Preserving the green oasis: government investment in the Mildura Older Irrigation Area

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Declaration

This is to certify that:

- This thesis comprises only my original work towards the Master of Philosophy degree, except where indicated in the preface;
- Due acknowledgement has been made in the text to all other material used; and
- The thesis is fewer than 40,000 words in length, exclusive of tables, maps, bibliographies and appendices.

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Ed Macartney

With thanks to Neil Barr, Tim Cummins and Al Watson, whose work drew me to the subject.
Abstract

In July 2008, the Commonwealth Government announced that it would spend $3.7 billion to upgrade irrigation districts across the Murray-Darling Basin as part of the Murray-Darling Basin Plan. Of this funding, $103 million was earmarked to repair and upgrade the ageing Mildura Older Irrigation Area, an irrigation precinct in north-western Victoria which had been operating for 120 years.

At the time of the announcement the Mildura Older Irrigation Area was in the midst of a prolonged downturn. A combination of small farm blocks, low commodity prices and fluctuating water availability had reduced many local irrigators to near-poverty. Irrigators had stopped watering a significant proportion of their crops, with perennial vines and fruit trees left to die. Against this background of decline, there were doubts about whether the Commonwealth’s $103 million upgrade plan could reverse the fortunes of the Mildura Old Irrigation Area.

A business case seeking Commonwealth funding for the irrigation upgrades sought to demonstrate that the investment would secure the irrigation area’s long-term future, while delivering cost-effective water savings to the Commonwealth. The business case was not made publically available. In 2014, construction commenced and the $103 million upgrade of the area’s pumps, channels and pipes began.

The upgrades aimed to enable irrigators to plant new, more profitable crops, and to create a host of smaller efficiency savings for water, labour and energy use. This study estimates the size of the benefits the upgrades will create for the Mildura Older Irrigation Area, in order to assess whether the $103 million investment will generate a reasonable return. Those benefits can be estimated by analysing past irrigator behaviour, and the costs and benefits of crops whose development will be stimulated by the upgrades.

This analysis indicates that the net benefits of the upgrades are marginally positive. However, these benefits are highly sensitive to changes in commodity prices and irrigators’ willingness to invest, and moderately sensitive to interest rates and changes in the price of water. In the context of competing government investments, the project has a poor rate of return. It is not likely to satisfy either the Commonwealth Government’s broad criteria for project investment, or its specific criteria for funding irrigation upgrades under the Basin Plan.

The analysis shows that the upgrades will benefit local irrigators, who will be able to access new crop options whilst avoiding infrastructure maintenance costs. The effects on the regional economy were found to be muted, as the economic significance of the Older Irrigation Area was surpassed years ago by nearby privately-funded irrigation precincts along the river. The project’s immediate costs will be borne by taxpayers, with its long-term costs to fall to irrigators as they change their businesses to take advantage of the upgrades.
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List of acronyms
ABS – Australian Bureau of Statistics
ACCC – Australian Competition and Consumer Commission
ALP – Australian Labor Party
CBA – Cost-benefit analysis
CMA – Catchment Management Authority
COAG – Council of Australian Governments
DPI – Department of Primary Industries
MOIA – Mildura Older Irrigation Area
NPV – Net Present Value
NVIRP – Northern Victoria Irrigation Renewal Project
Chapter 1 - Introduction

1.1 - Preamble

This thesis examines whether the Commonwealth Government’s funding of upgrades to irrigation infrastructure in the Mildura Older Irrigation Area is likely to be a worthwhile investment. The investment decision is assessed using cost-benefit analysis, as any such analysis was not made public by the Commonwealth when funding for the project was approved.

1.2 - The investment decision

In July 2008 the Commonwealth Government announced it would provide $103 million to repair and improve irrigation pumps, channels and meters in the Mildura Older Irrigation Area (herein referred to as the MOIA) on the Murray River in north-western Victoria. These funds were complemented by a contribution of $17 million from the local water authority, Lower Murray Water, creating a total project value of $120 million. Following the Commonwealth’s endorsement of a business case detailing the nature and benefit of the upgrades in 2012, on-ground works commenced in 2014.

The business case which triggered the release of the Commonwealth funds was not made public. In its absence, Lower Murray Water claimed the upgrades would enable irrigators to plant new, more profitable crops, and create a host of secondary efficiency benefits for water, labour and energy use.

In this study, the likely benefits of those changes are measured against the project’s costs, and against the Commonwealth’s stated criteria for irrigation infrastructure funding.

1.3 - Problem statement

Australia has approximately 32 million hectares (ha) of cultivable land, two million of which are irrigated1. Much of the development of irrigated agriculture has taken place in rural and regional areas, where it became an important part of the economic and social fabric of local communities. However, the long-term diversion of water for irrigation has come at the expense of the natural environment, with reduced flows having a significant impact on river ecosystems in the Murray-Darling Basin.

Despite government introducing measures designed to stem the flow of water to irrigated agriculture, such as a cap on diversions, the dilemma for the environment was brought to a head during the Millennium Drought. The government response was captured in the Murray-Darling Basin Plan, where the decision was made to purchase 2,750 gigalitres of water from farmers and set it aside for environmental purposes.

This transfer of water to the environment posed problems for irrigators, many of whom rely on shared irrigation pumps, channels and pipes – and the ability to collectively fund maintenance of this infrastructure. Water buybacks created the prospect of irrigators selling up and exiting the industry, leaving those who remained to bear the maintenance costs – which could potentially become unsustainable.

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1 (Australian Bureau of Statistics, 2011)
Recognising this, the Commonwealth Government offered irrigators a *quid pro quo*: accept the buybacks in exchange for government-funded upgrades to their ageing channels, pipes and pumps. In theory, the water-use efficiency savings created by these upgrades could be shared between the farmers and the environment. This strategy addressed two concerns for government: sourcing water for the environment, and minimising the economic impacts on regional irrigation communities.

Once the logic of funding irrigation upgrades was accepted at the political level, ensuing project funding commitments were made before a detailed analysis of each project’s water savings - and economic impacts - was conducted. This was the case in the Mildura Older Irrigation Area, where $103 million was earmarked to fund upgrades which would produce limited water savings and unknown economic benefits.

The government’s lack of transparency in funding the Mildura Older Irrigation Area upgrades raised several questions. In the absence of large water savings, what are the economic benefits of the project? Would they offset the costs of the upgrades? And did they account for other drivers shaping the future of irrigation in the area?

In this study, the value of the upgrades project is assessed using cost-benefit analysis. The findings are considered against the project’s ability to generate a positive return, and to satisfy investment criteria set out by the Commonwealth Government.

A detailed background study of the Commonwealth’s investment decision is presented in Chapter 2.

**1.4 - Aims and Objectives**

The aim of this study is to test the effectiveness of the Commonwealth Government’s $103 million investment in upgrading the irrigation network in the Mildura Old Irrigation Area. The specific objectives of this work are to:

1. Identify the prospective benefits of the upgrades to ageing irrigation pumps, channels and meters in the Mildura Older Irrigation Area; and
2. Determine the net present benefits of those upgrades.

The study addresses these objectives by using cost-benefit analysis. The first objective is considered by calculating the likely benefits of the upgrades process, in the context of the efficiency savings and new production opportunities the upgrades will create. The second objective is assessed by quantifying the findings of the first, and evaluating them using cost-benefit analysis.

By estimating the benefits the upgrades will create in the Mildura Older Irrigation Area, it is possible to infer whether the government’s $103 million investment will generate a reasonable return.

Importantly, this study does not examine or critique the broader water policy decisions which make up the Murray-Darling Basic Plan, as their scale and complexity puts them beyond the scope of this work. Rather, the study seeks to test the likelihood that the specific upgrades to the Mildura Older Irrigation Area will yield a net benefit, and whether they are likely to meet the Commonwealth Government’s threshold criteria for infrastructure investment.
1.5 - Structure of the thesis

Evaluation of the investment, its implications and conclusions are set out as follows:

- **Chapter 2** sets out the development of the MOIA to this point, the forces which have contributed to its current slump and the developments which led to the Commonwealth’s commitment of funds to the area. It goes on to explore past trends in the MOIA which are likely to influence the eventual success of the upgrades project.

- **Chapter 3** establishes the framework for calculating the net benefit of the upgrades, via a cost-benefit analysis. It details the assumptions that underpin the analysis and quantifies the individual benefits and costs, based on current industry data.

- **Chapter 4** outlines the findings of the cost-benefit analysis, and the implications for the success of the upgrades project. It uses sensitivity analysis to explore what changes in key variables such as commodity prices, interest rates and water availability would mean for the project’s success.

- **Chapter 5** discusses the consequences of the findings for irrigators, the regional economy and government. It concludes with implications for government policy and the scrutiny given to infrastructure spending.

- **Chapter 6** summarises the study’s findings in the context of Mildura’s regional economy, and considers the implications for the future of irrigated agriculture in the MOIA.

1.6 - Literature review

The analysis presented in the thesis is based on the literature on irrigation investment theory and the influence of water availability on regional economies. It is important to note that the critical analyses of specific irrigation infrastructure projects in Australia (such as that considered in this thesis) are typically undertaken within government, and are not published. As such, they are not subject to external review and scrutiny. In addition, the number of ex-post studies are relatively rare.

Accordingly, the thesis draws on two different bodies of literature:

- Government-commissioned reports specific to the Mildura region in which detail changes in farm size, crop selections, commodity prices and water prices over several years; and

- Published literature which examines broader issues relating to irrigation infrastructure, water trading and regional growth across the Murray-Darling Basin as a whole.

Key works which have examined the development of policies in this field are:

**Water Politics in the Murray-Darling Basin.** Connell (2007)\(^2\) focuses on the political considerations which underpinned the development of the Commonwealth-State water management framework. Connell highlights past misalignments in the relative power of the Commonwealth and State governments to allocate water, the policy complexities of trading off upstream and downstream users and the conflicts between environmental and production goals. Connell emphasises the political circumstances which led to the creation of the Water Act 2007 and the need for the Commonwealth to make concessions to State governments (chiefly in the form of infrastructure

\[^2\](Connell, 2007)
grants such as the $103 million allocated to the MOIA project). Connell also points to the difficulty of establishing a strong policy rationale for water management projects in the face of lobbying from concentrated, vocal producer groups.

**The Economic and Social impacts of Water Trading** Frontier Economics (2007) examined the impact of the introduction of water trading on regional irrigation communities, focusing on the Murray Valley. In the report they set out the stages in the development of the MOIA, the structural constraints imposed by closer settlement policies and their implications for farm enterprise viability. They also examine the costs and benefits of collectively-funded irrigation networks in comparison to individually-managed greenfield sites, highlighting that collective networks are suited to small, labour-intensive enterprises producing high-value crops.

**Australia: Wet or Dry?** Davidson (1969) examined the drivers behind government decisions to invest in regional irrigation networks in the first half of the 20th century. He sets out the government’s policy rationale of building irrigation infrastructure to ‘drought-proof’ regional economies, yet highlights a policy bias towards irrigation infrastructure over other users of capital and water (such as dryland agriculture). Davidson also details the failure of many early irrigation collectives to pay for and maintain the irrigation infrastructure they had originally committed to, in parallels with the main theme of this thesis. He goes on to raise the question of whether irrigation collectives will be worth maintaining in the future, once the sunk costs have been written off. This conclusion relates to the key hypothesis in this thesis, whether the $103 million for infrastructure upgrades is based on sound policy and is likely to produce a reasonable economic return.

**Industry Adjustment In Sunraysia** Watson and Cummins (2009) set out history of irrigation development in MOIA, in the context of the effect of government subsidies for key commodity types. They analyse the long-term effects of Australia’s trade deregulation policies on growers in the Sunraysia, and criticise the introduction of tax concessions for wine production and their distortionary effect on production decisions. They conclude by examining the challenges for producers operating in a collective irrigation network, and question whether those producers are able to respond to the cost-price squeeze when their ability to expand the scale of their operations is constrained in a way that greenfield enterprises are not.

**The Mildura Older Irrigation Area Rural Strategy** RMCG (2008) explored the challenges of trading off agricultural uses with other uses of land in the MOIA, a place where rural and urban areas are in close proximity – and the latter typically value land at a higher rate than the former. They detail the extremely small average farm size in the MOIA, the constraints on expansion and the effects of enabling alternative land uses in the district. They also highlight the issues associated with allowing the area to shift to unfettered urban development, as the burden of maintaining the irrigation network would fall to fewer and fewer irrigators, precipitating a mass exit. Their report has important implications for any discussion on how to maintain or decommission sections of the irrigation network, and the benefits of network effects in shared irrigation infrastructure.

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3 (Frontier Economics, 2007)
4 (Davidson, 1969)
5 (Watson & Cummins, 2009)
6 (RMCG, 2008)
Chapter 2 - Background: The Mildura Older Irrigation Area

2.1 - Introduction
This chapter sets out the development of the MOIA and the forces which have shaped it. It highlights the opportunities and constraints created by the shared irrigation network, the role government has played in influencing the region’s changing fortunes, and implications for the network’s future prospects. It concludes by setting out the current challenges facing the Older Irrigation Area, and the government’s most recent foray into the area.

