate Gross Value of Production



Description of Scenario 3: Pendulum

2005-2020	WATER RELATED DRIVERS			NON-WATER RELATED DRIVERS		INDUSTRY IMPACTS		REGIONAL IMPACTS	
	GOVERNMENT POLICY <ul style="list-style-type: none">Water reform white paper is progressively implemented, involving unbundling of water rights, instituting a process for infrastructure reconfiguration, making 'sales' water into an independent entitlement and returning 20% of 'sales' water to the environment.New government policy introduced to return and additional 3000 GL returned to Murray River, of which Victoria contributes 1250 GL (50% of C-MW entitlement).Government buys back all medium reliability water entitlement and 30% of the high reliability water entitlement at premium prices.Government initiates land restructuring program, resuming land, restructuring land boundaries and auctioning dryland properties.Irrigation system is restructured in conjunction with land restructuring, resulting in some water savings and no change in water tariffs. CLIMATE <ul style="list-style-type: none">Rainfall remains slightly drier than 'normal'. WATER TRADE <ul style="list-style-type: none">Sumrayia purchases NSW water.Interstate water trade result in water flowing from NSW to the region (5%).			GENERAL <ul style="list-style-type: none">Free trade agreements with USA and ASEAN create new opportunities for export, but also problems with cheap imports.Multi-nationals corporations take over processing facilities in the region.Use of genetically modified organisms prohibited.Large increase in energy costs and interest rates. DAIRY <ul style="list-style-type: none">Opportunity for export to Asian markets grows.Small increase in price.No change in competitiveness. HORTICULTURE <ul style="list-style-type: none">Free trade agreement allows cheap imports.Small decrease in price.Decrease in competitiveness. LIVESTOCK <ul style="list-style-type: none">Global demand for meat increases.Small increase in price.No change in competitiveness. CROPPING <ul style="list-style-type: none">Growth linked to the dairy industry.Increase in demand for bio-fuel feedstock.Small increase in price.Small increase in competitiveness. LIFESTYLE <ul style="list-style-type: none">Demand declines, and some return to Melbourne.		DAIRY <ul style="list-style-type: none">No change in milk production as water remains in dairy and horticulture.Fewer farms.Land area remains constant.Irrigated area decreases 5%.Irrigation water use decreases 5%. HORTICULTURE <ul style="list-style-type: none">Production decreases 30% due to lack of competitiveness.Irrigated area decreases 20%.Irrigation water use decreases 20%. LIVESTOCK <ul style="list-style-type: none">Production decreases 60%.Irrigated area decreases 60%.Irrigation water use decreases 60%. CROPPING <ul style="list-style-type: none">Production decreases 60%.Irrigated area decreases 60%.Irrigation water use decreases 60%. LIFESTYLE <ul style="list-style-type: none">Land area decreases 50%.Irrigation water use decreases 90% (sold into market).		GENERAL <ul style="list-style-type: none">A rapid planned decline in irrigation occurs, causing significant adverse economic impacts to both agricultural and service industries.Remaining dairy, livestock and cropping producers manage adverse conditions by growth in efficiency and scale.Niche industries and glasshouse production increase, but remain small in terms of overall water use and regional value of production.Unemployment increases due to the decline in agriculture and service industries.Significantly more water in the Goulburn and Murray Rivers results in little additional perceived environmental benefits, given the significant economic impacts.Planned re-adjustment of land leads to better matching between land capability and use. IRRIGATION INFRASTRUCTURE <ul style="list-style-type: none">Farming systems will move toward more dryland pasture and crops.Irrigated area decrease 30%.Irrigation water use decreases 25%.	

2020-2035	WATER RELATED DRIVERS			NON-WATER RELATED DRIVERS		INDUSTRY IMPACTS		REGIONAL IMPACTS	
	GOVERNMENT POLICY <ul style="list-style-type: none">Water resources management becomes a Federal responsibility.Lack of perceived benefits from environmental flows.Water reallocated to economic use. 3000GL of water auctioned and sold mostly to agriculture and tourism in NSW, Vic and SA.Agriculture in region purchases water entitlements equivalent to 2005 levels of high reliability water and 50% of medium reliability water.Government uses funds to build and rehabilitate irrigation infrastructure, in partnership with irrigator-owned water distribution companies. Land suitability and infrastructure condition drive investment in infrastructure.Water tariffs rise to meet debt. CLIMATE <ul style="list-style-type: none">Several seasons of above average rainfall, with floods occurring.Groundwater and salinity problems emerge.Permanent and temporary trading of water occurs at low prices. WATER TRADE <ul style="list-style-type: none">			GENERAL <ul style="list-style-type: none">China floats its currency, which strengthens against the Australian dollar.China and India grow as markets for agricultural products.Multi-national corporations owning processing facilities exploit their position.Australia's genetically modified free status becomes a competitive advantage. DAIRY <ul style="list-style-type: none">Export to Asian markets expand.Demand increases.Large increase in price.Increase in competitiveness due to genetically modified free status. HORTICULTURE <ul style="list-style-type: none">Exports to China and India grow.Demand increases.Large increase in price.Increase in competitiveness due to genetically modified free status. LIVESTOCK <ul style="list-style-type: none">Global demand for meat increases.Small increase in price.Increase in competitiveness due to genetically modified free status. CROPPING <ul style="list-style-type: none">Increase in demand linked to growth in the dairy industry.Small increase in price.No change in competitiveness. LIFESTYLE <ul style="list-style-type: none">No demand as a result of land use planning rules.		DAIRY <ul style="list-style-type: none">Milk production increases 40%.Land area increases 10%.Irrigated area increases 30%.Multi-national water use increases 50%. HORTICULTURE <ul style="list-style-type: none">Production increases 100%.Irrigated area increases 100%.Irrigation water use increases 100%. LIVESTOCK <ul style="list-style-type: none">Production increases 200%.Irrigated area increases 300%.Irrigation water use increases 150%. CROPPING <ul style="list-style-type: none">Production increases 300%.Irrigated area increases 150%.Irrigation water use increases 200%. LIFESTYLE <ul style="list-style-type: none">No change in land area.Irrigation water use increases 1000%.		GENERAL <ul style="list-style-type: none">Reversed water policy and market conditions produce a rapid planned expansion of irrigated agriculture.Regional economy booms on the back of expansion of agriculture and investment in irrigation infrastructure. Labour is in short supply.Periods of above average rainfall and floods lead to salinity and water-logging problems emerging. IRRIGATION INFRASTRUCTURE <ul style="list-style-type: none">Rapid increase in area irrigated and water delivery.Irrigated areas increases 70%.Irrigation water use increases 70%.'New water' targeted to best areas.	

Summary of Scenario 4: Drying Up

Driving Forces

2005-2020

- Financial crisis in the United States creates a global recession that reduces international trade considerably between 2009 and 2012.
- As global economy recovers, China begins to export high value horticultural products and import cheaper bulk commodities.
- Australian dollar strengthens making agricultural products expensive to overseas purchasers.
- Use of genetically modified organisms prohibited.
- Drought commences in 2012 lasting until 2020.
- High reliability irrigation water allocations between 2015 and 2020 are 80%, 50%, 30%, 90%, 100%.

2020-2035

- International export markets recover.
- International and domestic markets demand healthy food.
- Genetically modified free status becomes a marketing advantage.
- Government assists restructure and redevelopment of agriculture with focus on health food, environmental sustainability and animal welfare.
- Climate becomes wetter and enables medium reliability allocation of 25%

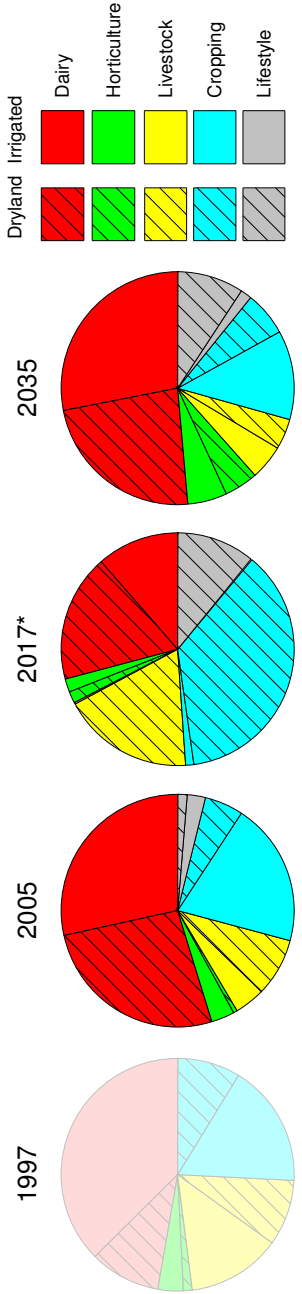
Impacts

- Initially, all agricultural industries and the regional economy is decimated by international market collapse and prolonged drought. The population is stable because employment opportunities are poor elsewhere.
- Unemployment is very high.
- Irrigators unable to pay for costs of infrastructure maintenance.
- Subsequently, regional economy booms as international markets grow and water availability increases. Growth of agricultural industries is constrained by land parcel size.
- Drought increases the frequency of severe bushfires.

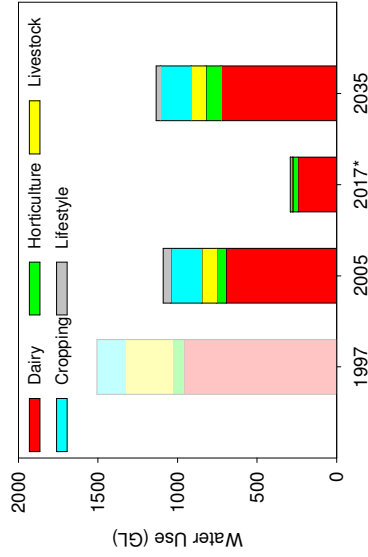
Implications

- Initially, a large decrease in irrigation water use and area irrigated as drought decreases allocations, followed by a large increase in irrigated area and water use as the drought subsides.
- Water returns along existing irrigation infrastructure as no restructuring occurred during drought.
- Infrastructure declines during times of little maintenance.

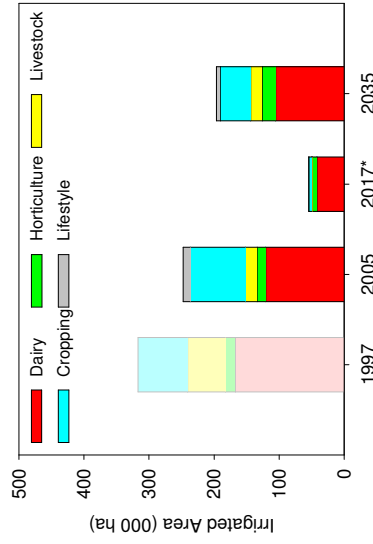
Land Use



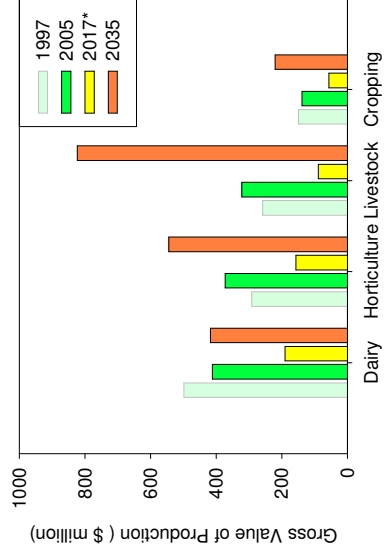
Farm Water Use



Irrigated Area



Farm Gate Gross Value of Production



* Graphics depict 2017 drought conditions with high reliability water allocation of 30%.