2.2 - The Mildura Older Irrigation Area today
The MOIA is situated on lower part of the Murray River, on land in and around the rural city of Mildura. It is part of Australia’s Murray-Darling Basin (see Figure 1). The Older Irrigation Area is so-named as it was the original irrigation precinct in what later became a series of irrigation areas around Mildura, drawing water from the Murray.

Figure 1 – The location of the Mildura Older Irrigation Area in the Murray-Darling Basin (ABC, 2013)
While there are several large-scale irrigation precincts across Australia today (notably those in the Goulburn Valley, the Murrumbidgee River and the Ord River area), the MOIA was one of the first attempts to establish a large irrigation collective in Australia. This early enterprise grew steadily in the decades following its establishment to become the area which is now referred to as the MOIA, made up of the adjacent districts of Mildura, Merbein and Red Cliffs (see Figure 2).

While the irrigation districts within the MOIA developed at different times – the First Mildura Irrigation District was established in the late 1800s, with the development of Merbein and Red Cliffs following each of the World Wars – they share some irrigation infrastructure (pumps, pipes and channels), and are collectively administered by the local water authority, Lower Murray Water.

2.2.1 - Any crop they want, as long as it’s grapes
The modern incarnation of the MOIA is a patchwork collection of small irrigation holdings, occupying an area of 13,600 hectares. This is relatively small compared to other irrigation areas such as the Goulburn Valley and the Murrumbidgee Irrigation Area, which occupy and 270,000 hectares and 660,000 hectares, respectively. However, whereas these areas concentrate in medium-intensity production of stone fruit, pome fruit and dairy, the MOIA specialises in high-value produce, particularly grapes, citrus and vegetables. In particular, the Mildura region produces 95 per cent of Australia’s dried vine fruit (sultanas, currants etc.), 69 per cent of table grapes and 20 per cent of the nation’s wine grape crop. Producers in the MOIA also grow a number of other crops, including citrus, asparagus and other vegetables.

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Figure 2 – Map of the Mildura Older Irrigation Area, 2012 (Department of Planning and Community Development Victoria, 2013)

7 (Hamilton-Mckenzie, July 2010)
8 (Essential Services Commission, 2012)
9 (Hansen Partnership Pty Ltd & Essential Economics, 2013)
10 (Goulburn Broken CMA, 2015)
11 (Murrumbidgee Irrigation Limited, 2015)
12 (Mildura Development Corporation, 2015b)
The breakdown of crops grown by area is presented in Figure 3. The heavy reliance on grape production is evident and accounts for approximately 87% of the 13,600 hectares planted.

![Crop types in the MOIA, 2012](image)

Figure 3 – Crop types in the Mildura Older Irrigation Area by area, 2012 (Mallee CMA, 2014)

While producers in the MOIA grow a variety of crops in response to emerging market opportunities or to manage risk, grapes have been the major crop in the region for decades\(^{13}\). While dried fruit made up the majority of the crop for much of this time\(^{14}\), since the dismantling of protection producers have increasingly diversified into other grape crops, as Figure 4 demonstrates.

![Grape production in the MOIA, 2012](image)

Figure 4 – Breakdown of grape crops produced in the MOIA in 2012 (Mallee CMA, 2014)

Irrigated horticulture forms an important part of Mildura’s regional economy, with agriculture contributing 17 per cent of Gross Regional Product\(^{15}\), and providing an important feeder to

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13 (Hamilton-McKenzie, July 2010)
14 (Hansen Partnership Pty Ltd & Essential Economics, 2013)
15 (Mildura Development Corporation, 2015a)
downstream industries such as processing and transport. Despite this, the relative importance of
the MOIA has declined since the 1980s, in part due to growth in other sectors of the local economy,
and also in part due to a downturn in the value of production from the MOIA itself\(^\text{16}\).

This gradual downturn in production value has accelerated sharply since 2005, with profound effects
on the welfare of irrigators. To understand this downturn – and its implications for the current
irrigation modernisation program – it is useful to investigate the development of the irrigation
district.

2.3 - Development of irrigation in the MOIA

The fortunes of MOIA irrigators in 2015 are still being shaped by policy decisions that were made in
the early 1900s\(^\text{17}\). Exploring the irrigated area’s development – and its swings between success and
failure – gives an opportunity to gain better insights into modern policy decisions in the area.

The role that modern government plays in supporting the development of Australian agriculture is
significantly smaller than that of the previous century\(^\text{18}\). The tools that governments use to further
the industry’s interests have largely been pared down to essentials – research and development,
biosecurity, some extension – with the prevailing policy view that farmers are best-placed to further
their own interests\(^\text{19}\).

This stands in contrast to the early 1900s when, in the face of widespread uncertainty about the
landscape’s agricultural production potential, policymakers took a direct role in promoting industry
development. Large, ambitious production projects were common, and policymakers looked abroad
for ideas to apply to the Australian environment.

It was in these circumstances that the establishment of an irrigation district at Mildura was
conceived. However, whereas government’s guiding hand steadily withdrew from broadacre
agriculture over subsequent decades, untangling itself from irrigation proved to be more difficult.

2.3.1 - 1884: The early stages of irrigation

In 1903, Alfred Deakin, the leader of the Protectionist Party, became the second Prime Minister of
Australia. This marked the culmination a significant political rise, which had begun twenty years
earlier as the 26-year old Victorian Commissioner for Public Works and Water Supply\(^\text{20}\). It was during
this earlier time that Deakin had overseen the first experiments with large-scale collective irrigation
in Australia.

In 1884 Deakin had stepped down from his role as Commissioner for Public Works and Water Supply
to chair a Royal Commission to identify means of developing the Murray River for irrigation, ‘ a cause
he pressed with fervour’\(^\text{21}\). This led him to California, with its cluster of fledgling irrigation precincts,
and the Chaffey brothers, two Canadians who had grappled with – and apparently solved - the same
problems of irrigation development now confronting Victoria. As later commentators remarked:

\(^\text{16}\) (Hansen Partnership Pty Ltd & Essential Economics, 2013)
\(^\text{17}\) (Cummins, 1992)
\(^\text{18}\) (Marsh & Pannell, 2000)
\(^\text{19}\) Notwithstanding the considerable government financial support still given to drought-affected farmers,
which does not target particular commodities or areas for development.
\(^\text{20}\) (Norris, 1981)
\(^\text{21}\) (Norris, 1981)
‘Deakin was enormously impressed with what he saw, and with seemingly very little understanding of the differences between the American and Australian situations assumed that irrigation on the Chaffey scheme could be successfully transplanted to the Mallee’.22

Following an agreement between the two parties, the Chaffeys sold their California irrigation investments (at a loss23) and travelled to Victoria to investigate the establishment of a California-style irrigation precinct on the Murray.

After travelling down the river, the Chaffeys selected a derelict sheep station known as the Mildura Run as the location for their new irrigation venture. It was a brave choice – years later, a newspaper noted:

‘The Mildura Run was in liquidation at the time. Lessee after lessee had left it in despair after being ruined…..one early squatter described the run as…”a Sahara of blasting hot winds and red driving sands, a howling, carrion-polluted wilderness”.’24

Undeterred, the Chaffeys signed an agreement with Deakin in 1886 to establish an irrigation colony in Mildura. After a series of delays in the Victorian Parliament, an agreement was reached whereby 250,000 acres (approximately 100,000 hectares) of the Mildura Run was leased to the Chaffeys, with options over an additional 200,000 acres (80,000 hectares). Notably, Deakin saw the project as providing a combination of private and public benefits, while confining the costs to the private proponents. As he noted:

Under the proposed agreement, the experiments necessary to determine [irrigation’s] profitableness can be tested under adverse circumstances at private expense, and with only private risk…[but] if the Messrs Chaffey succeed in their enterprise, the value of [the Mallee], which belongs to the State, will be very much increased.’25

The lease of the land was subject to a series of stringent conditions around building the channels and other infrastructure necessary for irrigation. The Chaffeys needed to fund this work, and being largely bereft of capital themselves26, turned to the market.

The brothers established a model whereby initial (debt-funded) irrigation works would attract paying settlers, whose money would then be used to fund further works – attracting more settlers. The Chaffeys embarked on a wide-ranging publicity campaign (illustrated in Figure 5, below) to bring prospective irrigators to the region, which succeeded in attracting settlers from across Australia and overseas. By 1890, the irrigation colony numbered 3,300 people27.

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22 (Discover Murray, 2015)
23 (ANU, 2007), p.4
24 (ANU, 2007, p.1)
25 (Victorian Government, 1886), p.1
26 (Hamilton-Mckenzie, July 2010)
27 (Westcott, 1979)
Interestingly, the irrigation scheme also drew a number of wealthier city-based investors, chasing the high prospective returns on offer. These investors subsequently lost most of their money\textsuperscript{28}, an experience their successors shared a short distance away and 120 years later, when the Managed Investment Schemes model collapsed.

### 2.3.2 - 1890 – 1900 – Collapse and rescue

Despite the Chaffeys’ success in attracting farmers to their new irrigation precinct, the area’s commercial prospects were shaky from the beginning. Hamilton (2012) highlights the dubious similarities between California and Mildura which formed the basis of the Chaffeys’ reasoning that irrigation would succeed. With the Victorian Government viewing the project’s risks as wholly private, it could be argued that neither party had done a proper analysis of the project’s likely shortcomings\textsuperscript{29}.

By the 1890s, physical constraints including pests and the inability to transport fresh fruit to Melbourne compounded governance problems in the irrigation district, such as confusion over poorly-defined water entitlements and irrigator rights. The gaps between the Californian experience and the Australian one were beginning to show, exemplified by ‘the Chaffeys’ [failure to] pay much attention to the issue of the potential market for irrigated produce in Victoria, which was much smaller than California\textsuperscript{30}.

By 1895 irrigators were abandoning their holdings in large numbers – as a newspaper remarked, ‘no-one now expects to be able to sit under his own vine or tree all day long, while the ripe fruits drop into his mouth and the bright sovereigns roll into his pocket’\textsuperscript{31}. The Chaffeys’ entire company went into liquidation, and amidst severe irrigator hardship and the potential collapse of the scheme, the Victorian Government appointed a Royal Commission to look into the issue.

For government, the Royal Commission represented a shift away from Deakin’s avowal that the risks of the project would remain private. As oil tycoon J. Paul Getty noted, ‘if you owe the bank $100, that’s your problem. If you owe the bank $100 million, that’s the bank’s problem’\textsuperscript{32}.

\textsuperscript{28} (ANU, 2007)  
\textsuperscript{29} (Discover Murray, 2015)  
\textsuperscript{30} (Crase, 2008), p.32  
\textsuperscript{31} (The Capricornian, 1895), p.18  
\textsuperscript{32} (Wiley, 2013)
By enabling the creation of an irrigation network which supported hundreds of irrigators, the Victorian Government had inadvertently created a problem it was reluctant to turn away from.

The Royal Commission’s subsequent report found that ‘the schemes had been built on wishful thinking rather than realistic costs estimates, and that as constituted they could never operate profitably’\(^\text{33}\). In response, the Victorian Government bought out the Chaffey’s considerable liabilities, and granted responsibility for management of the scheme’s water infrastructure to an irrigator collective, the First Mildura Irrigation Trust. Control over future development of irrigated agriculture in Victoria was vested in a new body, the State Rivers and Water Supply Commission\(^\text{34}\).

### 2.3.3 - 1900 – 1950 - soldier settlement years

Under the combination of reformed governance arrangements and irrigator adoption of increasingly sophisticated crops and management practices, the MOIA expanded slowly over the next few decades, punctuated by occasional growth surges or contractions in response to droughts and fluctuating market conditions.

Following the end of the First World War in 1918, soldier settlements dominated development in the area, as the Commonwealth Government allocated 23,000 farms to returning servicemen across Australia\(^\text{35}\). Many were encouraged to purchase blocks in the emerging irrigation areas of Merbein and Red Cliffs, where block sizes were made deliberately larger than the original Chaffey specifications. The larger blocks were a response to the need for greater farm scale, if irrigators were to generate the returns necessary to make liveable wage.\(^\text{36}\) This creeping need was to steadily undermine the viability of the old irrigation district for decades to come.

When Victorian Premier Harry Lawson visited the area in 1921, he noted that:

> ‘Where 12 months ago hundreds of acres contained nothing but straggling timber, the industry of the soldier settlers has transformed Red Cliffs into a prospering settlement, which may be a serious rival to Mildura in a few years…..the Ministry [has] undertaken a huge plan, confident that the Diggers would repay the State the enormous sums which had been voted for Red Cliffs’\(^\text{37}\).

However, the soldier settlement experiment was largely a failure. By 1939, 60 per cent of resettled soldiers had abandoned their blocks, with a proportion staying behind in ‘the most squalid conditions’\(^\text{38}\), and the government was forced to write off the majority of the associated debt\(^\text{39}\). Despite this setback, a second generation of soldier settlers was introduced to the region following the conclusion of the Second World War in 1945. Most of these soldiers were settled in neighbouring Robinvale, in an area outside what is today considered to be the old irrigation area.

As with the first generation of soldier settlements, block sizes in Robinvale were further increased to reflect the growing scale necessary for irrigators to make a commercial return. The effects of this

\[\text{33} \text{ (Discover Murray, 2015), p.1}\]
\[\text{34} \text{ (Pigram, 2006)}\]
\[\text{35} \text{ (ABC Landline, 2010)}\]
\[\text{36} \text{ (The Argus, 1921)}\]
\[\text{37} \text{ (The Argus, 1921), p.22}\]
\[\text{38} \text{ (ABC Landline, 2010), p.1}\]
\[\text{39} \text{ (ABC Landline, 2010)}\]

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are visible today, where it is no coincidence that irrigators on the larger Robinvale blocks generally outperform their neighbours in the MOIA.\footnote{Watson & Cummins, 2011}

Following a slump in dried fruit export prices in the 1920s and the Depression of the 1930s, the Commonwealth Government introduced a series of controls which supported the fortunes of irrigators in the area for the next 40 years\footnote{Watson & Cummins, 2009}. Separate dried fruit price schemes for export and domestic markets were introduced, supported by import tariffs and preferential supply arrangements which had been established with Britain in the wake of the First World War.

Under the latter arrangements, which saw Britain preference Australia as the source of many of its food imports, Mildura’s dried fruit producers were able to export their product to a secure market, where they were insulated from competition from other dried fruit-producing nations such as Greece and Spain\footnote{Ville, 2014}. As Milward (2013) notes,

‘The preferences on food imports into Britain had sustained incomes in many rural regions of Australia when world food prices had fallen, and still did so after 1945 [following the US push for liberalisation of international trade in the wake of the Second World War]’\footnote{Milward, 2013}, p.384

\subsection*{2.3.4 - 1950 – 1970 – consolidation and stability}

Early MOIA irrigators experimented with a diverse range of crops, including apricots, dried fruit and table grapes. As optimal crop types became clearer, by the 1960s most irrigators had adopted a set proportion of different crops, consisting of approximately 75 per cent grapevines (mostly producing dried fruit) and 25 per cent citrus or vegetables\footnote{ABC Landline, 2010}. The collectively-owned First Mildura Irrigation Trust continued to manage the costs associated with maintaining the capital-intensive irrigation network around Mildura, funded by irrigator levies.

By this time, government efforts to promote the region had shifted away from direct encouragement of settlement to pricing support in the market. With the adoption of cropping systems better suited to the Australian environment and pricing support provided by tariffs and preferential supply arrangements, irrigators were experiencing a period of relative stability, compared to the tumultuous changes and harsh adaptation lessons of the early decades.

\subsection*{2.3.5 - 1970 – 1990 – the music stops}

By 1970, the MOIA’s early primacy in Australian irrigation had been overshadowed by the development of much larger irrigation districts elsewhere in the Murray-Darling Basin, particularly in the Goulburn Valley region and along the Murrumbidgee River\footnote{Pigram, 2006} (see Figure 6).
With the steady expansion of water-using enterprises in all their forms – including irrigation - across the Murray-Darling Basin, the effects of competition for water were becoming increasingly apparent. Where previous water policy had focused on the appropriate limits to irrigation expansion, by the 1980s policymakers were becoming increasingly concerned with questions of allocation – how to divide scarce water resources across multiple competing users\(^{46}\). Irrigator collectives increasingly faced competition for the water resource, and a policy environment which was slowly removing the barriers to that competition.

While the cost and availability of one of one of their key inputs was shifting against them, irrigators also faced challenges with the market for their products. Irrigators in the MOIA had benefited greatly from the preferential supply arrangements established between Britain and Australia 40 years earlier. However, in 1973 Britain joined the European Economic Community, lifting its requirement to source certain imports from Commonwealth nations in the process\(^{47}\). As a result, Mildura dried fruit growers lost their preferential supplier status. The problem for growers was

\(^{46}\) Randall, 1981

\(^{47}\) Milward, 2013
compounded by the Commonwealth Government’s growing view that it should scale back its own support for domestic agricultural industries. Prime Minister Gough Whitlam characterised the mood for reform during a speech in 1973, in which he criticised protected industries for their view:

‘...that [their] very existence entitles [them] to a certificate of immortality and changelessness, to be guaranteed a safe and easy life by way of Government subsidy and protection through tariffs or, even worse, permanent quantitative controls on imports.’

These sentiments were followed by two investigations into the dried fruit sector by the Industries Assistance Commission in the mid- and late-1970s. These investigations highlighted the costs to Australian consumers of tariff arrangements, and the concentration of benefits for a small number of growers. The policy consensus was shifting against a protectionist approach to industry development. As Okamoto (2010) notes:

‘New recruitment of academic economists as consultants by the Tariff Board and the Industries Assistance Commission...played an important part in improving their research activities. These younger generations of university educated economists were basically against protectionist policies’.

Against this background, and in an environment of broader liberalisation reforms to the Australian economy, government price support and preferential marketing arrangements for dried fruit were progressively rolled back, and by the early 1990s had been fully abandoned. The effects on producers in the MOIA were profound, as increased competition for supply contracts and falling international prices began to have a detrimental impact.

Local growers remained bitter about this loss of protection years later. As one complained in a 2012 letter to the Sunraysia Daily on the poor condition of the local industry:

‘...the current situation has come about primarily because the Hawke administration sacrificed our industry on the altar of free trade and deregulation, while our National Party representatives stood by impotently.’

This statement gives an insight into both the long-term impacts of government policy on irrigator welfare, and the irrigators’ perceived entitlement to government support.

2.4 - End of the protection years

By the 1990s, the production environment for irrigators in the MOIA had changed fundamentally. ‘Set-and-forget’ approaches to production had become outdated with the removal of industry protection. Producers were confronted with the challenges – and opportunities – of selling products in markets with intense international competition.

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48 (Ville, 2014)
49 (Prime Minister and Cabinet, 2015), p.7
50 (Watson & Cummins, 2009)
51 (Rattigan, 1986)
52 (Okamoto, 2010), p.90
53 (Watson & Cummins, 2009)
54 This process was continuing in 2015, as Vintage Traders went into liquidation, leaving contracted suppliers looking for another buyer for their crop.
55 (Henshilwood, 2012), p.1
2.4.1 - 1990-2005 – wine grape boom and bust

The decline in the fortunes of dried fruit production in the early 1990s took place around the same time as another grape crop was on the rise in Australia – wine grapes. While wine grapes had been grown across many areas of Australia – including the MOIA – for decades, from the late 1980s a confluence of advances in production technology, favourable exchange rates and Australian wine becoming fashionable on international markets combined to stimulate strong demand amongst processors for wine grapes\(^56\).

Growers in the MOIA were well-placed to respond, with their extensive experience in grape production and ability to graft existing dried fruit vines over to wine grapes, minimising production downtime. Seeking a diversification option after the collapse of the dried fruit market, growers changed crops, and by the mid-1990s wine grapes had overtaken dried fruit as the main product in the area. Within ten years, the former regional staple of dried fruit was the third most popular crop grown in the broader Murray Valley area, behind wine grapes and table grapes, and only occupied half the area of irrigated land devoted to wine grape production (see Figure 7).

![Murray Valley grape production (ha), 1997-2006](image)

Figure 7 – Murray Valley grape production by area, 1997-2006 (Argus, 2012) (note: production figures pre-1997 were not collected)

The Commonwealth Government introduced accelerated depreciation of vineyard construction costs in 1993, further encouraging the switch to wine grapes\(^57\). The early successes of some growers in the MOIA induced others to make the change to wine grape production. By the late 1990s larger, corporate operations had entered the market, attracted by the high returns on offer.

The lag between planting the vines and picking the first crop – approximately three years – meant that a large area of wine grape plantings across Australia came on-line around the same time in the late 1990s and early 2000s. This coincided with increased production from growers in the ‘New World’ – Chile, Argentina and other international producers with lower production costs than Australia\(^58\). The net effect was to quickly push the market for wine grapes into oversupply around

\(^{56}\) (Anderson, 2015)
\(^{57}\) (Anderson, 2015)
\(^{58}\) (Anderson, 2015)
the end of the 1990s. Stocks of Australian wine held ready for sale subsequently grew more than threefold between 1995 and 2005, and prices received by growers in the Murray Valley (including the MOIA) for all major grape varieties crashed, as shown in Figure 8:

![Wine grape prices 1999-2013](image)

Figure 8 - Wine grape prices for major varieties in the Murray Valley, 1999-2013 (Murray Valley Wine Grape Industry Advisory Committee, 2014)

For growers in the MOIA, the damage to their farm gate returns was severe. Many had invested significant sums in restructuring their farms to grow wine grapes, willing to accept the initial capital expense and production downtime on the expectation that the eventual returns would prove worth it. Those who made the switch early enjoyed some years of high prices; those who followed later watched those prices begin to fall just as their plantings came into full production.

While growers sought to trim their production costs in response to the deteriorating price, they could not do it fast enough to keep their margins intact. The average cost of wine grape production for MOIA growers is approximately $300-$350/tonne. At the lower prices, their profits were reduced to near-zero, and many were making a loss.

Growers in this situation faced a conundrum. Many had paid a high up-front cost to plant vines and waited years for them to reach full production, and so chose to stick it out, hoping the price dip was temporary. By the time it became clear that low prices were here to stay, many growers’ financial reserves had been drained to the point where sticking with wine grapes was no longer a choice – they lacked the funds to plant a different perennial crop, and wait three years for it to come into

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59 (Anderson, 2015)
60 (Retallack, 2012)
production. The alternative of switching to annual vegetable crop also represented a significant and risky course of action for growers whose production and marketing expertise was limited to perennial vine crops. These pressures were compounded by surging water prices and falling allocations associated with the Millennium Drought.

The response of many growers was to take their land out of production, by cutting off water and allowing the vines to die (‘drying off’). Given the up-front costs incurred in planting those vines, drying off represents a significant decision – as Watson and Cummins (2009) note, ‘stripped to its essentials, the scrapping decision implies that expected annual revenues will be (permanently) less than annual costs’61. Rather than being confined to a few struggling properties, this activity was widespread throughout the MOIA, as shown Figure 9.

![Crop types and dried-off land (ha) 1997-2013](chart.png)

**Figure 9 – Grape and other crop types and dried-off land in the Mildura area (ha), 1997-2012 (Argus, 2012)**

As shown in Figure 9, irrigators in the MOIA were forced to dry off their land at a rapid rate in the wake of losses from the wine grape crash. In 1997, less than one per cent of the irrigation district was dried off. By 2012, this figure had reached 30 per cent.

**Case study – Merbein Secondary School**

The experience of the Merbein Secondary School in the wake of the wine grape crash is instructive. In 1964, the school had planted two hectares of its vacant land with grapes, revenue from which was used to fund the purchase of equipment for the school for the next forty years.

In 2005, the school received a $30,000 return from Chardonnay grapes grown on the property, at a historically strong price of $720/tonne. By 2007, wine grape prices had fallen so steeply that the vineyard was bulldozed62.

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61 (Watson & Cummins, 2011)  
62 (Port, 2006)
2.4.2 - Closer settlement squeeze

The MOIA is historically referred to as a ‘closer settlement’ – an agricultural community in which farm businesses and the regional centre are located in close proximity to one another. For farm businesses, this settlement pattern creates two problems over time; farmers become increasingly constrained by their neighbours, and farmland comes under pressure to be merged into the nearby urban area.

The binding nature of this settlement pattern became increasingly clear in the early 2000s, when the wine grape fall exposed the inability of many MOIA producers to farm at modern commercial scales. These issues were considered by the Mildura Housing and Settlement Strategy background report, commissioned in 2013 by the Mildura City Council. The report neatly summarised the barriers to farm development in the MOIA:

...in Australia the productively gains that have been made to date (which have kept farming businesses viable) have tended to rely on increasing the size of farms. In essence, the ‘get big or get out’ scenario. Within the Mildura context this has occurred relatively successfully within the broadacre and New Irrigation Districts but appears to be more problematic within the Older Irrigation Areas.63

This inability of MOIA producers to expand to offset their declining terms of trade effectively restricted the rate of adjustment in the area, and saw producers running farm businesses which were increasingly sub-economic.

2.4.3 - Water reform - winners and losers

At the same time as the effects of the wine grape crash were being felt, MOIA irrigators were coming to terms with changes in their entitlement to receive, use and sell water. Prior to 1987, water was nominally attached to parcels of land, and the ability to trade water between geographically distant areas was restricted to times of extreme need, such as the 1966-67 drought64. Against a background of increasing demand for water (aggregate water use in Australia increased by 65 per cent between 1983-84 and 1996-9765) and concerns about salinity, government began to impose tighter controls on the issue of water extraction licenses. In 1991, the Victorian Government introduced water trading within irrigation districts. In 1994, it expanded this to allow trade between districts (subject to an annual cap of two per cent of annual entitlements, which was later increased to four per cent, and wholly lifted in 201466).