Irrigation Futures Project - Milestone Report 4 Attachment

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8. Communication Activities July 2005 – June 2006

The project team has presented the following written and oral reports during Stage 3B.

Milestone Reports

- Irrigation Futures of the Goulburn Broken Catchment: Milestone 4 Report, DPI Tatura, June 2006.

Governance Committee

- Progress Report, 8 November 2005
- Completion of Stage 3 requirements, 2 May 2006

Stakeholder Reference Committee

- Progress Report, 9 December 2005
- Progress Report, 23 June 2006

Technical Working Group

- 14 Workshops between July 2005 – June 2006

Briefings for Stakeholder Groups

- Campaspe Shire Council, 12 July 2005
- Kyabram Dairy Centre & ACIAR, 15 July 2005
- Moira Shire Council, 18 July 2005
- Goulburn Broken CMA, 20 July 2005
- SIRIC Reporting Day, 29 July 2005
- University of Melbourne Science and Citizenship project, 1 Feb 2006
- Murray Valley Water Service Committee, 23 February 2006
- CRCIF Project review, 17 March 2006
- Tim Thelander AFFA, 22 March 2006
- Land and Water Australia, 22 March 2006
- Water Interest group, Campaspe Shire, 19 April 2006
- North East CMA Board, 21 April 2006
- State Minister for Agriculture, 9 May 2006
- AFFA, 17 May 2006
- Regional Catchment Strategy workshop, 18 May 2006
- Economic Development Managers, CoGS, Moira and Campaspe Shires, 1 June 06
- SIRIC Reporting Day, 14 June 2006

Conference Papers Presented

- Linking Research and Extension – Bendigo, 7 September 2005
- ANCID - Mildura, 24-26 October 2005
- International Symposium on Water Resources Management – Beijing, October 2005
- ABARE Outlook Conference - Canberra, 1 March 2006
- APEN Conference - Beechworth, 6 March 2006

Articles / Newsletters

- Information updates to Irrigation Futures Forum members, Sept 05 & May 06

Other presentations

- Invited Speakers Day, Professor Jonathan West & Dr Peter Ellyard: 14 September 2005

Appendix 1: Detailed Scenarios

Scenario 1: Moving On 2005-2020

Drivers	Responses	Impacts
Primary Drivers		
Social, Economic, Political, Technological, Ecological Drivers		
<ul style="list-style-type: none"> • <i>Climate change</i> causes a 10% decrease in annual rainfall, increases summer rainfall intensity and reduces chill hours. • <i>Free trade agreements</i> are signed with the United States and ASEAN • <i>Genetically modified organisms</i> are permitted for agriculture in Australia and are used globally. Consumers have a wide range of opinions on the acceptability of consumption of genetically modified organisms. • Demand for <i>rural living properties</i> and tourism increases. • Government water reform package reallocates some irrigation water entitlement to the environment, reduces barriers to water trade and reduces the third party effects of water trade. • <i>Agricultural production costs</i> escalate partly because employment in agriculture is viewed as undesirable and partly because of rising costs associated with increasing quality assurance requirements of markets. • Energy shortages create demand for <i>alternative energy sources</i> including biofuels. • Community willingness and ability to volunteer decreases due to decreasing availability of time and money and increasing regulation. • Governments let market forces direct outcomes and only intervene when market failure is significant. Exceptional circumstances support decreases. 		
Our Industries		
<i>Overall</i>		
<ul style="list-style-type: none"> • Regional irrigation entitlement reduces due to inter-regional water trade and government water reform. Entitlement remaining in the region in 2020: High reliability 995 GL, Medium reliability 550 GL • Regional irrigation allocation reduces due to lower rainfall. 2020 Allocations: High reliability 100%, Medium reliability 0% • Water tariffs increase at the inflation rate • High demand for lifestyle properties increases the price for small blocks of land. This places pressure on farmers with low returns to sell. 		
<ul style="list-style-type: none"> • Manage declining terms of trade and seasonal variability by diversifying income and reducing production costs. Small businesses that cannot adapt leave the industry. • Make considered choices about the adoption of genetically modified organisms and target production to meet the needs of niche and boutique markets. • Improve environmental credentials by complying with industry codes of practice. • Sell redundant assets, eg houses, to lifestyle. • Become highly skilled at business management including land, plant, animal and people management. • Campaign for strong “country of origin” labelling laws. • Trade irrigation water entitlement to enable business development. • Pump increasing volumes of groundwater. 		
<ul style="list-style-type: none"> • The region continues to prosper despite global competition. • Businesses in larger centres prosper and become less dependent on the fortunes of agriculture. 		

Dairy

- Demand for dairy products grows predominantly in Asian markets.
 - International production grows, particularly in Eastern Europe and South America, in response to increasing world demand for dairy products.
 - There is no change in the real price paid to farmers because demand for dairy products is fulfilled by production increases.
 - Improvements in farm efficiency do not keep pace with increasing costs causing the competitiveness of dairy production in the region to decrease.
- Increase business efficiency and effectiveness through the following: increasing the economies of scale, use of genetic modification, imported fodder, and increasing irrigation efficiency.
 - Collectively negotiate supply contracts to realise long-term price surety.
 - Increase size of drainage and effluent management systems to cope with larger rainfall events.
- Number of dairy farms decrease.
 - Milk production increases 30%.
 - Area of dairy farm land decreases 10%. Production is increasing through genetic modification, grain and fodder imports, and increasing irrigation efficiency.
 - Irrigated area decreases 5%, irrigation water use decreases 10%.

Horticulture

- Free trade agreements allow the importing of fruit into Australia.
 - Global prices for horticultural products are lower than Australian prices due to lower labour costs and lower standards for chemical use in competing countries.
 - Fruit imports lower the real price for horticultural produce in the region.
 - Local production costs continue to increase, causing a decrease in the competitiveness of horticultural production in the region.
- Increase efficiency through labour and water saving technologies and practices.
 - Attract new investment, particularly vegetable growers, away from Melbourne's fringe.
 - Instigate think tanks to develop a future industry direction.
 - Manage climate change by moving to cooler areas, changing rootstock and modifying their microclimate.
- Fruit production decreases 10%, but gross value of production increases 5% due to diversification into new higher value products.
 - Growth of new industries with controlled environment systems for QA. These industries require year round access to water.
 - There is no change in irrigated area, irrigation water use decreases 5%

Livestock

- As Asian countries become more affluent, global demand for meat increases.
 - Increasing global production results in no change in the real price for meat.
 - Use of genetic modification and more intensive production systems cover increasing costs, ensuring no change in competitiveness.
- Increase investment in feedlots and intensive production systems.
 - Use genetic modification technology to increase production efficiency.
 - Develop supply chain to access Asian markets.
- Production increases 20% to accommodate increased global demand.
 - Land area decreases 5% through increasing use of feedlots and intensive systems.
 - Irrigated area decreases 10%, irrigation water use decreases 10%

Cropping

- The cropping industry remains highly dependent on the dairy industry.
 - Declining competitiveness of the dairy industry ensures there is no change in the real price.
 - Competitiveness increases slightly as genetic modification increases yields and reduces production costs.
 - Demand for grain for bio-fuel production is fulfilled by worldwide oversupply of grain, with little increase in demand for grain from the Goulburn-Broken region.
- Adopt genetically modified crops to increase yields.
 - Invest in technology to reduce production costs, including satellite controlled tractors.
 - Increase business flexibility by opportunistically leasing and cropping land.
- Production increases 20% to accommodate increasing demand from the dairy industry.
 - There is no change in land area.
 - Irrigated area decreases 10%, irrigation water use decreases 10%.

Processing

- Cooperative processors find it difficult to raise capital to invest in processing capacity.
- Free trade agreements encourage the expansion of processing capacity where costs are lowest.
-
- To enable business development, cooperative processors are sold to multinational corporations. The multinationals rationalise production facilities and invest in just-in-time processing, improve logistics and use alternative fuels.
- Improve vertical integration of production systems, increasing control of the supply chain.
- Undertake research and development into new products, particularly into health food products including pharmaceuticals and nutraceuticals.
-
- Large multinational processors show less commitment to production in the region.

Other

- Water resources of the region become the focus for the expanding tourism industry.

Our Community and Environment

- Owners of lifestyle properties only remain for a few years before selling up. They have an unrealistic expectation of agricultural practice eg animal welfare, less noise, less smell and less dust.
 - Population of the region increases and ages due to increasing numbers of retirees relocating to the region even though there is a continuing loss of school leavers to Melbourne.
 - Inter and intra regional water trade leads to irrigation infrastructure being under used in some areas and over used in others
- Increasingly engage a broad cross-section of the community in regional decision making processes.
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Water Supply Manager

- The process for reconfiguring irrigation infrastructure commences. Production and lifestyle zones are recognised.
- Invest in irrigation infrastructure improvements that realise water savings. Receive support from government on the condition that efficiency gains are returned to the environment.
- Investigate implications of climate change on water availability and communicate results to industry groups to encourage adaptation.

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Local Government

- Encourage the development of tourism, health and education industries to diversify the rate base.
- Encourage the use of Section 173 agreements to manage 'right to farm' issues on subdivided agricultural land.

Catchment Manager

- Enforce land use controls through: irrigation water use licences, land use planning processes and referrals. The controls restrict development on the flood plain, encourage irrigation on light soils and, introduce buffer areas around significant natural features and irrigation areas.
- Reserve areas of the flood plain to manage salt and nutrients during floods. Fences and levee banks along the river are removed.

Communities

- Active communities create opportunities to maintain local services, eg banks, petrol stations, schools etc.
- Develop community leadership skills of young people through encouraging their involvement in sporting clubs, young farmers and other community groups.
- Lobby state and federal governments to invest in improved transport infrastructure.
- Irrigators support the CMA management of flood plains to reduce the demand for increased environmental flows.
- Support environmental education in schools and the wider community.

Infrastructure

- Transport infrastructure improves with the completion of Goulburn Valley Highway from Seymour to the NSW border, and the road-rail transport interchange at Mooroopna.
- Irrigation infrastructure is rationalised to reduce maintenance and renewal costs, stranding salinity management infrastructure.
- Housing development occurs on the fringes of larger centres. The developments encroach onto agricultural land.

Environment

- Extent of shallow watertables decreases due to less recharge and increased groundwater pumping, decreasing the risk of soil and wetland salinisation.
- Catchment yields are reduced due to climate variability. Environmental flow entitlement increases, due to 80:20 sales deal and water saving projects. No effects of the increased environmental flow entitlement are observed due to low water availability.
- Nutrient pollution continues to be a problem due to the intensification of agriculture, particularly the dairy industry.
- Interspecies transfer of genes from genetically modified plants creates herbicide resistant weeds, infertile native species and reduces insect populations.
- Frequency of aquatic birds breeding decreases due to wetlands receiving less water.
- Area of isolated native vegetation in agricultural land continues to decline.