The goal of introducing water trading was to enable producers who stood to benefit the most from the water to purchase it – or ‘to enable the water to flow to its highest-value use’. In effect, this was a process of revelation, where governments and water authorities could step back and see which regions were the most willing (and able) to pay for water.

As it transpired, irrigators in the MOIA preferred to sell water than to buy it. The introduction of water trading saw a net outflow of water entitlements from the MOIA to other regions. This was a

63 Ref Mildura housing strategy draft report, p.49
64 (National Water Commission, 2011)
65 (National Water Commission, 2011)
66 (National Water Commission, 2011)
cause of concern for the First Mildura Irrigation Trust, which operated and maintained the network - as the ACCC noted in 2006:

‘Many infrastructure operators fear that water entitlements will flow out of their districts with any expansion in interregional trade. To date, Goulburn-Murray Water and the First Mildura Irrigation Trust have experienced the largest outflow of permanent entitlements. Since 1998, the cumulative net permanent trade out of these regions has represented 5.8 and 4 per cent of their current water entitlements respectively.’\(^{67}\)

The fear on the part of infrastructure operators reflects the dual nature of water trading. For individual irrigators, being able to sell their water to raise capital is a useful risk management tool. For irrigator collectives such as the First Mildura Irrigation Trust, maintenance of the irrigation network relies on local irrigator levies, and any trade-out of water enables irrigator exit – and the erosion of their levy base.

Importantly, the water from the MOIA was being traded only a few kilometres upstream – largely to private diverters. These were large businesses which had opted against taking part in the MOIA-style collective irrigation model, instead preferring to find greenfield sites elsewhere along the river to build their own, private irrigation networks. New technology was making this option increasing feasible – as Watson and Cummins note:

‘…cheap pumps…have changed the economic balance between the large-scale shared irrigation infrastructure that characterised the old irrigation settlements, and individual irrigation operations - that are now based on privately owned pumps and separately conducted irrigation systems.’\(^{68}\)

For the First Mildura Irrigation Trust, this was a harbinger of decline for the old collective model. In a letter to the Productivity Commission as part of a group of local irrigation trusts, it noted:

‘Large corporate developments using investors’ funds are able to install large, low maintenance water delivery systems enabling them to deliver water to their property boundaries at a significantly lower cost, compared to government-run systems designed at the turn of the last century.’\(^{69}\)

The concluding remark about systems designed at the turn of the last century was critical. Since 1895, maintenance and improvement of those systems had been the responsibility of the First Mildura Irrigation Trust. In the 2000s, it was becoming increasingly clear that these systems had fallen behind their competitors. This raised two questions: who was going to pay for them to catch up, and given the parlous state of the old irrigation area, was it worth doing?

2.4.4 - Governance – the First Mildura Irrigation Trust's demise

The First Mildura Irrigation Trust was a remarkable study in longevity. Appointed by the Victorian Government in 1895 to oversee operation of irrigation in the Mildura irrigation district (as shown in Figure 1), by 2005 it was the last of its kind. Responsibility for management of water resources

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\(^{67}\) (ACCC, 2006), p.24  
\(^{68}\) (Watson & Cummins, 2009), p.5  
\(^{69}\) (Sunraysia Irrigators Council Inc., 2005), p.2
throughout the Murray-Darling Basin had been progressively transferred over time to statutory water authorities such as Lower Murray Water and Goulburn-Murray Water, who were directly accountable to the Victorian Water Minister. In contrast, the First Mildura Irrigation Trust remained an irrigator-appointed collective, managing a relatively small area of irrigated land with less accountability to government than either of its larger contemporaries.

By the mid-2000s, the Trust was in a difficult position. It was responsible for maintaining and upgrading the 120-year old irrigation network, against a backdrop of significantly more efficient private networks emerging along the river. Irrigation infrastructure is capital-intensive and expensive to maintain – large river pumps and channels are lumpy investments that degrade over time and require periodic renewal or replacement, sometimes at great expense. The Trust relied on irrigator levies to fund this work; however, irrigators were reeling from the catastrophic reversal of wine grapes, and some were being forced to sell water entitlements as a last-ditch measure to shore up their capital base. In this environment, imposing additional levies ran the risk of sending more irrigators to the wall, further eroding the Trust’s rates base.

Although there are no public evaluations of the condition of the district’s irrigation infrastructure at the time, it is probable that it suffered as a result. Whereas Goulburn-Murray Water and Lower Murray Water were required to meet agreed accounting standards for regular valuation of their irrigation assets, the First Mildura Irrigation Trust conducted its evaluations behind closed doors, using its own methodology.

In 2004, the Trust flagged plans to improve a section of the irrigation district from open channels to pressurised pipeline, as part of periodic upgrade plans. Following negotiations, in 2007 the Victorian Government granted a $4.7 million loan to the Trust to partially fund the work. However, the Trust invested a portion of the loan funds in investments which subsequently lost value in the Global Financial Crisis. In response, the Victorian Government conducted an audit of the Trust’s finances, and stripped it of its responsibility for managing the Mildura irrigation network – a role it had fulfilled for 112 years.

Once the First Mildura Irrigation Trust was dissolved, responsibility for management of all of the MOIA’s irrigation infrastructure was vested in the neighbouring statutory water authority, Lower Murray Water. In this process, Lower Murray Water inherited an irrigation district in need of fundamental maintenance, with an irrigator rate base facing extreme financial hardship stemming from falling commodity prices and drought. The area was in need of benevolent intervention.

2.5 - Commonwealth intervention in the MOIA

By 2005, farmer finances in the MOIA were at extreme lows. Many farmers had seen their contracts with processors torn up in the wake of weakening consumer demand, and some growers opted to let fruit rot on the vine rather than harvest it. Anecdotally, the local Rural Financial Counselling Service was experiencing more demand for its services than any of its contemporaries across the country.
Victoria. Irrigators were lobbying the government for increased support or exit subsidies to support industry adjustment, and were looking for signs of improvement in their businesses. Against this background, the Commonwealth embarked on an ambitious series of water reforms which were to have important implications for the MOIA.

2.5.1 - The Basin Plan
Nearly 200 years of debate between states over their respective rights to extract water from the Murray and its tributaries came to a head on 3 July 2008, when members of the Council of Australian Governments (COAG) signed an agreement that the states’ powers to allocate water from in the Murray-Darling Basin would be referred to the Commonwealth76. This marked the culmination of extensive COAG negotiations, after decades of environmental pressure on the Basin had been brought into focus by the Millennium Drought. The Commonwealth stepped in to simplify management of the Basin’s water resources through introduction of the Water Act 2007, the principles of which were – grudgingly in some cases – acceded to by the states77.

In the discussion about whether to refer the states’ powers to the Commonwealth, the proposed cap on water extractions from the river system was a recurring theme. A cap had existed since the early 1990s; however, the Commonwealth was proposing that it be reduced, in order to restore environmental flows in Basin. While there was a consensus that the river system was badly degraded and in need of better management, state governments feared that regional irrigation communities – such as Mildura and the Goulburn Valley – would suffer as irrigators sold their water to the Commonwealth, and left the land.

To allay these concerns, the Commonwealth Government offered the states a $3.7 billion quid pro quo: the money to upgrade their ageing irrigation networks78. These upgrades were designed to make the networks more efficient, and offset the reduction in water associated with any Commonwealth buybacks. As part of the signing of the agreement, the Commonwealth outlined a series of state priority projects which would be funded ‘subject to due diligence’. The second project on Victoria’s list was $103 million to upgrade the MOIA.

The Commonwealth’s decision to invest in the MOIA took place in a broader context of similar projects across several parts of the Murray-Darling Basin. While the economic merit of some of these investments may be called into question, the nature of the decisions highlight the constraints placed on modern policy makers, when faced with a situation where several decades of ad-hoc investment in irrigation networks have produced large vested interests79. Balancing these interests with contemporary demands for use of the water resource presented a difficult challenge for the Commonwealth in the context of the Basin Plan, including in the case of the MOIA upgrades.

Due diligence hurdles
The commitment of Commonwealth funding to improve the ageing infrastructure in the MOIA represented an important injection of capital and confidence for the district. It also addressed some of Lower Murray Water’s short-term concerns about remedial work on large pumps which were fundamental to the continued operation of the area’s irrigation network. However, while the funds

76 (Commonwealth Government, 2008)
77 (Kildea & Williams, 2011)
78 (COAG communique, 2008)
79 (Watson & Cummins, 2012)
had been committed to in principle, Victoria was still required to demonstrate that the upgrades would satisfy the Commonwealth’s due diligence requirements. Under these requirements, prospective projects had to satisfy the following three criteria:

‘(a) projects must be able to secure a long-term sustainable future for irrigation communities, in the context of climate change and reduced water availability in the future;

(b) projects must deliver substantial and lasting returns of water to the environment to secure real improvements in river health;

and

(c) projects must be value for money in the context of the first two tests’80.

The Victorian Government then tasked Lower Murray Water with the development of a business case for the improvements to the MOIA which would fulfil the requirements set out above.

Clearing the hurdle

Lower Murray Water engaged a consultancy firm to develop the business case for the MOIA upgrades, at a cost of approximately $620,00081. While the business case was not made public, early drafts indicated it would include a proposal for a comprehensive multi-stage update of the irrigation network, with the first stage to be funded by the Commonwealth at the cost of $103 million82. However, the business case projected relatively meagre water savings of 4.5 gigalitres from the upgrades. This reflected the fact that substantial effort had already gone into removing the worst of the leaky infrastructure in the MOIA in the 1990s – in effect, most of the low-hanging fruit was gone83. In comparison, the second stage of the Northern Victorian Irrigation Renewal Project – the other large Victorian upgrades project being proposed – promised 204 gigalitres of water savings at a cost of $1 billion to the Commonwealth84, a significantly more cost-effective ratio of dollars-to-water saved.

Anecdotally, Lower Murray Water had already begun advertising for earth-moving contractors to begin the irrigation upgrades when the business case was submitted to the Commonwealth in 201185. This came to an abrupt halt when the Commonwealth refused to fund the business case based on the estimates provided, and the Victorian Government was asked redo the business case.

2.5.2 - Getting over the line

The Mildura Development Corporation, an organisation controlled by the Mildura Rural City Council, was tasked with development of the revised business case in 2012. Following extensive discussions with the Commonwealth, the new business case was accepted in December 201386. It proposed a streamlined, single-stage upgrades process which combined essential maintenance of key river pumps with limited upgrades to channels and pipelines in the MOIA, at a total cost of $120 million.
(to be shared by the Commonwealth and Lower Murray Water as costs of $103 million and $17 million, respectively).

The revised business case proposed returning 7 gigalitres of water to the Commonwealth in the form of environmental flows. The language used here was carefully chosen – whereas the first iteration of the business case committed 4.5 gigalitres of water ‘savings’ to the Commonwealth (in the same way other projects throughout the Basin committed savings), the second version only noted that 7 gigalitres would be ‘returned’ to the Commonwealth. This indicated that Lower Murray Water was prepared to trade away some of its limited water resource in return for infrastructure funding, even where that infrastructure would not recoup all of the lost water through improved water-use efficiency.

In 2013, the first tranche of $103 million of Commonwealth funding was released to fund the upgrades to the MOIA outlined in the business case. The business case was never made public, and the Commonwealth’s release of money attracted little attention outside of the irrigation community and government, being relatively small in the context of projects being funded elsewhere in the Basin. In this way, the Commonwealth and Victorian Governments were able to avoid several difficult questions about the business case. These questions are set out below.

2.6 - Summary
The aim of this thesis is to investigate the questions that arise in the absence of a publically-available business case. These questions include calculating the benefits that would accrue from the upgrades. In addition, would those benefits ‘secure a long-term sustainable future’ for irrigators in the MOIA, as stipulated by the Commonwealth? And could a large investment of taxpayer funds be justified when more fundamental forces were pushing irrigators out of the MOIA?

These questions are addressed by examining what would have to go right for the upgrades to succeed; at a minimum, they would need to at least cover their own costs.

From this base assumption, there is a need to consider what else would need to happen for the upgrades to achieve the government’s goals. Is the boost they create likely to reverse the steady decline of the MOIA as a whole – and secure its ‘long-term sustainable future’? And what are the implications for the regional economy?
Chapter 3 - The MOIA upgrades: costs and benefits

3.1 - Introduction
In this chapter, the costs and benefits of the irrigation infrastructure upgrades program in the MOIA are presented. The details of the MOIA upgrades are also contrasted with other, similar programs in the Murray-Darling Basin.

3.2 - Use of cost-benefit analysis
When seeking to assess the policy merit of the infrastructure upgrades, it is necessary to use a methodology which is robust, transparent and capable of estimating the project’s prospective costs and benefits over time. This thesis uses cost-benefit analysis for this purpose.

Where governments with limited funds are faced with numerous competing investment options, cost-benefit analysis can be used both to evaluate the value of projects in isolation and to rank competing projects by value. As a result, this form of analysis is extensively used by governments to inform public investment decisions, and it is an appropriate means of assessing the merit of the government’s investment in the MOIA upgrades program87.

In its simplest form, cost-benefit analysis aggregates the costs and benefits of a project and represents them in a single measure. By detailing the data which makes up the aggregate, cost-benefit analysis enables a rigorous accounting of a project’s merits, set out in a transparent fashion which is open to interrogation.

In this context, sections 3.5 – 3.7 of the thesis identify and estimate the value of the costs and benefits of the MOIA upgrades. Importantly, these estimates consider financial costs and benefits only (such as infrastructure costs and crop returns). Non-financial costs and benefits, such as the psychological benefit to farmers of remaining on their land, are not considered. Estimating the value of these benefits is highly subjective and does not form part of the analysis for this reason.

In the case of the MOIA upgrades, the project’s costs and benefits will be realised at different times. Many of the costs will be incurred early in the project’s life, with the related benefits to flow in the subsequent years. To enable accurate comparison of future costs and benefits at one point in time, cost-benefit analysis typically employs a discount rate to reduce the present value of future costs and benefits. This reflects society’s ‘time preference’ for consumption in the present over consumption in the future. In effect, the analysis considers that future costs and benefits will be worth less than present costs and benefits, and discounts them at a uniform rate (the calculation of which is detailed further in Section 4.2).

By aggregating the total costs and benefits of a project over time, and discounting the value of future costs and benefits at an established rate, cost-benefit analysis enables the total values of a project’s costs and benefits to be expressed at the current point in time. The ratio of these measures represents the cost:benefit value of the project. While this measure is useful for

87 (Sinden & Thampapillai, 1995)
evaluating a project’s value in isolation, it is also used to compare and rank several, competing projects. This is explored further in Section 5.3.

3.3 - Objectives of the upgrades program
The physical upgrades to the network have clear objectives - to improve the pumps and pipes to provide pressurised water to a large part of the district, with more accurate water metering. These changes will create a more complex range of benefits for irrigators and the water authority. The links between the upgrades and the type of benefits to be realised are set out here as the first step in the cost-benefit analysis.

The objectives of the upgrades program are to ‘modernise the water delivery systems across the Mildura, Red Cliffs and Merbein irrigation districts by upgrading pump stations, replacing sections of channels with pipelines, installing modern metering systems and upgrading regulators’88. By doing so, the upgrades aim to ‘substantially increase the quality and reliability of water supplies in the irrigation districts’, and ‘provide the opportunity for new plantings and different crops, as well as potentially improving yields in existing crops’.89

3.4 - Elements of difference with other upgrade programs
The major benefits of the MOIA upgrades will not be in the form of water savings, as has been the case in similar irrigation renewal programs elsewhere in the Murray-Darling Basin. Whereas programs in areas such as the Goulburn Valley typically upgraded leaky earth channels, those changes had already been made by the early 2000s in the MOIA, where producers faced with high evaporation rates and low water availability had sought to improve their water use efficiency90.

When the original business case for the upgrades was submitted to the Commonwealth Government by Lower Murray Water in 2008, it was rejected on the grounds that the promised water savings did not meet Commonwealth targets. This is not a reflection of the quality of the proposed upgrades, but rather of the fact that most of the low-hanging fruit of water use efficiency gains in the MOIA has already been harvested.

The major benefits of the upgrades process instead come in the form of improving the timeliness and quality of producers’ access to water – enabling them to plant new, higher-value crops which take advantage of this reliability. The upgrades will improve several parts of the delivery network, and will create a host of secondary water and production efficiency benefits.

3.5 - Calculating the costs and benefits
The cost of delivering the upgrades program is $120 million. Quantifying the benefits of the upgrades is less straightforward, as they are a mix of water use efficiency gains, water quality improvements and the opening up of new production options for farmers. Capturing these opportunities will also involve a number of future costs, as farmers making the proposed transition to new crops will incur significant changeover and opportunity expenses.

While some of the costs and benefits are simple to measure, others are more difficult to predict as they depend on the rate at which farmers adapt, or on future commodity price shifts. An estimate

88 (Lower Murray Water, 2014b), p.3
89 (Lower Murray Water, 2014b), p.6
90 (Mallee CMA, 2014)
of these variables needs to include this flexibility to enable sensitivity testing of how future changes in the variables would influence the final benefit : cost ratio.

The various sub-projects which make up the upgrades, their effects and the nature of the benefits they create are set out in Table 1. In this chapter, these benefits are analysed in detail. By examining the scope of each benefit its likelihood of being realised, the impact on the farm bottom line can be calculated. These figures are used to inform the cost-benefit analysis.

**Table 1 - Components of the upgrades process and their benefits**

*(Lower Murray Water, 2014b)*

<table>
<thead>
<tr>
<th>Physical upgrade</th>
<th>Effect</th>
<th>Nature of benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Replacement of open channels with pressurised pipelines.</td>
<td>Removes need for periodic decommissioning of channels for dredging and maintenance.</td>
<td>Irrigators can produce crops which require 365-day/year water.</td>
</tr>
<tr>
<td></td>
<td>Pipelines reduce potential for wind-borne contamination of irrigation water.</td>
<td>Reduced on-farm filtration costs.</td>
</tr>
<tr>
<td></td>
<td>Water transmission losses significantly reduced.</td>
<td>Reduced cost to Lower Murray Water through distribution losses.</td>
</tr>
<tr>
<td>Installation of 2,000 new water meters at farm outlet points.</td>
<td>Inaccurate mechanical meters (Dethridge wheels) are replaced with highly-accurate mag-flow meters.</td>
<td>Lower Murray Water better able to quantify water received by irrigators.</td>
</tr>
<tr>
<td></td>
<td>New meters equipped with remote telemetry will have reduced monitoring costs.</td>
<td></td>
</tr>
<tr>
<td>Upgrade of pump stations</td>
<td>Automated control of pump flows</td>
<td>Real-time supply increases energy efficiency of pumps.</td>
</tr>
</tbody>
</table>
3.5.1 - Major benefit: access to pressurised, 365 days per year water

When announcing funding for the upgrades, the Commonwealth Government highlighted that ‘providing irrigators in the region with a more reliable, quality water supply, enabling them to produce higher value crops’\(^91\) was a key objective of the program. In this section the likely extent and benefits of this crop diversification are set out.

To understand these benefits, it is useful to explore the limitations imposed by the existing irrigation network. The area of the MOIA which will benefit from the upgraded irrigation network (76 per cent)\(^92\) is currently serviced by a mixture of manual and automated river pumps, which feed into a series of open concrete channels. The channels then supply water to the boundary of irrigator properties by gravity feed, from which point the water is distributed around the farm through a mix of gravity feed and irrigator-owned pumps.

In practice, this imposes a number of constraints on the irrigated water supply. These constraints are:

- The open channel system is decommissioned in stages for several weeks every winter for dredging and maintenance\(^93\). During this time, affected irrigators rely on on-farm storages or stored soil moisture. This effectively limits growers without on-farm water storage to crops which can survive for short periods during winter with little or no moisture – typically, grape vines.
- The main pumps are a mix of automated and manual systems, which creates lags between irrigators ordering water and receiving it – impairing their ability to fine-tune water delivery to match crop conditions and daily temperatures\(^94\).

By removing these limitations, the upgrades program is designed to improve the quality of crops by giving producers greater control over the watering regime, enabling both better management of existing crops and the establishment of crops which require water during the usual winter channel maintenance period.

The issues highlighted in Chapter 2 are important in this context. A significant proportion (45 per cent by area\(^95\)) of the MOIA produces wine grapes. Around 90 per cent of this production is unprofitable\(^96,97\) with significant negative consequences for farmer and community wellbeing\(^98\). By improving the timeliness of water availability, the upgrades program aims to incentivise irrigators to diversify into new, more profitable crops.

The proponents of the upgrades have not put forward a list of new crops for investment (presumably to avoid picking winners), although Lower Murray Water has suggested table grapes as

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\(^{91}\) (Victorian Minister for Water, 2013), p.1
\(^{92}\) (Lower Murray Water, 2015)
\(^{93}\) (Lower Murray Water, 2015a)
\(^{94}\) (Lower Murray Water, 2014b)
\(^{95}\) (Argus, 2012)
\(^{96}\) (Winemakers’ Federation of Australia, 2015)
\(^{97}\) (Retallack, 2012)
\(^{98}\) (Godwin, 2014)
a key option during public consultation. Anecdotally, late-season table grapes and winter vegetable crops have been raised as key opportunities for producers.

It is important to note that although the improvements to water availability created by the upgrades are considerable, they are unlikely to create a large-scale change in the production capacity of the MOIA. The upgrades will be limited to 76 per cent of the irrigation district, with the future of the remainder uncertain. Further, many farmers will still not be able to take full advantage of the opportunities offered by the upgrades, as their production systems are structured around the existing water distribution system, and restructuring is costly. These issues are explored in more detail in Chapter 5.

3.5.2 - Calculating the benefits of a pressurised, 365-day system
Irrigators in the MOIA considering whether to change their crop are confronted with a number of difficult decisions. In practice, the probable return of the crop, its establishment cost, and the capacity of the irrigator to grow it all have a significant influence on the rate at which transition to new crops takes place.

Estimating the value of the crop diversification options created by the upgrades requires two separate calculations. The first is the extra value of each of the new crop types. The second is the rate at which those crops are likely to be established.

3.5.3 - New crop options
A hypothetical farmer in the pumped irrigation district has access to a range of cropping options. These options are physically limited by the area’s warm climate and soil types (which suit some but not all types of horticultural production), and practically restricted to crops which promise an adequate financial return. Key commodity types likely to benefit from the irrigation upgrades, their average farm gate returns and average production costs are presented below. The up-front costs of making the transition to the new crop are also detailed, both in terms of capital expense and the opportunity cost of foregone production.

While the future returns offered by prospective crops are an important part of the cost-benefit analysis, equally important is the rate at which they replace existing crops. This rate of transition from old crops to new crops is driven by a combination of up-front costs (mentioned above) and other barriers to adjustment which are more difficult to quantify.

For example, installation of a new table grape crop may require new trellis and sprinkler systems which cost $30,000/ha to install. Switching to table grape production may also require a different – and considerably more sophisticated – set of production skills on the part of the farm owner. Further, the farmer may need robust capital reserves to fund the up-front expense the transition creates.

Each of these factors has a strong influence on the likelihood of the farmer installing a new crop, and hence on the rate of transition from old crops to new crops. These rates are difficult to quantify, but

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99 (Lower Murray Water, 2013b)  
100 (Lower Murray Water, 2015b)  
101 (Sinnett, Dalton, Pitt, & Downey, 2012)
some idea can be gauged by observing past rates of adjustment using historical data. These issues, and a predicted rate of transition, are set out in Section 3.5.

**General points about crop options**

When seeking to identify crops which are likely to benefit from the irrigation upgrades, this analysis assumes that farmers in the MOIA are restricted to crops which can generate a commercial return from a modest scale. As outlined in Section 5.4.4, the majority of farms in the area are less than 15 hectares in size, with comparative production advantages in crops which can attract a quality premium and reward small businesses’ attention to detail.

Viticulture (grape production) has been the main enterprise in the MOIA for several decades\(^{102}\). The proportion of land given over to the various types of grape production – wine grapes, dried fruit and table grapes - has fluctuated during the irrigation area’s life. By 2012, following 15 years of declining wine grape prices\(^{103}\), 85 per cent of the cropped area was still dedicated to grape production\(^{104}\). The remaining 15 per cent of the cropped area was evenly distributed between citrus production, nuts, other fruit, and a variety of vegetables. This analysis focuses on grape production – and in particular, table grapes – as a key diversification option for producers, reflecting their expressed preferences over time.

While producers in the MOIA may also seek to diversify into other crops, such as vegetables and citrus, they are generally poorly-placed to compete in horticulture markets which tend to be suited to large-scale production. As Watson and Cummins (2011) note in the case of almonds:

> Modern technology allows almond orchards to operate on a large scale. Since land and irrigation is most often cheaper outside the [old irrigation] districts, it seems unlikely that almonds have much of a role to play in adjustment of the old irrigation area.

In this context, the main crop diversification options for producers in the MOIA are set out below. For each option, estimates of their ongoing farm gate returns and costs are detailed, along with their up-front costs of installation.

**Table grapes**

Growers in the Mildura region (which includes the pumped districts and irrigation areas upstream to Robinvale) produce 69 per cent of Australia’s table grapes\(^{105}\). In the most recent (2012) survey of production in the region, table grapes had become the area’s dominant commodity, doubling in size since 1997 to account for 35 per cent of the area under production (wine grapes were second at 34 per cent)\(^{106}\).