Community

- Regional population continues to grow, supported by new migrants continuing to move into the region to seek employment and an increased retention of young people due to the increasing availability of tertiary educational opportunities.
- Area of land used for lifestyle purposes increases 100%, while irrigation water use on these properties increases 20%.
- Unemployment remains low because the service and retail industries grow.
- Some small towns decline due to the increasing size of farms, reducing the number of people living in rural areas. The decline is first evidenced by the withdrawal of services such as banks, supermarkets and petrol stations.
- Small towns, within commuting distance of larger centres, become dormitory centres with limited services.
- Conflicts between agricultural and lifestyle values result from limited intervention by local government in land-use planning.
- Volunteer organisations decline and are progressively amalgamated to maintain service provision.
- Influence of the farming community in government decision-making decreases due to the decreasing number of people involved in agriculture and the increasing size of the urban population.

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Scenario 1: Moving On 2020-2035

Drivers	Responses	Impacts
Primary Drivers		
Social, Economic, Political, Technological, Ecological Drivers <ul style="list-style-type: none"> Water delivery <i>infrastructure is privatised</i> causing a reduction in the cross-subsidisation of infrastructure costs and an increase in water tariffs. <i>International trade</i> barriers continue to decrease. The growing middle class in <i>India and China become a market</i> for high quality agricultural produce. <i>Consumers</i> become increasingly affluent, health conscious and concerned for animal welfare. Lifecycle of <i>product differentiation</i> decreases as competitors rapidly eliminate product differentials. <i>Climate</i> remains drier than the historical average; but, with increasing summer rainfall intensity. Increasing reliance on electronic communication and trade. <i>Agricultural land prices</i> remain low due to historical small farm sizes that contain redundant assets. <i>Increasing work pressures</i> and the changing nature of work mean that time away from work is more highly valued and tends to be spent with family. 		
Our Industries		
Overall <ul style="list-style-type: none"> Regional irrigation entitlement is maintained as inter-regional water trade declines. Entitlement in the remaining region in 2035: High reliability 995 GL, Medium reliability 550 GL Regional irrigation allocation varies but remains lower than the long term average. 2035 Allocations: High reliability 100%, Medium reliability 25%. Water tariffs increase through building in a commercial rate of return and through decreasing cross-subsidisation. 		
<ul style="list-style-type: none"> Agricultural businesses continue to invest in the region due to low land prices and reliable water. Develop markets and build closer relationships with customers to reduce competitors' influence. Increasingly rely on contractors to provide specialised services, such as quality assurance, conservation services, labour hire and product marketing Agricultural franchises develop to enable small agricultural businesses to exist. Franchises provide the farming system, product marketing and insurance services. Large agricultural businesses are increasingly managed as specialised business units. Wireless electronic animal control measures remove the need for fences. Form active industry lobby groups to influence political decisions. Reduce the use of groundwater for irrigation as the availability of surface water increases 		
<ul style="list-style-type: none"> The region continues to prosper despite global competition. Agricultural businesses use irrigation water carefully and as a result water moves about the landscape from year to year. 		
Dairy <ul style="list-style-type: none"> Demand for dairy products in Asian markets continues to grow. Increasing demand causes a small increase in the real price for dairy products. Increases in real prices and improvements in farm efficiency result in no change in the competitiveness of dairy production in the region. 		

- Reduce labour requirements by automating irrigation and milk harvesting.
 - Introduce controlled feeding systems
 - Use genetic modification technology to modify cows to produce milk to meet processor requirements for the production of high-value nutraceuticals.
 - Develop business consortiums to seek private investment to fund investment in technology.
- Milk production increases 30% to fulfil increased international demand.
 - Land area decreases as farms become larger and more intensive and small farms exit.
 - Irrigated area increases 5%, while irrigation water use increases 5%.

Horticulture

- Demand from India and China grows.
 - Global production grows in response to increasing demand and there is no change in real price.
 - Increases in production efficiency and product diversity ensure the competitiveness of the industry does not change.
- Increasingly use controlled environment and hydroponic technologies to provide for greater control over fruit quality.
 - Develop mechanical harvesting and pruning systems to reduce labour requirements.
- Production increases 50% to fulfil market opportunities, enabled by genetic modification technology.
 - Land area increases 50%, while irrigation water use increases 50%.

Livestock

- Global demand for meat continues to increase.
 - Global production increases in response to increasing demand. No change in real price occurs.
 - Relative industry competitiveness decreases due to the prosperity of other industries, and their ability to pay for water, feed etc.
- Sell water and land to dairy and horticulture.
 - Invest in controlled feeding systems to tailor stock feeding to maximise growth efficiency.
- No change in production as increased demand is fulfilled by international competition.
 - No change in land area, however grazing is important to consumers.
 - Irrigated area increases 10%, while irrigation water use increases 10%.

Cropping

- Growth in cropping industry remains highly dependent on the dairy industry.
 - There is a small growth in demand for pulses from Asia.
 - Genetic modification increases yields. The increasing availability of locally produced fodder and grain causes a decrease in the real price.
 - Increased yield potential ensures there is no change in competitiveness.
- Increase production of high protein pulses to cater for increasing international demand.
 - Use precision agricultural techniques to spatially tailor use of water, fertilisers and herbicides to crop requirements.
- Production increases 100% due to genetic modification and demand from the dairy industry.
 - Irrigated area increases 40%, while Irrigation water use increases 40%.

Processing

- Intra-regional transport costs increase substantially due to deteriorating roads and increasing

volumes of product.

- Encourage pre-processing of farm products on farm to reduce transport costs

Other

- Water resources of the region become the focus for expanding the tourism industry.

Our Community and Environment

- Household sizes continue to decrease, increasing the demand for residential land. Migration of people from other regions occurs due to low land prices.

Water Supply Manager

- Continue to reconfigure infrastructure, with a more commercial focus.
- Automate large sections of the delivery infrastructure to reduce labour costs.

Local Government

- Encourages lifestyle and urban development to diversify the rate base.
- Sell off under-used community assets, including sporting grounds and community halls.

Catchment Manager

- Develop an enforcement capability, being the primary environmental regulator.
- Introduce a board comprised of elected representatives and skills based appointments by government
- Produce an annual report describing the health of the catchment using a range of indicators.
- Provide incentives and support for environmental farm plans for less productive areas.

Communities

- Consolidate activities to ensure a critical mass of volunteers.

Infrastructure

- Permanent trade in entitlement within the region results in water moving closer to the main trunk channels and rivers. Irrigation infrastructure is progressively withdrawn from the extremities of the system.
- Salinity management infrastructure is stranded as irrigation infrastructure is rationalised.

Environment

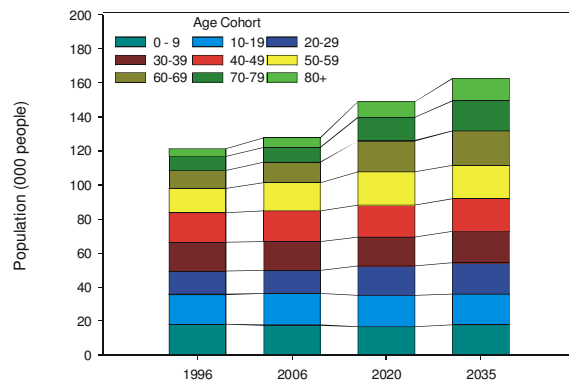
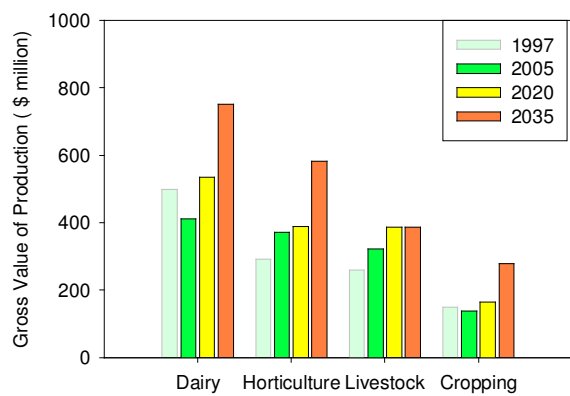
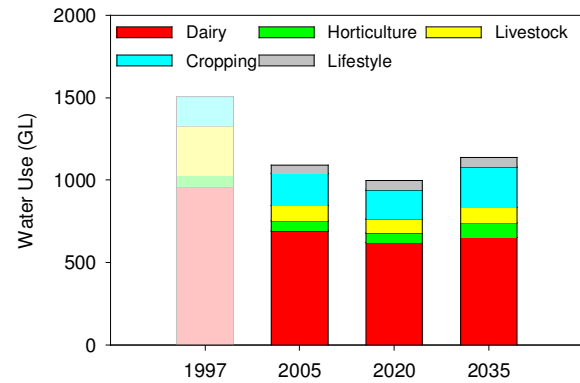
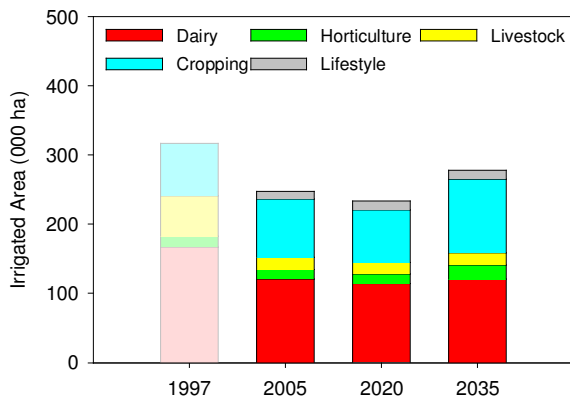
- Soil salinity problems follow water about the landscape. Floods play an important role in washing excess nutrient and salt off agricultural land.
- Environmental water entitlements are used judiciously to encourage spawning of native fish and nesting of water birds.
- Large areas of the region are revegetated resulting in corridors linking many remnant vegetation stands.
- Tensions exist over native vegetation conservation. The public are concerned with preserving what currently exists, regardless of why it exists. This means that conflict arises when management changes have impacts on biodiversity. For example, the piping of an open channel eliminates seepage that enabled a wetland or red gums to emerge and exist.
- The extent of shallow water tables increases due to increasing availability of irrigation water and lower groundwater pumping volumes, increasing the extent of soil and wetland salinisation.
- Nutrient runoff decreases as precision agricultural practices are adopted.

Community

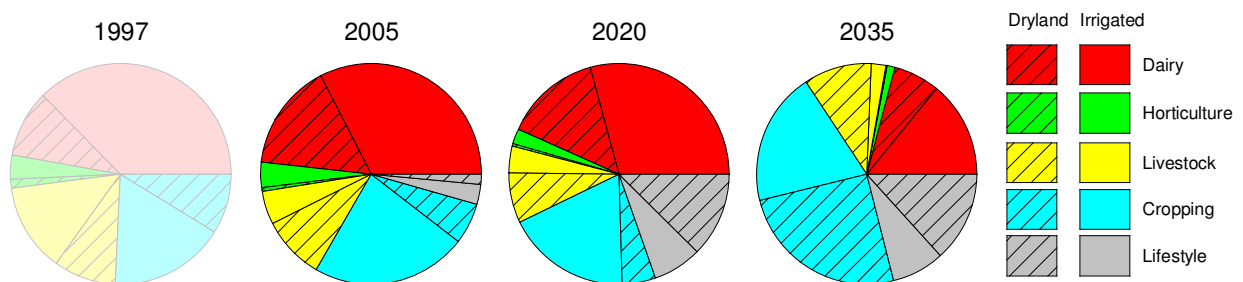
- Regional population increases as new migrants continue to move into the region to seek employment. Young people are increasingly retained in the region by increasing educational and employment opportunities.
- Unemployment remains low as the prosperity of the region sustains continuing growth in employment. Very few labouring jobs exist with a large number of people employed as specialised technicians.
- Urban areas continue to expand as the population continues to increase. Larger towns grow at the expense of smaller communities. The area of land used for lifestyle purposes does not change, nor does the volume of irrigation water used.
- Ageing population places pressure on aged care facilities.
- Conflicts between agricultural and lifestyle land uses continue, due to the frequent turnover of the owning of lifestyle properties.
- Voluntary community groups become increasingly interest-based rather than location-based. Amateur sporting clubs decline due to declining voluntary activity and decreasing population in smaller towns.
- Agricultural industries influence political decisions through lobby groups.