In this context, table grapes have been identified as a key expansion opportunity for growers in the area. Lower Murray Water noted that the upgrades program ‘provides the potential for diversification of land use by enabling extended watering of late summer crops (i.e. table grapes), continuous irrigation crops and winter specific cropping’ (Lower Murray Water 2013, p.4). As the domestic market for table grapes is highly competitive during seasonal peaks, producers who can

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\(^{102}\) (ABC Landline, 2010)

\(^{103}\) (Argus, 2014)

\(^{104}\) (Mallee CMA, 2014)

\(^{105}\) (Mildura Development Corporation, 2015a)

\(^{106}\) (Argus, 2012)
supply product during shoulder periods have the opportunity to capture significant price premiums\textsuperscript{107}.

**Farm gate returns**

The gross value of table grape production varies significantly from year to year, in line with seasonal shifts in the domestic market and fluctuations in international market access and pricing\textsuperscript{108}. The average farm gate value of table grapes for producers in the region surveyed in 2014 was $29,869/ha (in 2015 dollars, adjusted for inflation)\textsuperscript{109}. This average was based on a unit price of $1,250/tonne and yield of 24 tonnes per hectare.

This is consistent with yield modelling conducted by Ngo in 2002, which estimated farm gate returns to be $31,250/ha at 2015 prices\textsuperscript{110}, assuming a unit price of $1,250/tonne and yield of 25 tonnes per hectare. Accordingly, the survey result of $29,869/ha is used for the cost-benefit analysis.

It is important to note that prices have varied significantly over and below this level in recent years in response to changing domestic and international competition, and quality downgrades forced by extreme weather events\textsuperscript{111}.

**Cost of production**

The costs of table grape production are several times higher than many alternative crops, including wine grapes. While wine grapes are heavily processed before consumption, the sale of table grapes relies on the cosmetic quality of the fruit – and is hence subject to stringent quality standards.

The increased emphasis on product quality relative to more processed fruit types increases the physical inputs to table grape production significantly. Water is used more regularly for to support robust fruit growth, but also to protect fruit quality during periods of extreme heat or cold\textsuperscript{112}. As a result of this and of higher planting density, table grape production requires almost twice as much water as wine grape production (9.8 megalitres/ha to 5.1 megalitres/ha, respectively)\textsuperscript{113}. Grapes are stored in on-site cool-rooms prior to transport, which adds to on-site infrastructure costs.

In addition to this, the most significant cost in table grape production is labour. While wine grapes and dried fruit are sprayed, pruned and harvested mechanically, these activities are performed manually with table grapes\textsuperscript{114,115}. As a result, the labour costs of table grape production are considerable – estimated at between 70 and 85 per cent of the total cost of production\textsuperscript{116}.

\textsuperscript{107} (Hawke, 2009)  
\textsuperscript{108} (Argus, 2014)  
\textsuperscript{109} (Argus, 2014)  
\textsuperscript{110} (Ngo, 2002)  
\textsuperscript{111} (Hawke, 2009)  
\textsuperscript{112} (Proffitt & Campbell-Clause, 2011)  
\textsuperscript{113} (Argus, 2014)  
\textsuperscript{114} (Victorian Government Rural and Regional Committee, 2011)  
\textsuperscript{115} (Hawke, 2009)  
\textsuperscript{116} (NSW Parliament Hansard, 2003)
Ngo (2002) estimates the cost of production to be $26,200/ha\textsuperscript{117} adjusted for inflation. This figure is used in the cost-benefit analysis.

\textbf{Cost of establishment}

Switching a farm’s production to table grapes is a significantly different proposition to producing other grape crops (wine grapes or dried fruit). Table grapes use a trellis system which cannot be appropriated from other types of viticulture, as it uses a narrower spacing than that of wine grapes and dried fruit\textsuperscript{118}.

While table grapes can be grafted onto existing rootstock, the quality of the fruit typically begins to deteriorate after three years of production, reducing the incentive to use this technique. In practice, the establishment of table grapes typically involves the removal of all existing vines and infrastructure, effectively creating a greenfield site.

Sinnet et al. (2012) estimates the physical cost of establishing table grapes (trellis, vines, irrigation infrastructure and labour) to be $25,000 per hectare for a basic system\textsuperscript{119}. This may a conservative estimate – as anecdotal advice from irrigators in the MOIA estimated establishment costs to be in the order of $35-$45,000/ha. Ngo (2002) estimated establishment costs to be $45,400/ha, adjusted for inflation\textsuperscript{120}.

As highlighted by Sinnet et al. (2012), ‘there is a significant labour requirement in the first two years of establishment’, and a further delay between establishment and first yield. Table grape vines typically have zero yield in their first year, rising at an annualised rate of approximately 20 per cent thereafter, and reaching full yield in their sixth year\textsuperscript{121}.

In this context, the establishment costs of table grapes are conservatively estimated for the purposes of the cost-benefit analysis to be $35,000/ha.

\textbf{Vegetables}

A variety of seasonal vegetables including onions, potatoes, squash and broccoli are grown in the MOIA\textsuperscript{122}. Vegetable production remains a small proportion of overall production in the MOIA, occupying four per cent of the irrigated area in 2012\textsuperscript{123}. The composition of the vegetable crop varies from year to year, as producers seek to take advantage of market opportunities or manage risk associated with their main crop\textsuperscript{124}. The result is that the area of the MOIA dedicated to vegetable production varies over time. For example, between 2006 and 2009 the area dedicated to vegetable production in the MOIA fell by a third, only to rebound by 45 per cent by 2012\textsuperscript{125}. This highlights the willingness of farmers to use vegetable crops as a flexible production alternative, but usually as an adjunct to the main crop.

\textsuperscript{117} (Ngo, 2002)
\textsuperscript{118} (Hannah, Jaensch, & Moulds, 2002)
\textsuperscript{119} (Sinnett et al., 2012)
\textsuperscript{120} (Ngo, 2002)
\textsuperscript{121} (Ngo, 2002)
\textsuperscript{122} (Top & Ashcroft, 2005)
\textsuperscript{123} (Argus, 2012)
\textsuperscript{124} (Watson & Cummins, 2011)
\textsuperscript{125} (Argus, 2012)
In a study commissioned by the Victorian Department of Primary Industries, Watson and Cummins (2011) noted that it was unlikely that vegetable production will ever become the main production type in the area, stating that:

This [vegetable] category includes a plethora of small one-off and often successful products operating in so-called niches in the highly differentiated domestic market for fruit and vegetables. The whole point of a niche is that it is a niche; once filled, there is not much room for others. There is not much prospect that the aggregate production of these activities would fill the void created by the contraction of major irrigated industries.

The point here is that the domestic market for fruit and vegetables is such that it is unlikely that these crops will occupy a significant proportion of Sunraysia’s irrigation districts.\(^{126}\)

Despite this, the opportunities offered by the irrigation upgrades – particularly for the planting of seasonal winter crops – are likely to induce more producers to transition to vegetable production. The likely benefits of that production are summarised below.

**Farm gate returns**

Estimating the farm gate value of vegetable production is complex due to the wide variations in price across the commodities which make up the ‘vegetables’ category. Detailed farm budget data on revenue and production costs for various vegetable commodities can be combined with the main vegetables produced in the MOIA to produce a weighted average farm gate return of $19,225/ha, based on a yield of 14 tonnes/ha at $1,370/tonne\(^{127}\).

Notably, the irrigation upgrades will enable vegetables to be grown for an extended period over the winter months, when the irrigation network would otherwise be closed for maintenance. The typical winter shutdown period is six weeks spread over the course of two months\(^{128}\); the upgrades will effectively enable vegetables to be produced for an extra 12 per cent of the year. The estimated rate at which producers transition to vegetable production in the cost-benefit analysis has been adjusted to reflect this incentive.

**Cost of production**

Farm budget data prepared by the NSW DPI (2013) suggests that the weighted average production cost of the main vegetable crops produced in the MOIA is $16,839/ha. This is based on a weighted average yield of 14 tonnes/ha at an average production cost of $1,200/tonne\(^{129}\).

This estimate is used in the cost-benefit analysis, noting that variations in the vegetable crop mix in the MOIA are likely to change these weighted averages. However, the ratio of crop production revenue to costs is likely to be significantly more stable, given the ability of producers to identify and exploit niches in vegetable production (as discussed by Watson and Cummins, 2011).

\(^{126}\) (Watson and Cummins 2011, p.12)
\(^{127}\) (NSW Department of Primary Industries, 2013)
\(^{128}\) (Lower Murray Water, 2015a)
\(^{129}\) (NSW Department of Primary Industries, 2013)
**Cost of establishment**

The cost of establishing vegetable crops is lower than that of table grapes, as vegetables do not rely on the expensive trellis infrastructure required for viticulture. Further, the opportunity costs of foregone production incurred by perennial plants are largely avoided, as crops are ready for harvest within a few months. The NSW DPI suggests the average cost of preparing the ground and installation of the associated irrigation infrastructure is $12,000/ha\(^{130}\). This figure is used in the cost-benefit analysis.

**Citrus**

The importance of citrus as a regional crop has declined over the past two decades, with the area under production falling from 555ha in 1997 to 265ha in 2012, or two per cent of the irrigated area. This decline is partly attributable to international competition created by the development of new frozen juice concentrate technologies in the 1990s\(^{131}\), and its effect on domestic fruit prices.

Citrus production in the MOIA is hindered by its need to access year-round water, and the shutdown of sections of the irrigation network during the winter channel maintenance period. Farmers during this time rely on on-farm storage to water crops. Accordingly, citrus production is seen as a potential beneficiary of the upgrades program.

Profitable production and marketing of citrus is a challenging proposition for small block owners in the MOIA. The WA Department of Agriculture notes:

> ‘A small fruit producer will compete in the same markets as bigger producers, with their years of experience and economies of scale. A local market niche, which has provided high returns to existing orchardists, may not exist in two to three years as fruit growers are quick to notice and take advantage, causing an oversupply. Small, specialised, high return crops would generally have the associated high risks attached’\(^{132}\).

Despite this, new access to overseas export markets\(^{133}\) and recent falls in the Australian dollar have generated some interest in developing new citrus investments in the area. Importantly, approximately 50 per cent of citrus grown in the Murray Valley is exported internationally\(^{134}\).

**Farm gate returns**

A 2013 Federal Parliamentary review of the Australian citrus industry received numerous submissions from Victorian producers on the average revenue and costs of citrus production\(^{135}\). While the farm gate returns for citrus vary seasonally and in response to changes in market access, several submissions to the review cited average farm gate returns of $15,000/ha\(^{136,137}\), based on an average yield of 50 tonnes/ha at $300/tonne. This figure is used in the cost-benefit analysis.

\(^{130}\) (NSW Department of Primary Industries, 2013)

\(^{131}\) (Watson & Cummins, 2011)

\(^{132}\) (WA Department of Agriculture and Food, 2015a)

\(^{133}\) (Citrus Australia, 2015)

\(^{134}\) (Murray Valley Citrus Board, 2013)

\(^{135}\) (Commonwealth Rural and Regional Affairs and Transport References Committee, 2013)

\(^{136}\) (Commonwealth Rural and Regional Affairs and Transport References Committee, 2013)

\(^{137}\) (Murray Valley Citrus Board, 2013)
In 2010-11 Australia produced 428,500 tonnes of citrus\textsuperscript{138}; approximately 30 per cent of this was exported\textsuperscript{139}. Growers receive a significant premium on export markets over domestic markets – the parliamentary inquiry cited domestic prices of about 30c/kilo, while the average export price was $1.06/kilo (typically for premium-quality fruit).\textsuperscript{140} Accordingly a weighted average price of citrus of 53c/kilo has been used in the cost-benefit analysis.

Cost of production

Multiple growers surveyed during the Federal Parliamentary review of the citrus industry cited an average production cost of $10,000/ha\textsuperscript{141,142,143}. This figure is used in the cost-benefit analysis.

Cost of establishment

Citrus has relatively high costs of establishment, both in terms of up-front costs and opportunity costs, as the trees are slow to reach full productive capacity. The establishment costs of citrus as set out in the Parliamentary review are approximately $40,000/ha\textsuperscript{144}, with fruit taking five years to reach full production potential\textsuperscript{145}.

3.5.4 - Crops not considered for expansion

While table grapes, vegetables and citrus have been highlighted as potential growth crops in the MOIA due to their potential to benefit from the upgrades, some existing crops stand to benefit less, and are not considered as expansion crops in the cost-benefit analysis.

Dried fruit

Dried fruit is the third-largest commodity produced in the MOIA by area (making up 16 per cent of the irrigation district)\textsuperscript{146}. However, that proportion is unlikely to increase in response to the upgrades. While the farm gate price of dried fruit increased by 66 per cent between 1997 and 2014\textsuperscript{147}, this increase was off a historically low base, and the proportion of the MOIA given over to dried fruit production actually halved during this time (from 33 per cent to 16 per cent)\textsuperscript{148}.

While these trends may change in response to further price improvements, dried fruit is unlikely to benefit from the upgrades due to their overlap with the timing of production and harvest, which do not rely on access to winter watering. In this context, dried fruit is not considered in the cost-benefit analysis as a potential diversification option arising from the upgrades, as it does not stand to benefit from the main opportunities created by the new irrigation infrastructure.

\textsuperscript{138} (Commonwealth Rural and Regional Affairs and Transport References Committee, 2013)
\textsuperscript{139} (Gray, 2014)
\textsuperscript{140} (Commonwealth Rural and Regional Affairs and Transport References Committee, 2013)
\textsuperscript{141} (Commonwealth Rural and Regional Affairs and Transport References Committee, 2013)
\textsuperscript{142} (Vitonga Citrus, 2013)
\textsuperscript{143} (Murray Valley Citrus Board, 2013)
\textsuperscript{144} (WA Department of Agriculture and Food, 2015a)
\textsuperscript{145} (Hardy, 2004)
\textsuperscript{146} (Retallack, 2012)
\textsuperscript{147} (Argus, 2014)
\textsuperscript{148} (Argus, 2012)
Wine grapes
Extensive data are available on the profitability of growing wine grapes in the MOIA. These data point to the same conclusion: the majority of producers (approximately 90 per cent) have made a loss for the past five years, as illustrated in Figure 10\textsuperscript{149,150}. Further, the likelihood of those producers making a profit in the near future does not appear to be high; in 2005, local industry figures speculated that wine grape prices had reached their nadir. Prices have fallen since then.

Proportions of profit, break-even and loss amongst wine grape growers, 2012-15

Figure 10 - Grower profitability of Australian warm inland grape growing districts, 2012-15 (WGGA, 2015)

In this context, for the purposes of the analysis it is assumed that wine grape production yields a zero return.

3.5.5 - Cost of water
Assigning a value to the average cost to farmers of water per megalitre is difficult for two reasons:

- Farmers use a mix of permanent and temporary water to meet their water needs
- The price of both types of water fluctuates from year to year – particularly the price of temporary water

Accordingly, the cost-benefit analysis calculates an average price of water by averaging farm expenditure on water per megalitre (including distribution and drainage costs) in the Murray Valley in 2010/11, the most recent year figures are available, adjusted for inflation. Using this method, the average on-farm cost of water is estimated to be $148 per megalitre in the cost-benefit analysis\textsuperscript{151}.

3.6 - Other factors affecting the rate of transition
There are further considerations which will influence farmers’ decisions to diversify crops, beyond those associated with the relevant establishment costs, ongoing costs and benefits of alternative crops. These considerations can be divided into three categories:

\textsuperscript{149} (Winemakers’ Federation of Australia, 2015)
\textsuperscript{150} (Retallack, 2012)
\textsuperscript{151} (Retallack, 2012)
- Price risk (the risk that the price received for the new crop will fluctuate over time)
- Capability risk (the risk that growing the new crop requires new skills on the part of the farmer)
- Capital reserves (the funds to establish the new crop and cover initial production downtime)

The importance of these factors in farm decision-making is set out below. Together with the costs and benefits (established above), the conclusions reached in this section influence the predicted rate of crop diversification in the cost-benefit analysis.

**Price risk**
Farmers will typically seek to produce crops where price risk is manageable, or is offset by the prospect of considerable positive returns over time\(^{152}\). Aimin (2010) highlighted that farmers are collectively averse to short-term risks, and may compromise long-term profitability by making conservative decisions in the short term\(^{153}\). This is a rational choice on the part of many producers in the MOIA, who may lack the capital reserves to ride out periods of low commodity prices – or the information to accurately predict future price changes.

The experience of producers in the MOIA is important in this context. The major horticulture crops in the MOIA – table grapes, wine grapes, dried fruit, vegetables and citrus – have been subject to significant price variations over the past two decades. As demonstrated on the following page in Figure 11, many of these variations have been to the detriment of producers. Individual producers in the MOIA are forced to accept these prices as they are price-takers, lacking the scale to influence prices in their destination markets.

\(^{152}\) (Nguyen et al., 2007)
\(^{153}\) (Aimin, 2010)
Figure 11 - Prices for grape products in the Murray Valley, 1997-2014 (Sunrise 21, 2014)
While accurate data on citrus and vegetable prices are not available, price fluctuations for these commodities are also subject to regular fluctuations. For example, citrus and table grape exporters were affected by an unexpected ban on Australian imports imposed by Vietnam in January 2015, with the fruit having to be sold on the domestic market at a lower price\textsuperscript{154}. These risks are also shared by the vegetable industry, where market niches can quickly be exploited by competing producers\textsuperscript{155}.

The price variability experienced by MOIA producers in the last 20 years is likely to inhibit their willingness to take risks on new crops, particularly where significant up-front costs are involved. A generation of Mildura producers who switched production from dried fruit to wine grapes in the 1990s have suffered as a result of their investment, and now have little ability to recoup their costs (see Figure 12).

![Average wine grape business return/ha 2002 - 2010](image)

Figure 12 - Business returns for wine grape producers in the Mildura region, 2002/03 to 2010/11 (Retallack, 2012)

Perversely, for wine grape producers who entered the industry around the year 2000 (and whose vines would have come into full production as prices were beginning to fall), continuing to produce dried fruit may have resulted in a better outcome. The poor experience of many MOIA producers in diversifying into alternative crops is likely to diminish both their risk appetite, and their financial ability to take risks. This in turn is likely to lower the rate of diversification that might otherwise be stimulated by the irrigation upgrades.

It is important to note that for commodities where growers in the MOIA contribute a significant proportion of domestic output, the benefits of further expansion into those commodities is likely to be overstated. This is because the cost-benefit analysis is calculated using current prices, which are susceptible to being depressed if significant amounts of new production are brought onto the market.

\textsuperscript{154} (Jasper, 2015)
\textsuperscript{155} (Watson & Cummins, 2011)
**Capability risk**

In addition to extra inputs such as water, fertiliser and labour, switching production types places new and unfamiliar demands on the skills of the farmer. As Retallack (2012) notes, the majority of wine grape producers in the Murray Valley operate farms less than 10ha in size, and rely on their own labour outside small amounts of contract labour at harvest time\(^\text{156}\). Over 80 per cent of those producers also have purchase contracts with large processors\(^\text{157}\), who offer secure supply arrangements. These factors have the effect of creating a simpler business operation, where short-term costs and revenue are predictable, and the farm business can be administered relatively simply by a single farmer.

**Production capability**

In contrast, table grape production presents an entirely new, more complex set of production variables. Chief amongst these is labour – as Grow Mildura notes, ‘the labour-intensive nature of the table grape crop (unlike dried or wine grapes) requires the industry to employ a great number of permanent and itinerant workers’\(^\text{158}\). In 2003 the Australian Table Grape Association estimated that labour costs made up 78 per cent of the cost of producing table grapes\(^\text{159}\).

While labour costs can be seen as a physical input to the production process, they also require a dedicated set of skills on the part of the farm business owner. The ability to reliably source large amounts of seasonal harvest labour and manage associated regulatory requirements (such as WorkCover obligations and payment of superannuation) creates a significant and costly impost for farm business owners. The labour supply networks and business skills required to manage this effectively are not easily acquired. As one dried fruit grower in the area noted:

‘...business now isn’t great, but I can pretty much run it by myself. To go into table grapes you need a bank willing to lend you the money, and you have to be a people manager with [WorkCover] and all that stuff. It’s [a] totally different [business]...what bloke over 50 is going to turn around and do that?’\(^\text{160}\)

This highlights the range of capability considerations facing producers, and that demographics, lifestyle choices and financial ability all influence their willingness to change crops.

**Marketing capability**

The second major capability constraint is highlighted by Watson and Cummins (2011), who noted that producers who switched from dried fruit to table grapes ‘opted for a production technique that was more labour intensive – including labour associated with irrigation and marketing management, in all its subtlety’\(^\text{161}\). While much of the wine grape production in the MOIA is characterised by supply contracts with major processors, table grape producers operate in a more varied international and domestic marketing environment, where individual producers have more

\(^{156}\) (Retallack, 2012)  
\(^{157}\) (Retallack, 2012)  
\(^{158}\) (Mildura Development Corporation, 2015a)  
\(^{159}\) (NSW Parliament Hansard, 2003)  
\(^{161}\) (Watson & Cummins, 2011)
responsibility for negotiating marketing and distribution arrangements. This effectively introduces a new source of complexity for producers. As with the sourcing of labour, the skills required to do this effectively are not simple to acquire.

**Capital constraints**

As outlined in Section 3.4, the process of transitioning to alternative crops involves a significant up-front cost to producers, both in the form of capital and labour costs, and the opportunity cost of foregone production during the time the new crop reaches productive capacity.

The size of this up-front cost varies between commodities. To accumulate the capital necessary to meet this up-front cost – and bear the necessary risks associated with the crop change – producers require a period of reliable income, either from the farm operation or sourced off-farm.

However, falling commodity prices – particularly those of wine grapes – coupled with increasing input prices (such as temporary water during the Millennium Drought) have combined to significantly reduce the value of agricultural businesses in the Mildura area over the past decade, as shown in Figure 13.

![Estimated value of horticultural operations, Mildura](image)

Figure 13 - EVAO of horticulture in Mildura, 1983-2011 (Barr, from ABS)

(Note: The ABS data this graph is derived from is based on a limited sample size, and is used for illustrative purposes only)

The data set out above, and the average farm business return for wine grape producers in Figure 13, illustrate the financial pressure and capital erosion experienced by grower in the MOIA over the past decade. Anecdotally, growers have borrowed against their properties and sold water to fund farm operating costs.

Producers in this situation may have the information and risk appetite to diversify into new commodities, but a lack of necessary capital will inhibit their ability to translate this to action.

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162 (Watson & Cummins, 2011)
3.6.2 - Further considerations

Restrictions on exit

As set out in Chapter 2, Lower Murray Water and its predecessors have a strong interest in restricting the rate at which irrigators can exit the MOIA. This reflects Lower Murray Water’s need to continue to meet the large fixed costs of maintaining the irrigation network, and to protect itself from a cost spiral in the event that large numbers of irrigators choose to exit – and remove themselves from the rates base.

To address this, Lower Murray Water imposes exit penalties on irrigators who seek to dry off their land permanently (an approach which has been endorsed by the ACCC). The net effect is to restrict the rate at which land changes hands in the district, as irrigators are less willing to sell their properties unless they can find a buyer willing to take over liability for the water share. The consequences of this for producer adjustment are explored further in Chapter 5.

Past rates of transition

As set out above, irrigators considering whether to switch into alternative crops will be affected by influences of price risk, capability risk and capital constraints. In this context, it is also useful to examine past rates of crop diversification in the area, as they can provide a measure of the extent to which these influences have affected irrigator behaviour in the past.

![Pumped district crops (ha), 1997-2012](image)

Figure 14 - Crop production in pumped districts 1997-2012 (Argus, 2012)

In Figure 14, the crop types for the pumped districts between 1997 and 2012 are shown (only irrigated land is included - the area of dried-off land is not shown). As Figure 14 highlights, the area dedicated to production of the region’s main commodity - wine grapes - fell by 41 per cent between 2003 and 2012. However, this did not presage a widespread shift into other crops, as farmers sought more profitable alternatives to wine grapes.

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163 (Watson & Cummins, 2009)
164 (ACCC, 2006)
Instead, production of table grapes and other crops (such as citrus and vegetables) only changed by a small amount during this time, while dried fruit production fell by 50 per cent. Most of the land taken out of wine grape production was instead dried off and left uncropped (the dried-off proportion of the area increased from less than 1 per cent in 1997 to 30 per cent in 2012). The reason for the shift away from wine grapes is clear – vineyard income in the area fell by 70 per cent between 2002/03 and 2010/11, as prices for key wine grape varieties slumped. However, the farmer response was muted, and rather than switching to different, more profitable crops, focused on taking land out of production.

This slow rate of transition highlights the influence of price risk, capability constraints and capital constraints on farmer decision-making in the region. Despite clear price signals over several years, the rate of transition between different crops in the MOIA has been limited, with a significant proportion of farmers persisting with production of loss-making crops for more than a decade. Where active investment decisions have been made (as opposed to simply drying land off), the rate of transition has been slow. Table grapes, the only major crop to have increased in the area between 1997 and 2012, expanded its footprint at an annualised rate of three per cent. This may reflect the fact that table grapes tend to be better-suited to small enterprises – as Watson and Cummins (2010, p.8) note, table grape production is an activity that is most suited to family operations because flexibility in labour supply and timeliness is of the essence in production and marketing. Other crops such as vegetables have made rapid short term gains off a low base, but have failed to maintain those gains in subsequent years.

More broadly, across all crops that increased their footprint between 1997-2012, their collective expansion took place at the rate of 0.6 per cent of the irrigated area per year. Although this is a relatively slow rate of change given the poor fortunes of wine grapes (and to a lesser extent, dried fruit), it is likely that the new production opportunities offered by the irrigation upgrades will increase the rate of change substantially.