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Scenario 1: Illustrative Graphs



Land Use



Scenario 2: New Frontiers 2005-2020

Drivers	Responses	Impacts
Primary Drivers		
<p>Social, Economic, Political, Technological, Ecological Drivers</p> <ul style="list-style-type: none"> • <i>Free trade agreements</i> are signed with USA and ASEAN, but Middle East <i>trading partners are lost</i> due to the alliance with USA. • Significant increase in <i>demand for rural lifestyle properties</i> and rural tourism causes rural land prices to increase. • Urban communities become <i>increasingly affluent</i> and have increased concern for the environment, personal health and food safety. Government responds to community concerns and demands by <i>increasing regulation</i> on agricultural development and practices. • <i>Genetically modified organisms</i> are prohibited for agriculture in Australia. • <i>Cost of oil</i> doubles causing an international recession. • The high price of oil causes <i>substantial increases in transport costs</i>. • <i>Government water reform</i> increases environmental flow entitlement through a deal, which allows medium-reliability water entitlement to be exchanged for high-reliability water entitlement. • <i>Government water reform</i> allows for interstate water trade to occur. • <i>Climate</i> remains drier than long-term average, causing <i>bushfires</i> throughout large parts of south eastern Australia. • <i>Ageing population</i> creates high demand for aged and health care workers. This demand decreases the number of workers available for other industries. The increasing number of retirees creates a pool of <i>willing volunteers</i> for community activities. • <i>Communications technologies</i> rapidly improve in rural areas as rural lifestyle property owners demand high service levels. 		
Our Industries		
<p><i>Overall</i></p> <ul style="list-style-type: none"> • Regional irrigation entitlement changes due to a government deal to secure water for the environment and water trade out of the region. Entitlement in the region in 2020: High reliability 1050 GL, Medium reliability 0 GL • Regional irrigation allocation reduces due to a lower than average rainfall and a decrease in run-off due to bushfires. 2020 Allocations: High reliability 95%, Medium reliability 0% • Water tariffs increase at the inflation rate. • Market value of irrigation water increases due to low water allocations. • Manufactured fertiliser prices increase substantially as the price for oil increases. <ul style="list-style-type: none"> • Build lifestyle properties and residents into their businesses through: leasing redundant houses to new lifestyle residents and tourists, targeting production to emerging niche tourist markets and leasing lifestyle properties for productive purposes. • Many farmers leave their industries due to decreasing competitiveness, particularly those farmers with small margins. • Small properties in aesthetically pleasing areas and surrounding towns are sold as rural lifestyle blocks. • Lobby governments to reduce regulation of agricultural practice, apply similar conditions to other land uses and control lifestyle development. • Become highly skilled at business management including land, plant, animal and people management. • Banks broker deals for new industry entrants, encouraging them to set up in low risk locations. • Increase use of groundwater in response to low water availability and higher market value. <ul style="list-style-type: none"> • Declining prosperity of agricultural production causes many businesses to sell out to rural lifestyle developers. 		

- Lifestyle development increasingly underpins the economic base of the region. Lifestyle development creates an increasing demand for service industries.
- There is a contraction of most industries due to declining exports.

Dairy

- International demand for dairy products decreases due to the international recession. Demand for Australian products decreases further due to loss of middle eastern markets.
- Decreasing demand for dairy products causes a decrease in the real price.
- Increases in production efficiency do not keep pace with decreases in prices and increases in production costs causing the competitiveness of the dairy industry in the region to decrease.
- Invest in technology to improve efficiencies, reduce operating costs, maintain competitiveness, and meet government regulations.
- Reduce production costs by increasing reliance on their own pasture base.
- Increase business size by purchasing neighbouring properties.
- Purchase irrigation water from NSW farmers.
- Investigate the use of biodigesters and methane as sources of energy.
- Decrease in competitiveness of the dairy industry causes many producers to exit the industry. Those who remain cannot increase regional production to historical levels.
- Milk production decreases 5%
- Irrigated area decreases 10%, irrigation water use decreases 10%.

Horticulture

- Free trade agreements allow importation of fruit into Australia.
- Fire blight outbreak cripples pome fruit industry.
- Import quarantine restrictions on pome fruit are lifted. This causes a large decrease in the real price for pome fruit.
- Marketing of other horticultural products using a clean and green image causes a small increase in real prices.
- Price increases of non-pome fruit production increases the competitiveness of horticultural production in the region.
- Remove and burn fire blight infected pome trees.
- Increasingly grow short rotation fruit and vegetable crops to minimise long-term capital commitment.
- Use increased government regulation to substantiate clean and green production credentials.
- Develop speciality niche products and production systems catering for tourist market.
- Purchase irrigation water from NSW farmers.
- Widespread infection of pome fruit trees with fireblight causes fruit production to decrease 75%.
- Increases in prices for other fruit and vegetables encourage increases in production by 20%.
- Irrigated area decreases 40% as fireblight infected pome fruit trees are removed, irrigation water use decreases 40%.

Livestock

- International demand for Australian meat decreases due to loss of Middle Eastern Markets.
- Lower demand causes a decrease in real price for meat.
- Improvements in production efficiency ensure competitiveness remains unchanged.
- Sell water to owners of lifestyle properties to supplement income.
- Increasingly adopt dryland production systems and seek second income off farm.
- Shortage of water reduces the production potential of the livestock industry.

- Production decreases 5%.
- Irrigated area decreases 20%, irrigation water use decreases 25%..

Cropping

- Demand reduces slightly due to decreasing competitiveness of the dairy industry.
- Reducing demand causes a moderate decrease in price.
- Declining demand and prices causes competitiveness to decrease.
- Sell water temporarily to provide an income source in a time of water shortage.
- Increasingly adopt dryland production systems.
- Investigate viability of biofuel production.
- Decreasing demand for product and a shortage of water causes production to decrease 5%.
- Conversion to dryland production systems causes the irrigated area to decrease 20%.
- Irrigation water use decreases 25%.

Processing

- Free trade agreements result in lower profit margins for our processing industries. Free trade agreements allow imports to increase. There is a loss of international market share and increasing production costs.
- Invest in product development to maximise returns from markets.
- Purchase raw product from lowest price producer, predominantly from overseas producers in the horticultural industry.
- Reduce expenditure on maintenance of processing facilities.
- Rationalise transport systems and improve linkages to reduce transport costs.

Other

- The number and diversity of service and tourism businesses increases substantially to cater for new lifestyle residents.
- Service industries for new lifestyle residents grow rapidly.

Our Community and Environment

- Communication technology improvements enable major changes in the way professional work is undertaken.
- Demand for rural living properties is high as professionals seek aesthetically pleasing locations for their home-offices.
- Owners of rural lifestyle properties seek irrigation water entitlements to maintain the aesthetics of their properties and support the few stock they keep.

- Rely heavily on central government to provide direction.

Water Supply Manager

- Invest in channel automation technology to reduce labour costs and water losses.
- Increase the range of service levels, including pressurised supply, available to cater for demands of lifestyle customers.
- Introduce pricing differentials related to service levels.

Local Government

- Encourage tourism and lifestyle developments to diversify economic base.
- Use government regulations to define acceptable agricultural practice and allow interspersed land uses.
- Allow decisions to be strongly influenced by lifestyle residents.

Catchment Manager

- Encourage owners of rural lifestyle properties to plant native vegetation.
- Enforce government regulations relating to the environmental impact of agriculture, including management of runoff, weeds etc.

Communities

- Run pro-active programs to engage new and existing residents to encourage them to contribute to debate and become involved in the community.

Infrastructure

- Irrigation infrastructure is withdrawn from some areas and enhanced in other areas at the request of irrigators.
- Communication infrastructure is substantially upgraded to meet demands of lifestyle residents. High-speed wireless broadband is available throughout the region.

Environment

- Environmental flow entitlements increase, however the volume of water in the river does not increase due to low water availability.
- Extent of shallow watertables decreases in broad acre agricultural areas, due to increased groundwater pumping, increased irrigation efficiency and low rainfall. Water tables in rural lifestyle areas remain high as inexperienced irrigators have low irrigation efficiency.
- Extent of soil and wetland salinisation risk decreases as watertables fall.
- Extent of native vegetation on rural lifestyle areas increases as lifestyle residents invest in environmental improvements eg planting trees.
- Pest, plant and animal management on broad acre properties decreases as agricultural industries become less profitable and landowners decrease investment in environmental improvements and protection.
- Nutrient runoff from the region decreases as irrigation efficiencies improve and manufactured fertiliser use decreases.

Community

- Regional population grows strongly due to the increase in number of lifestyle residents. Youth leave the region to pursue educational and employment opportunities. Young families and retirees move into the region.
- Area of land used for lifestyle purposes increases 350%, while irrigation water use on these properties increases 150%. Lifestyle development predominantly occurs on the fringes of towns.
- Unemployment remains low in the region. The focus of employment opportunities changes toward service provision to the tourism industry and lifestyle residents.
- Available workforce increases due to new lifestyle residents.
- Diversity of community facilities is retained throughout the region as the presence of these services attracts new lifestyle residents.
- Under-planned lifestyle developments cause tension between agricultural production and lifestyle values.
- Interaction between neighbouring communities decreases because technology development and infrastructure advances result in the development of large dispersed communities.
- There is a marked decline in the influence of the agricultural community on central government.
- Voluntary groups prosper as increasing number of retirees provide time and energy.
- New lifestyle residents bring new ideas and energy to the community, increasing its vibrancy.

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Scenario 2: New Frontiers 2020-2035

Drivers	Responses	Impacts
Primary Drivers		
Social, Economic, Political, Technological, Ecological Drivers		
<ul style="list-style-type: none"> Barrages at the mouth of the Murray River are removed. The removal has large water savings and increases salt disposal entitlements. Government purchase of agricultural land to provide wildlife corridors and wetlands throughout the state. World Trade Organisation agrees to remove all <i>agricultural production subsidies</i>. <i>Genetically modified organisms</i> are permitted for agricultural production. Technological development enables <i>laboratory-based food production</i> from basic carbohydrates. Internationally, affluent consumers demand high quality real food that has credence values including environmental friendly and ethical production. <i>Climate</i> dries further. Governments strengthen <i>regulation</i> on acceptable agricultural practice. <i>Oil substitution</i> occurs (electricity, fuel cells, biofuels). Energy costs increase slightly. 		
Our Industries		
<i>Overall</i>		
<ul style="list-style-type: none"> Regional irrigation entitlement reduces due to significant water trade out of the region. Entitlement in the region in 2035: High reliability 550 GL, Medium reliability 0 GL Regional irrigation allocation reduces due to lower than average rainfall and a decrease in run-off due to bushfires. 2035 Allocations: High reliability 95%, Medium reliability 0%. Water tariffs increase as there is less water in the region to fund infrastructure. 		
<ul style="list-style-type: none"> Many producers sell water on the national market. The sale allows them to leave their industry with a large superannuation. Sell land to government for wildlife corridors. Some producers develop real food production and marketing systems, which target niche affluent markets both within Australia and internationally. Form active industry coordination and lobby groups, who campaign for strong product labelling laws to distinguish between synthetic and real food. Invest in genetic modification technology to ensure a share of profits from technology is retained in the region. Increase mechanisation to reduce production costs. 		
<ul style="list-style-type: none"> There is a significant decline in agricultural economic activity due to loss of markets and use of laboratory based food production. Most industries undergo a major contraction, while areas under cropping are maintained. Small and difficult to manage land parcels limit the ability of the region to respond to changes in markets and to remain competitive. 		
<i>Dairy</i>		
<ul style="list-style-type: none"> Substantial decrease in demand for real milk due to cheaper laboratory-made product. Small niche market for real milk exists. Global supply of real milk contracts as demand declines. Real milk commands a higher price than laboratory-made product. However, real milk price increases a small amount over time. Decreasing demand for real milk and increasing costs of production causes a large decrease in the competitiveness of the dairy industry. 		
<ul style="list-style-type: none"> Adopt low cost pasture-based production systems to reduce dependence on grain and bought 		

in fodder.

- Form small cooperative processors to cater for niche real food and tourism markets.
- Decreasing competitiveness causes many farmers to leave the industry.
- Milk production decreases 50%.
- Irrigated area decreases 55% and irrigation water use decreases 60% as farmers sell irrigation water to other users.

Horticulture

- There is a substantial decrease in demand for real fruit and vegetables due to cheaper laboratory-made products.
- Small niche markets for real fruit and vegetables exist.
- Global supply of real fruit and vegetables contracts as demand declines.
- Real fruit and vegetables command a higher price than laboratory-made product. However, the real fruit and vegetable price increases a small amount over time.
- Decreasing demand for real fruit and vegetables and increasing costs of production cause a large decrease in the competitiveness of the horticultural industry.
- Develop pick-your-own production systems to cater for tourism market.
- Invest in controlled environment production systems, such as hydroponics, to cater for market demanding high quality real food.
- Decreasing competitiveness causes many growers to leave the industry.
- Fruit and vegetable production decreases 50%.
- Irrigated area decreases 50%, while irrigation water use decreases 50%.

Livestock

- There is a substantial decrease in demand for real meat due to cheaper laboratory-made products.
- Small niche market for real meat exists.
- Global supply of real meat contracts as demand declines.
- Real meat commands a higher price than the laboratory-made product, The real meat price increases a small amount over time.
- Decreasing demand for real meat and increasing costs of production cause a large decrease in competitiveness of the livestock industry.
- Increasingly use dryland production systems and reduce the intensity of production.
- Diversify production system to include increasing numbers of sheep and goats
- Develop markets to maximise return from low impact production systems.
- Decreased competitiveness causes many farmers to leave the industry.
- Production decreases 50%.
- Irrigated area decreases 50%, while irrigation water use decreases 50%.

Cropping

- Demand for grain increases as a raw feedstock for synthetic food and bio-fuel.
- Global supply of grain cannot keep up with increasing demand.
- Shortage of grain causes a large increase in price.
- Price increases cause the cropping industry competitiveness to increase substantially.
- Expand production using irrigated winter cropping to maximise efficiency of water use.
- Expand significantly dryland production of grain.
- Adopt genetically modified organisms to increase yield and to provide the synthetic food production industry with the required composition.
- Produce grain for production of biofuel.

- Land parcel size and land price limits the ability of the cropping industry to achieve economies of scale in the region. Expansion of cropping occurs in other regions.
- There is no change in production.
- There is no change in irrigated area, and no change in irrigation water use.

Processing

- Synthetic food technology makes existing food processing technology redundant without significant capital investment
- Sell processing facilities to multinationals.
- Invest in synthetic food production capability
- Food processing industry is maintained in the region.

Our Community and Environment

- Demand for rural lifestyle properties plateaus.
- Changes in the nature of work allows increased time for recreation and leisure.

- Develop production zones for genetically modified organisms and for real food. This supports industry development and protects environmental assets.
- Government purchases land as buffer zones between production zones and environmental assets.

Water Supply Manager

- Withdraw irrigation infrastructure as water moves out of district.
- Provide 'stranded' irrigators with alternative supply sources or relocation support.

Local Government

- Withdraw community assets and facilities to larger centres.
- Continue to rely on government to regulate on acceptable agricultural practice to govern land use.

Catchment Manager

- Manage buffer zones between production and environmental zones in conjunction with the community.
- Enforce government regulations on acceptable agricultural practice through agricultural production licenses.

Communities

- Run pro-active programs to engage new and existing residents to encourage them to contribute to debate and to be involved in the community.

Infrastructure

- New niche production systems create demand for year round supply of water.
- There is a large, unplanned movement of water out of the region. The movement creates a financial pressure on the remaining irrigators to pay for the infrastructure.
- Public transport services within and to the region improve and are increasingly used due to rising fuel costs.

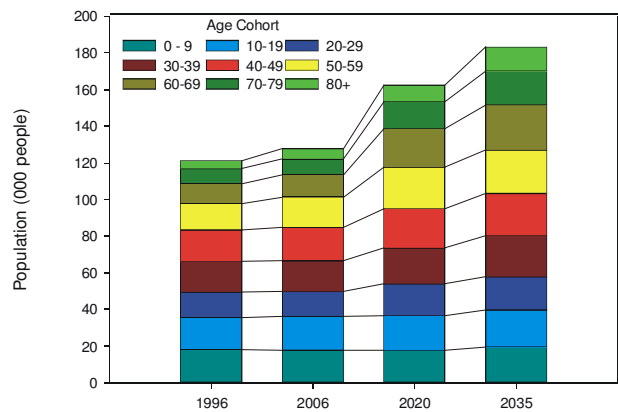
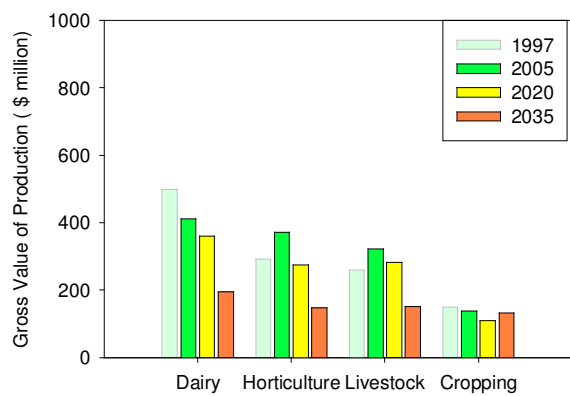
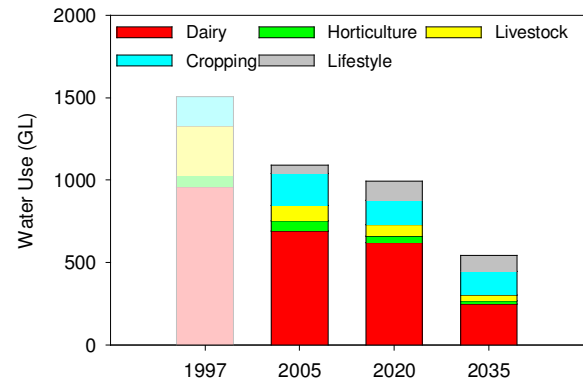
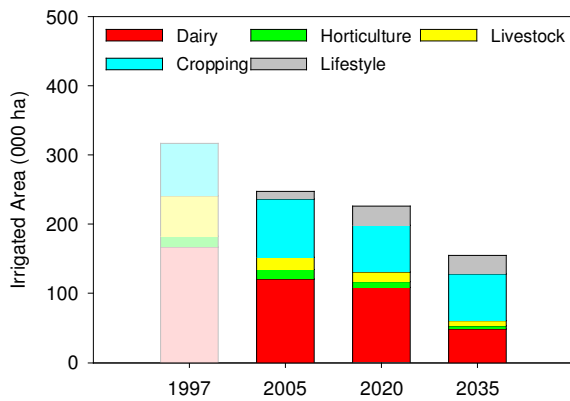
Environment

- Large areas of land are reserved for environmental purposes, including flood management, biodiversity conservation and for buffer zones.
- Extent of shallow water table decreases further as irrigation area contracts due to water trade out of the region.
- Extent of problem weeds increases as land that is not irrigated and too difficult to manage for dryland cropping is less intensively managed.
- Extent of native vegetation increases as lifestyle residents on rural lifestyle properties invest in environmental protection and enhancement

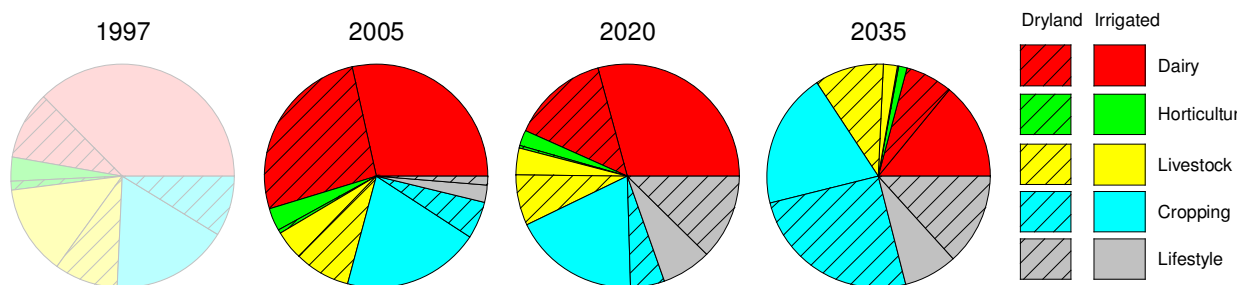
Community

- Population of the region continues to increase, with growth focused along corridors surrounding major arterial roads. Young people make up a smaller proportion of the population.
- Area of land used for lifestyle purposes does not change in irrigated area, while irrigation water use decreases 20%.
- Unemployment remains low, with a large portion of the workforce employed as professionals or in service industries supporting professionals and lifestyle residents.
- Demand for low skilled labour reduces, and is replaced by demand for highly skilled labour.
- Agricultural employment is focussed on niche farms.
- Community services and facilities are retracted to major centres.
- Larger towns and increasing use of electronic communication create an increased sense of anonymity.
- Increasing leisure time creates opportunities for community activity. However, increasing regulation, particularly OHS and public liability, and the increasing size of town populations decrease the community's willingness to participate.
- Influence is expressed through interest groups, eg. fishing clubs, Landcare, etc.

Scenario 2: Illustrative Graphs



Land Use



Scenario 3: Pendulum 2005-2020

Drivers	Responses	Impacts
Primary Drivers		
Social, Economic, Political, Technological, Ecological Drivers <ul style="list-style-type: none"> <i>Green ideals</i> dominate the political landscape. Major government <i>water reform</i> package is announced for the purchase of 1 500 GL of irrigation water entitlement from Victoria for the environment. Government policy removes barriers to interstate water trade and reduces the third party effects of water trade. Government sponsors <i>land and infrastructure restructuring</i> program, to support water reform adjustment. <i>Environmental credit</i> trading markets are established. <i>Climate</i> remains drier than the historical average, with increasing summer rainfall intensity. <i>Energy shortages</i> cause large increases in energy costs and large demand for biofuels. The government signs <i>free trade agreements</i> with the United States and ASEAN. <i>Multinational corporations</i> take over Australian manufacturing operations to benefit from free trade agreements. <i>Genetically modified organisms</i> are prohibited for agriculture in Australia. Large increases in <i>interest rates</i> cause a decline in demand for rural living properties. Rural communities increasingly resent ill-informed attitudes of urban communities. 		
Our Industries		
Overall <ul style="list-style-type: none"> Regional irrigation entitlement is reduced due to government purchase of water. Entitlement in the remaining region in 2020: High reliability 828 GL, Medium reliability 0 GL Regional irrigation allocation is reduced due to lower rainfall. 2020 Allocations: High reliability 100%, Medium reliability 0% Water tariffs remain constant as infrastructure is restructured to reduce maintenance costs. <ul style="list-style-type: none"> Improve risk management particularly toward water. This includes using shorter crop rotations, adopting water saving technology and planning for variation in water supply. Take a more flexible approach to asset and land management. Encourage new entrants to diversify product base. These new entrants bring new ideas and, new bring business practices. Hold industry focussed public forums for strategic planning and identifying change. Many farmers take the opportunity offered through government water purchases and land restructuring to leave farming. Dryland farms generate income by planting native vegetation for carbon credits. <ul style="list-style-type: none"> Confidence in agricultural production decreases. Many irrigators have a large influx of capital through the sale of water to the government. 		
Dairy <ul style="list-style-type: none"> Demand for dairy products in Asian markets grow. International production cannot keep pace with increasing demand, resulting in a small increase in the real price for dairy products. Increases in production costs cause the competitiveness of dairy production in the region to remain constant. <ul style="list-style-type: none"> Decrease dependence on irrigation water through more efficient water use and increasing use of brought in feed. Strengthen marketing capability. Increase the value of product by developing differentiated products and protecting intellectual property. 		

- Secure long term supply contracts for reliability of price and supply.
- Number of dairy farms decreases.
- Milk production remains constant because of the availability of water for the dairy industry.
- The cropping industry produces grain, which is used by the dairy industry.
- Area of dairy farm land remains constant as the remaining dairy farms expand their land holdings.
- Irrigated area decreases 5%, and irrigation water use decreases 5%, as very few dairy farmers sell irrigation water to the government.

Horticulture

- Free trade agreements allow importation of fruit into Australia.
- Imported fruit, particularly for processing, is cheaper than locally grown product.
- Production costs continue to increase causing a decrease in the competitiveness of horticultural production in the region.
- Increase production of vegetables.
- Focus on production for the domestic market.
- Growers increase specialisation and produce fewer types and varieties of fruit.
- Invest in product development to differentiate export products.
- Fruit production decreases 30%, due to lack of competitiveness of the industry.
- There is a growth of new industries with controlled environment systems for QA, requiring year round access to water.
- Irrigated area decreases 20% as non-competitive fruit trees are removed, while irrigation water use decreases 20%.

Livestock

- As Asian countries become more affluent, global demand for meat increases.
- Increasing global production does not match increasing demand, resulting in a small increase in real price.
- Increases in production costs are equal to price increases, resulting in the competitiveness of livestock production to remain constant.
- Strengthen export markets by increasing diversity of production, eg goat meat.
- Attract a fish and sea food industry supplying the domestic market.
- Production decreases 60% due to the reduction in water entitlement.
- There is no change in land area as farming systems convert to dryland production.
- Irrigated area decreases 60% and irrigation water use decreases 60%, as water is sold to government.

Cropping

- The cropping industry remains dependent on the dairy industry. However, demand for grain as a feedstock for bio-fuel production increases.
- Increasing demand from both the dairy and energy industries causes a small increase in real price.
- Increases in price are greater than increases in production costs, ensuring increasing competitiveness of the cropping industry in the region.
- Concentrate on fodder production to support the local dairy industry.
- Specialisation of production and harvest systems to link with dairy industry needs.
- Production decreases 60% due to the reduction in water entitlement.
- Land area increases 15%, taking over former horticultural and lifestyle properties.

- Irrigated area decreases 60% and irrigation water use decreases 60%.

Processing

- Decreasing availability of raw products reduces the ability of processing facilities to maintain economic utilisation.
- Multinational processors rationalise processing facilities.
- Invest in product development and differentiation through small-scale cooperatives.
- Large multinational processors show less commitment to production in the region.

Other

- Water trading and speculation industries emerge as water becomes scarce.

Our Community and Environment

- Rise in interest rates decreases the demand for lifestyle properties in the region.

- Land restructuring program, using land resumption and auction, involves local government, water authority and catchment management authority. The program redefines irrigation areas using land use principles – Losers are compensated.
- Build the capacity of the regional community to engage in strategic planning, thereby providing opportunities and developing skills within the community.
- Encourage new business investment in the region.

Water Supply Manager

- Promote realistic reliability of water supply.
- Further discriminate water costs, identifying differential costs to individual properties.
- Provide different levels of service for different costs.
- Rationalise distribution infrastructure in conjunction with government purchase of irrigation water and land restructuring, The process encourages the movement of water away from less productive areas.
- Improve management of the total water resource; and give consideration to interactions between surface and groundwater.

Local Government

- Strengthen and enforce planning zones, which define agricultural production zones and concentrate hobby farm development around towns.
- Develop long-term strategic plans that have community ownership.

Catchment Manager

- Lead the process to identify zones for alternative land use, eg environmental and tourism purposes.
- Encourage the planting of indigenous vegetation for carbon credits.

Communities

- Increase communication between community groups and regional agencies through community group leaders engaging with each other.
- Lobby political parties and the urban community to return water to agriculture to rebuild the rural economy.

Infrastructure

- Irrigation infrastructure contracts significantly, reducing water distribution costs.
- Goulburn Valley Highway duplication is not completed.
- Rail services to the region improve resulting in the availability of high frequency and high speed passenger and freight services.

Environment

- Extent of shallow watertables decreases considerably across the region due to improved irrigation efficiency.
- Extent of soil and wetland salinisation risk decreases as watertables fall, decreasing the need for salt disposal from the region.
- Environmental flow entitlement increases considerably, due to a government buy back of irrigation entitlements. The increased environmental flow entitlement results in small improvements to river health, particularly on the vegetation on the flood plain and native fish and bird populations.
- Quality of water in the Murray River improves due to decreased salt disposal and increased environmental flows.
- Land amalgamation program ensures properties remain a viable size and pest plants and animals are adequately managed.
- Large areas of the region are revegetated resulting in corridors linking many remnant vegetation stands.

Community

- Population growth in the region slows as people seek employment and education elsewhere. Population of young people decreases, while retirees are less inclined to leave the region.
- Area of land used for lifestyle purposes decreases 50%, while irrigation water use on these properties decreases 90%.
- Unemployment in the region increases due to a decline in agricultural, processing and service industries.
- Small towns in the region decline rapidly as farms become larger and the rural population and workforce reduce.
- Animosity exists between those who sell water to government and those who do not.
- Voluntary activity in the region declines as population growth slows and the population ages.

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Scenario 3: Pendulum 2020-2035

Drivers	Responses	Impacts
Primary Drivers		
Social, Economic, Political, Technological, Ecological Drivers <ul style="list-style-type: none"> • <i>Water resources management</i> becomes a federal responsibility. • Conservative federal government perceives that <i>environmental flows</i> are not worth the economic cost and reallocates water to economic use. 3000GL of <i>water is auctioned</i> in the Murray basin. Most of the water is purchased for agricultural and tourism businesses. • <i>The Government rebuilds and rehabilitates Irrigation infrastructure</i> in partnership with irrigator-owned water distribution companies. • <i>Climate</i> returns to a wet period with several seasons of above average rainfall and frequent floods. • China floats its <i>currency</i>, which strengthens against the Australian dollar. The stronger Chinese currency increases the attractiveness of Australian agricultural products. • Australia retains a ban on the use of <i>genetically modified organisms</i> in agricultural production. • Internationally, <i>consumer concern</i> arises over the possible human health side effects of genetically modified foods. 		
Our Industries		
Overall <ul style="list-style-type: none"> • Regional irrigation entitlement increases due to the government auction of water. Entitlement in the remaining region in 2035: High reliability 1160 GL, Medium reliability 276 GL • Regional irrigation allocation increases considerably because of above average rainfall. 2035 Allocations: High reliability 100%, Medium reliability 100%. • Water tariffs increase to fund the expansion of the irrigation system. 		
<ul style="list-style-type: none"> • Number of boutique providers with direct customer outlets increases to reduce the influence of multinational companies. • Seek capital investment from superannuation funds and private investors to expand and develop businesses. 		
<ul style="list-style-type: none"> • Regional economy booms as investment in agriculture and irrigation infrastructure expands rapidly. 		
Dairy <ul style="list-style-type: none"> • Demand from Asian markets grows as their populations become more affluent. • Increasing demand for dairy products is not met by increases in global production. This causes international prices to increase. A Decrease in the value of the Australian dollar and genetically modified free status causes a large increase in the real price for dairy products in Australia. • Rises in price increase the competitiveness of dairy production in the region. 		
<ul style="list-style-type: none"> • Multinationals control brands. • The number of boutique cheese factories increases. • There is an expansion using pasture base to minimise capital outlay. 		
<ul style="list-style-type: none"> • Milk production increases 40%. • Land area increases 10%. • Irrigated area increases 30%, while irrigation water use increases 50% . 		

Horticulture

- Demand from China and India grows as their populations become more affluent and the Chinese currency strengthens.
 - Increasing demand for horticultural product is not met by increases in global production.
 - Decrease in the value of the Australian dollar and the genetically modified free status causes a large increase in the real price for horticultural products.
 - Price increases are greater than increases in production costs, increasing the competitiveness of the horticultural industry.
- Boutique pick your own industry emerges
 - Use of hydroponics increases.
 - There is a reluctance to invest in volatile market
- Production increases 100%.
 - Irrigated area increases 100% and irrigation water use increases 100%.

Livestock

- Global demand for meat increases.
 - Increasing global demand is matched by increasing production. Genetically modified free status ensures a small increase in real price.
 - Price increases are greater than increases in production costs. As a result the competitiveness of livestock production in the region increases.
- There is an increased use of feedlots.
 - Large numbers of high quality replacement stock are bred using selective breeding from the high quality GM free gene pool.
 - Australia's quarantine status is maintained.
 - Fish and seafood production emerges.
- Production increases 200%.
 - Irrigated area increases 300%, and irrigation water use increases 150%.

Cropping

- There is a small increase in demand as demand for grain for biofuel production increases, though demand for grain for the dairy industry declines due to increasing availability of irrigation water.
 - There is a small increase in price due to increasing demand.
 - Increase in price is equivalent to increases in production costs leaving the competitiveness of the cropping industry unchanged.
- The industry diversifies.
 - Grain is produced for biofuels – biodiesel and ethanol.
 - High protein, high quality grain is produced for human consumption
 - Stockfeed production remains an important part of business.
- Production increases 300%.
 - Irrigated area increases 150%, and irrigation water use increases 200%.

Processing

- Genetic modification free status and the lower value of the Australian dollar increases the value of locally processed product.
- Control of processing facilities by multinational companies increases.
 - Invest in upgrading processing facilities to maximise benefits of expanding opportunities.

Our Community and Environment

- Demand for rural living properties does not increase

Water Supply Manager

- Manage remaining irrigation infrastructure in competition with irrigator-owned cooperatives
- Infrastructure expansion is planned, focusing on land suitability for irrigation development.

Local Government

- Encourage urban development on town fringes away from production zones.

Catchment Manager

- Enforce environmental controls on expanding irrigation areas.
- Provide advice on drainage to new developments but provide no financial support.

Infrastructure

- There is an expansion of privately owned irrigation infrastructure

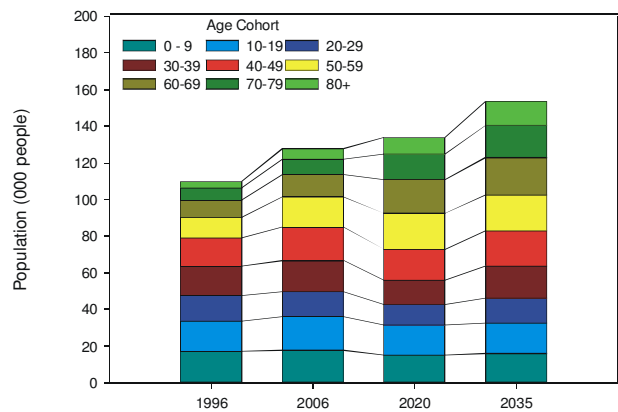
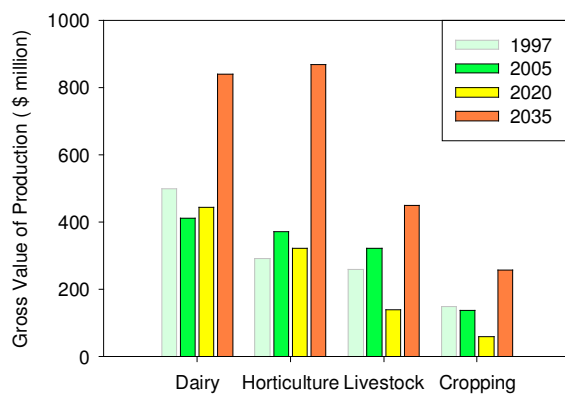
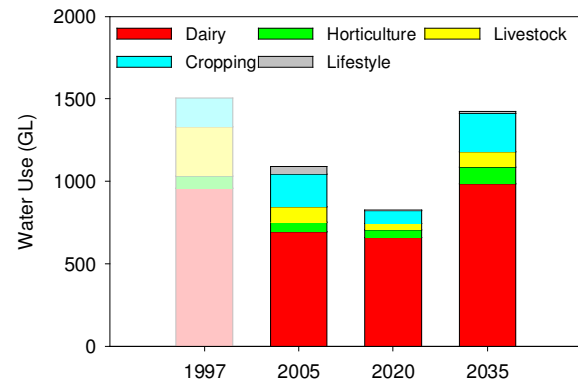
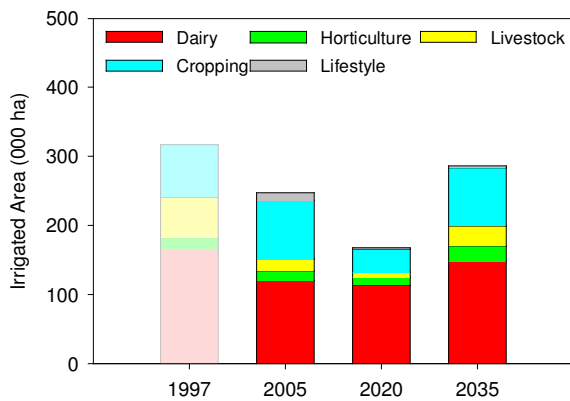
Environment

- Extent of shallow water tables increases due to increasing availability of irrigation water and above average rainfall.
- Water logging and salinity problems emerge as the area affected by shallow water tables increases.
- Above average rainfall causes river flows to remain high, and flooding occurs.
- Riparian vegetation thrives.
- Large areas of the region are revegetated resulting in corridors linking many remnant vegetation stands. Native fauna species colonise revegetated areas, as do introduced pests.

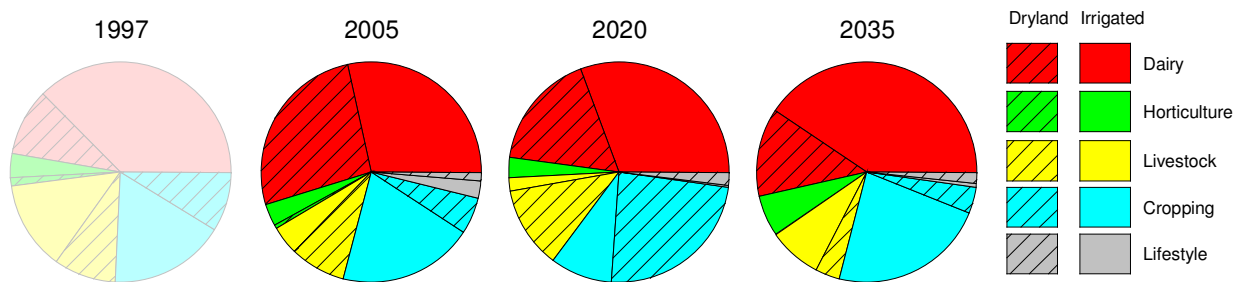
Community

- The region's population grows strongly as the improving prospects for agriculture attract to the region migrants who are seeking employment.
- Area of land used for lifestyle purposes does not change. Irrigation water use on these properties increases 1000%, but remains a very small proportion of the total available water.
- Unemployment is low and labour shortages exist in many fields.
- Large expansion of housing developments around the fringes of larger towns.

Scenario 3: Illustrative Graphs



Land Use



Scenario 4: Drying Up 2005-2020

Drivers

Responses

Impacts

Impacts described in the first period of Scenario 4 are at 2017

Primary Drivers

Social, Economic, Political, Technological, Ecological Drivers

- Free trade agreements are signed with the USA and ASEAN.
- *Genetically modified organisms* are prohibited for food production.
- Financial crisis in the USA causes a *recession* between 2009 and 2012. The USA dries up as a market.
- The value of the *US dollar depreciates*, increasing the value of the Australian dollar.
- National *unemployment increases* as Australian industry becomes less competitive.
- *Severe drought* conditions occur between 2012 and 2020.
- China begins to *export high value horticultural products* and import lower value bulk commodities.
- Political will exists to *support communities* experiencing extreme hardship.
- *Egalitarianism* decreases across the wider community, but adverse conditions draw *local communities together*.

Our Industries

Overall

- Regional irrigation entitlement reduces slightly, due to water traded out of the region. Entitlement remaining in the region in 2020: High reliability 995 GL, Medium reliability 550 GL
- Regional irrigation allocation is reduced considerably by prolonged drought. Lowest allocation is received in 2017: High reliability 30%, Medium reliability 0%. Rain returns to restore 2020 allocations to: High reliability 100%, Medium reliability 0%.
- Urban water authorities purchase temporary water from irrigators to supplement supplies.
- The Essential Services Commission maintains water tariffs constant.
- Scale back production to manage reduced availability of water, becoming highly efficient.
- Drought and adverse market conditions cause many farmers to leave the industry. Some farmers leave voluntarily and some are forced to leave by banks foreclosing.
- Lobby federal and state governments for drought assistance.
- Hold industry forums to boost industry confidence and to share knowledge of how to cope with adverse conditions.
- Seek alternative income sources including off farm income.
- Sell assets to pay the bills.
- Pump large quantities of groundwater to supplement water supply.
- Focus on short term survival, creating a dynamic and aggressive business environment.
- Trade in properties increases
- All agricultural enterprises and the regional economy are decimated due to loss of international markets coupled with prolonged drought.
- Farmers, particularly those on small blocks, sell water as they become less viable. Then they sell land, which now has little value, generally to lifestylers, thereby decreasing the effectiveness of agriculture.

Dairy

- Global demand for dairy products declines.
- Decline in the value of the US dollar increases competitiveness of US producers enabling them to increase production and dominate the international markets.

- Decreasing demand and increasing production in the US causes a small decrease in the price for dairy products.
- Decreasing global demand and lower prices causes a decrease in the competitiveness of dairy production in the region.
- Scale back production systems to minimise production costs.
- Rely on irrigated fodder crops rather than imported feed to maintain breeding stock.
- Purchase water to irrigate fodder crops.
- Some farms sell off excess cows to abattoirs to supplement income.
- Small properties sell water and go into hibernation mode.
- Number of dairy farms decreases considerably.
- Milk production decreases 50%.
- Irrigated area decreases 65% and irrigation water use decreases 65%.

Horticulture

- Global demand for horticultural produce remains largely steady, although consumers tend to purchase lowest cost product.
- Global supply increases as China begins to export horticultural products and US producers become more competitive on the global market.
- Increasing global supply causes a moderate decrease in the global price for horticultural products.
- Increasing production costs and lower global prices cause a large decrease in the competitiveness of the horticultural industry in the region, particularly in export focussed industries.
- Focus on producing fresh fruit and vegetables for local markets.
- Remove varieties grown primarily for the processing industry, as they are unable to compete with production in China.
- Purchase water to ensure orchards survive dry conditions.
- Production decreases 50% due to lack of competitiveness and drought.
- Irrigated area decreases 50%, and irrigation water use decreases 50%.

Livestock

- Global demand for meat remains strong.
- US producers become increasingly competitive on the global market and increase their production.
- Global prices remain constant but the increasing value of the Australian dollar causes a small decrease in the price of meat in Australia.
- Lower meat prices cause the competitiveness of livestock industries in the region to decrease.
- Move to dryland and intensive production systems and seek off farm income.
- Sell water to provide income.
- Production decreases 70%.
- Irrigated area decreases 95%, and irrigation water use decreases 95%.

Cropping

- Decreasing fortunes of the dairy industry cause a decrease in demand for grain and fodder in the region.
- Grain and fodder supplies, and hence prices, are highly dependent on seasonal conditions. Drought conditions cause large increases in prices.
- Decreasing demand and increasing production costs causes the competitiveness of the cropping industry in the region to decrease.

- Move to dryland productions systems and seek off farm income.
- Lease land from dairy and livestock producers to grow grain and fodder.
- Sell water to provide income.
- Grow grain for the production of biofuel.

- Production decreases 70%.
- Irrigated area decreases 95%, and irrigation water use decreases 95%.

Processing

- International market conditions place pressure on the profitability of processing.
- Dry conditions reduce the availability of raw product for processing.
- Rationalise facilities.
- Provide support in sourcing farm inputs, eg water and fodder, for suppliers at low cost.
- Import raw product from overseas to enable processing plants to continue operating.
- One export-oriented processor for each industry remains in the region.

Other

- Decline in service industries due to little primary production to sustain them.

Our Community and Environment

Water Supply Manager

- As the drought begins to reduce the profitability of agriculture, a moratorium is declared on water tariffs.
- Reduce asset maintenance as income and water use decrease.

Local Government

- Provide rate relief.
- Organise community activities to boost morale

Catchment Manager

- Restrict water related recreational activities to minimise damage to ecosystems and to minimise the chances for human injury to occur.

Communities

- Lobby all governments to provide direction and support for agricultural industries.

Infrastructure

- There is major community discontent over water fees paid during the drought.
- GMW loses a major part of its income and receives a cash injection from the government to continue.
- Infrastructure declines markedly due to a lack of maintenance and investment.

Environment

- Drought conditions cause the extent of watertables in the region to decline substantially.
- Tributaries of the Goulburn River dry up completely.
- Minimum environmental flow is not delivered in 2016 and 2017 resulting in a substantial decline in fish numbers.
- Increases in the frequency of bushfires in the region are caused by drought conditions.
- Native aquatic bird numbers decline due to long-term lower river levels restricting breeding.
- Prevalence of weeds increases due to decreased ability of farmers to afford to manage them.

Community

- Population remains stable in the region as people seek employment elsewhere.
- Area of land used for lifestyle purposes increases 150% as small agricultural land parcels become more affordable than houses in urban areas. Irrigation water use on these properties decreases 95%.
- Drought causes high unemployment in the region, and people who remain in the region are prepared to accept any employment to 'stay alive'.
- Technology developments increase unemployment in service and processing industries.
- Social divisions occur between those with wealth, employment etc and those without.
- Interpersonal skills decline due to increased use of technology.
- Small communities draw together to help each other.
- Tensions continue to exist over land use values.
- Local community groups work together and encourage participation in community activities to give support and boost morale.
- Influence of the rural community on government increases as the evidence of rural hardship becomes more prominent.

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Scenario 4: Drying Up 2020-2035

Drivers	Responses	Impacts
Primary Drivers		
Social, Economic, Political, Technological, Ecological Drivers <ul style="list-style-type: none"> • <i>Global economy</i> experiences a period of extended growth following the US recession, with a more even balance of wealth across the globe. Affluence of many Asian and South American countries increases. • Improvements to the global economy enable the World Trade Organisation to agree to remove all <i>agricultural production subsidies</i>. • International and domestic <i>consumers demand</i> for health and natural foods. • Australian ban on <i>genetically modified organisms</i> is a marketing advantage. • <i>Governments are assisting</i> rural communities and provide support to accelerate the growth of agricultural production. In order to access international markets there is a strong focus on health food, environmental sustainability and animal welfare. • Environmental water allocation is maintained. • <i>Climate</i> is slightly wetter than the long-term average. 		
Our Industries		
Overall <ul style="list-style-type: none"> • Regional irrigation entitlement reduces slightly due to water trading out of the region. Entitlement remaining in the region in 2035: High reliability 995 GL, Medium reliability 550 GL • Regional irrigation allocation is reduced considerably by prolonged drought. 2035 allocations: High reliability 100%, Medium reliability 25%. • Water tariffs increase at the inflation rate. <ul style="list-style-type: none"> • Attract private sector investment, eg superannuation funds, on the expectation of long term growth and profitability in the agricultural sector. • Maintain attitudes toward efficiency of water use as people are reluctant to return to wasteful practices. • Having experienced financial hardship, our industries manage expenditure very carefully. • Increase flexibility and just-in-time delivery. • Increasingly use robotics to minimise labour requirements. • Import guest workers to undertake manual tasks. <ul style="list-style-type: none"> • Regional economy booms as irrigated agriculture expands due to increasing availability of water and the government providing assistance to agriculture. • Limited land restructuring during drought constrains growth. • Disposable incomes increase in the region. • International interdependence on industries increases as a result of changing social structures and real-time feed back from global customer base. 		
Dairy <ul style="list-style-type: none"> • Global demand for dairy products increases as consumers become increasingly affluent. • Increases in global supply of dairy products do not keep up with increasing demand. • Global shortage of dairy products and genetically modified free status cause a moderate increase in the price for Australian dairy products. • Increasing prices increase the competitiveness of dairy production in the region. <ul style="list-style-type: none"> • Slowly increase production and carefully manage business risks. • Lease and purchase additional land to expand production • Farms minimise capital investment, due to low availability of capital and reluctance of private investors to invest in dairy production. 		

- Milk production increases 90%.
- Irrigated area increases 150%, and irrigation water use increases 200%.

Horticulture

- Global demand for horticultural products increases, as consumers become increasingly affluent.
- Increases in global supply of horticultural products do not keep up with increasing demand.
- Global shortage of horticultural products and genetically modified free status cause a moderate increase in the price for Australian horticultural products.
- Price rises increase the competitiveness of horticultural production in the region.
- New investment in the region occurs on greenfield sites in the mid and upper catchment areas adjacent to waterways.
- Small properties on margins of towns become lifestyle and niche farms.
- Production increases 200%.
- Irrigated area increases 200% and irrigation water use increases 200%.

Livestock

- Global demand for meat products increases as consumers become increasingly affluent.
- Increases in global supply of meat products do not keep up with increasing demand.
- Global shortage of meat products and genetically modified free status cause a moderate increase in the price for Australian meat products.
- Increasing prices increase the competitiveness of meat production in the region.
- Attract new private investment and rapidly expand production.
- Expand free range production on irrigated pastures.
- Continue development of feedlots, using private investment, for the export market.
- Production increases 700%.
- Irrigated area increases and water use increases 1900%.

Cropping

- Demand for grain and fodder increases as the dairy industry expands and international markets seek grain that is free of genetic modification.
- Genetically modified free status causes a moderate increase in the price for Australian grain products.
- Price rises increase the competitiveness of the cropping industry in the region.
- Develop international markets for grain free of genetic modification.
- Use local genetics to develop high protein legumes and grains for expanding markets in Asia and South America.
- Increase use of summer cropping to meet market demands.
- Production increases 240%.
- Irrigated area increases 1000%, and water use increases 1900%.

Processing

- Demand for processed product increases as does the availability of raw product for processing.
- Invest in developing and rehabilitating processing capability.
- Use technology to build linkages between consumers and producers, eg microdots in packaging that contain product history and scope for feedback to producers and processors.

- Develop products tailored to newly affluent countries.

Our Community and Environment

- Government support for agricultural development limits development of rural residential properties.
- Demand for rural residential properties rapidly declines as the economy improves and employment in the cities becomes more attractive.

- Selection of greenfield sites, land parcel restructuring and local government zoning is based on soils and access to infrastructure.
- Facilitate and support the importation of guest workers to fill a shortage of manual labour.

Water Supply Manager

- Invests in rehabilitating degraded infrastructure and developing greenfield sites.

Local Government

- Initiate strong land use planning to assist the redevelopment of agriculture.
- Encourages consolidation of lifestyle properties around town margins.

Catchment Manager

- Conservation and environmental improvement works are undertaken to enhance the market advantage of the areas genetic modification free status.

Infrastructure

- Rapid increase in the area irrigated and the volume of water that is being delivered.
- Delivery system follows the existing infrastructure pattern.

Environment

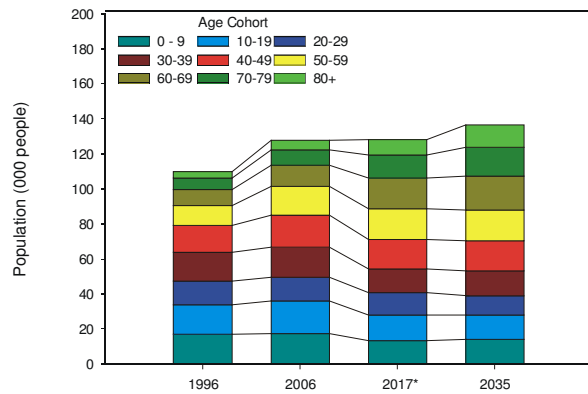
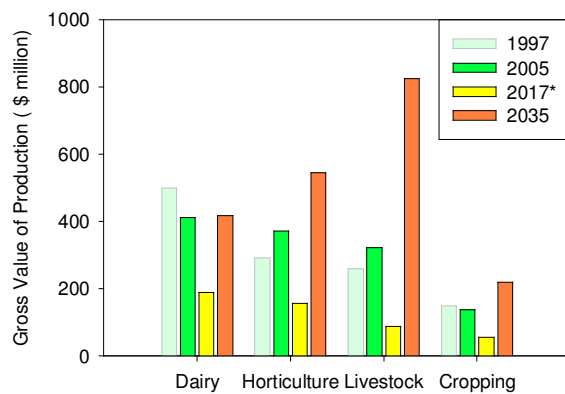
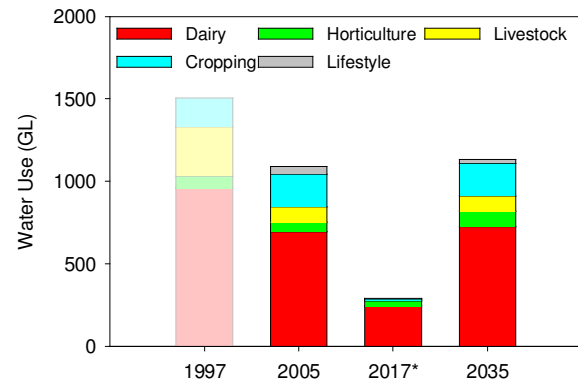
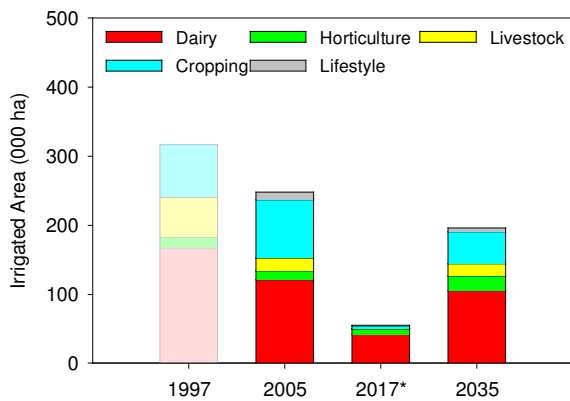
- Flows in the Murray and Goulburn Rivers increase due to a wetter climate.
- Wetter climate and increasing availability of irrigation water causes the extent of shallow water tables to increase.
- Extent of soil and wetland salinisation risk increases as the area of shallow water table increases.
- Improving prosperity of agricultural production results in investment in improved land and environmental management. The investment in improved land and environmental management decreases the extent of pest plants and animals.
- Increasing the intensity of production systems reducing the need for land for agriculture. This results in an increase in land available for biodiversity.

Community

- Population growth in the region slows. The population and the proportion of young people in the region decreases.
- Area of land used for lifestyle purposes remains stable, whilst the irrigated area and irrigation water use both increase 1000%. However, the overall volume of water used for lifestyle purposes remains relatively small.
- Labour is in short supply and unemployment is low. Employment opportunities in the service industries increase substantially.
- Technology developments cause a new set of social skills and culture.
- Face to face communication decreases due to technology improvements.
- Community influence is exerted through electronic means.
- Generation Y look to maximise their own individual comfort and therefore are unwilling to contribute to community activity.

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Scenario 4: Illustrative Graphs



Land Use