In this context, the cost-benefit analysis estimates an annual land-use transition rate of 2.5 per cent following the upgrades. Given the land-use types already in place in the district, the analysis assumes that 1.5 per cent of the transition will be into table grapes, with the remainder equally distributed between vegetables and citrus crops. The land is expected to transition from being dried off or out of wine-grape production, given the latter’s extremely poor medium-term performance and dim future prospects.

### 3.7 - Other benefits of the upgrades

While the new production opportunities offered by access to 365-day per year water are the major benefit of the upgrades program, there are a number of other, lesser benefits which are considered as part of the cost-benefit analysis. These are set out below.

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165 (Mallee CMA, 2014)
166 (Retallack, 2012)
167 (Argus, 2012; Mallee CMA, 2014)
168 (Watson & Cummins, 2011)
Reduced on-farm filtration costs

By distributing irrigation water through sealed pipelines rather than open channel, Lower Murray Water (2013, p.4) notes that the upgrades program will ‘prevent wind born [sic] contaminants getting into the channels where piped’169. Farmers currently filter their water at the property’s access point, in order to reduce the incidence of blockages in the on-farm irrigation system.

Although the introduction of pipelines will alleviate the potential for wind-borne contaminants to enter the water as it is distributed around the irrigation network, it will not improve the quality of the water which is extracted from the river and pumped into the irrigation network by the main river pumps. As such, the water quality benefits introduced by the piped system are likely to be incremental rather than significant.

To estimate the value of these benefits, Lower Murray Water notes that 1,334 customers will benefit from the upgrades program170. For the purposes of the cost-benefit analysis, it is estimated that the improved water quality will reduce the time irrigators take to replace water filters on their pumps by three hours per year, calculated at the Australian minimum hourly wage of $17.29/hour. The cost-benefit analysis also assumes irrigators will save $20 per month in filtration hardware for pumping equipment, with the combined savings totalling $390,000/annum across the upgraded area. As these estimates have been made in the absence of available data, the sensitivity analysis in Chapter 4 considers alternative scenarios under which these costs are doubled and halved.

Reduced water distribution losses

The business case for the irrigation upgrades noted that the project would return seven gigalitres of water to the Commonwealth171. As outlined in Chapter 2, Lower Murray Water avoided referring to the seven gigalitres as ‘savings’ created by increased water-use efficiency in the MOIA arising from the upgrades. Instead, it simply noted that seven gigalitres of water would be ‘returned’ to the Commonwealth as part of from a combination of reduced distribution losses through modernisation of the channel network, and installation of modern, accurate metering systems to all water customers.

This casts doubts on the actual water savings created by the project, which the first business case estimated to be 4.5 gigalitres. While the exact value of water savings is not possible to quantify using available information, the cost-benefit analysis estimates that the upgrades will recover six gigalitres of water, which will be transferred to the Commonwealth Environmental Water Holder in the form of high reliability water shares172,173.

While some of the water savings will be realised through the replacement of the existing concrete channel system – which can be seen as absolute water savings – others will be realised through more accurate measurement of the water provided to irrigators at their property boundaries. This comes about as a result of replacement of the existing mechanical water meters (Dethridge wheels, as shown in Figure 15) with ‘mag-flow’ meters. A 2008 study commissioned by Goulburn Murray

\[\text{References}\]

169 (Lower Murray Water, 2013b)
170 (Lower Murray Water, 2015b)
171 (Australian Government Department of the Environment, 2015c)
172 (Lower Murray Water, 2014b)
173 (Lower Murray Water, 2014a)
Water found that the wheels, on average, under-measure the water being delivered to farmers by 7.5 per cent\textsuperscript{174}.

While installation of new mag-flow meters will reduce this rate to near-zero, the resultant water savings cited by Lower Murray Water represent a transfer of water from irrigators to the water authority, rather than an absolute saving of water. For the purposes of the cost-benefit analysis, this transfer is assumed to be 7.5 per cent of the overall 6.0GL water saving target, reducing it to 5.6GL.

The value of this water can be contrasted against what it otherwise would have cost to purchase in the water market. Using Commonwealth Government figures for the most recent buyback of high-reliability water shares in the Mildura area, an average price of $1,464 per megalitre was paid\textsuperscript{175}. This equates to $1.46 million per gigalitre, or $8.2 million for the 5.6 gigalitres saved by the upgrades process. This is discussed further in Chapter 5.

\textbf{Reduced monitoring costs through meter telemetry}

Introduction of mag-flow meters will enable irrigators to remotely monitor water deliveries to their property, and reduce costs associated with manual monitoring. This will have benefits for irrigator labour efficiency. For the purposes of the cost-benefit analysis, it is assumed that remote monitoring capability will save irrigators an hour of labour per month, costed at the minimum wage of $17.29/hour. Across the 1,334 properties affected by the upgrades, this represents an annual saving of $277,000. Given the uncertainty in making this estimation, the benefits of the labour savings are subjected to sensitivity testing in Chapter 4.

\textbf{Real-time supply increases energy efficiency of pumps}

The upgrades to the main river pumps installed as part of the modernisation program will increase their energy efficiency, both through the installation of equipment which is more efficient under load, and the flexibility with which that equipment is employed. A study of the cost-effectiveness of the pump upgrades commissioned by Lower Murray Water in 2015 noted that "stepped" control of the existing pumps caused gaps in the station control range, and the minimum flow was too high for low seasonal conditions\textsuperscript{176}. This had the effect of over-supplying water during periods of low irrigator demand.

\textsuperscript{174}(Hydro Environmental, 2008)
\textsuperscript{175}(Australian Government Department of the Environment, 2015a)
\textsuperscript{176}(Rhoden, Lade, Harding, Smith, & Murphy, 2014)
To quantify the value of the energy savings realised by the new pumps, Lower Murray Water estimates its annual electricity costs incurred through pumping to be $13.24 million\textsuperscript{177}. The cost-benefit analysis estimates that efficiencies gained through modernisation of the pumps will reduce that cost by 10 per cent, reflecting contemporary improvements in pump efficiency, creating an annual saving of $1.32 million.

\textbf{3.8 - Summary}

The costs and benefits of the program to upgrade the irrigation network in the MOIA have been set out in this chapter. While the costs of the investment are straightforward ($120 million, shared between the Commonwealth Government and Lower Murray Water), the benefits were shown to be more complex. The benefits that arise from the upgrades relate to the fact that water is now available on a continuous, 365-day per year basis. This is likely to stimulate change in the type of crops grown, affecting both the costs and benefits arising from the irrigation network. The upgrades will also create a host of smaller efficiency benefits for energy, labour and water use.

The costs, benefits and rates of transition are summarised in Table 2. These data are used in a cost-benefit assessment of the program, the results of which are reported in the next chapter.

\textsuperscript{177} (Lower Murray Water, 2013a)
Table 2 - Summary of estimated project benefits and costs

<table>
<thead>
<tr>
<th>Variable</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Return on table grapes</td>
<td>Farm gate return of $29,425/ha (annual)</td>
</tr>
<tr>
<td></td>
<td>Cost of production of $26,200/ha (annual)</td>
</tr>
<tr>
<td></td>
<td>Cost of establishment of $40,000/ha (one-off)</td>
</tr>
<tr>
<td></td>
<td>Assume first-year crop yield of zero, rising at 20 per cent per year thereafter.</td>
</tr>
<tr>
<td>Return on vegetables</td>
<td>Farm gate return of $19,225/ha (annual)</td>
</tr>
<tr>
<td></td>
<td>Cost of production of $16,839/ha (annual)</td>
</tr>
<tr>
<td></td>
<td>Cost of establishment of $1,200/ha (one-off)</td>
</tr>
<tr>
<td>Return on citrus</td>
<td>Farm gate return of $10,800/ha (annual)</td>
</tr>
<tr>
<td></td>
<td>Cost of production of $10,000/ha (annual)</td>
</tr>
<tr>
<td></td>
<td>Cost of establishment of $40,000/ha (one-off)</td>
</tr>
<tr>
<td></td>
<td>Assume first-year crop yield of zero, rising at 20 per cent per year thereafter.</td>
</tr>
<tr>
<td>Annual rate of land use transition</td>
<td>1.5 per cent into table grapes (annual)</td>
</tr>
<tr>
<td></td>
<td>0.5 per cent into vegetables (annual)</td>
</tr>
<tr>
<td></td>
<td>0.5 per cent into citrus (annual)</td>
</tr>
<tr>
<td>Savings on filtration costs</td>
<td>$390,000 (annual)</td>
</tr>
<tr>
<td>Market value of water savings</td>
<td>$8.2 million (annual)</td>
</tr>
<tr>
<td>Reduced water monitoring costs</td>
<td>$277,000 (annual)</td>
</tr>
<tr>
<td>Reduced costs through improved energy efficiency</td>
<td>$1.32 million (annual)</td>
</tr>
</tbody>
</table>
Chapter 4 - Results

4.1 - Introduction

In Chapter 3, the variables which would make up a cost-benefit analysis of the upgrades to the Mildura Older Irrigation Area were identified, and their value estimated. Cost-benefit analysis is used as it 'captures the trade-off between the real benefits to society from [the project], and the real resources that society must give up to obtain the benefits'178 (Sinden and Thampapillai, p.2).

This type of analysis enables the project’s projected benefits to be compared with its projected costs, in order to make an informed decision about whether to proceed with the project. It also provides a standardised measure for comparing this project’s value with that of other projects, which would otherwise be alternative candidates for Commonwealth investment. This in turn has implications for the integrity of the Commonwealth’s decision to invest in the MOIA upgrades.

Using cost-benefit analysis also enables the future costs and benefits of the upgrades to be estimated. By discounting future benefits and costs at an established rate, cost-benefit analysis enables the overall value of the project to be assessed at a single point in time. The future benefits and costs are discounted to reflect ‘society’s time preference’ – that is, people’s tendency to prefer immediate benefits over future ones. Cost-benefit analysis discounts the value of those future benefits accordingly179.

The first decision point in this type of analysis is that the project being considered should be accepted if the present value of its benefits exceeds the present value of its costs. In cost-benefit analysis, this is described as the project’s Net Present Value (NPV) being greater than zero. A second decision point considers whether there are no other, competing investment options for the project funding.

4.2 - Discounting and timing assumptions

This CBA uses an operating timeline of 30 years, which reflects the replacement time of the pumps and other major electrical assets (although it may be less than useful life of the major pipeline assets).

The analysis also uses a discount rate of 7.8 per cent. This is based on the proportions of the project costs which will be borne by the Commonwealth, Lower Murray Water and irrigators over time, and reflects the fact that each party has a different cost of capital.

The discount rate for irrigators was estimated to be 8 per cent, reflecting the opportunity cost of capital for the private sector. The discount rate for the Commonwealth was estimated to be 3.9 per cent, reflecting the average five-year bond rate between 2010-2015180. The discount rate for Lower Murray Water was estimated to be 4.7 per cent, based on its weighted average cost of capital determined by the Essential Services Commission’s 2013-18 water price review181.

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178 (Sinden & Thampapillai, 1995)
179 (Sinden & Thampapillai, 1995)
180 (Reserve Bank of Australia, 2015b)
181 (Essential Services Commission, 2013)
incidence of project costs set out above, the weighted average discount rate was calculated to be 7.8 per cent.

The calculations show that although Lower Murray Water and the Commonwealth incur a significant up-front cost ($120 million) over the first three years of the project, the majority of the costs over time will come in the form of irrigator expenses as they convert to new crops. Over the 30 years, 81 per cent of the total costs of the project will be borne by irrigators in this fashion. This has implications for the conversion rate, which are discussed in Chapter 5.

The modelling assumes that the up-front capital costs of the project are evenly expended over the first three years, to the point in 2016 at which the Lower Murray Water project schedule indicates the capital works will be completed\(^{182}\).

### 4.3 - Further assumptions

One of the project’s main benefits is enabling producers to transition to higher-value crops. However, there is no discussion in the Lower Murray Water project documentation of which crops they are likely to be transitioning away from. The value of the incumbent crop has implications for the CBA, as removing it creates an opportunity cost of the value of future foregone production.

In practice, it is reasonable to assume that producers will prioritise two types of land for the transition to new crops:

- Land currently producing the lowest-value crops; and
- Vacant land.

The lowest-value crop in the area is easily identified from available data. Wine grape production has collectively been a loss-making enterprise in the MOIA since 2010/11, and well before then for many individual producers\(^ {183}\). As set out in Chapter 2, data from the Winemakers’ Federation of Australia show that the profitability of warm inland producers (such as the MOIA) has continued to fall since this time\(^ {184}\).

However, since the onset of the decline in wine grape prices in the early 2000s, significant areas of the MOIA have also been dried off and removed from production. In 2012 (the most recent year data are available for), 29.2 per cent of the MOIA was dried off and non-productive (up from 0.9 per cent in 1997). In the same year, a similar proportion (23 per cent) of the MOIA was used for wine grape production.

For the purposes of the CBA, it is assumed that producers considering a transition to more productive crops will be indifferent between transitioning dried-off land, or land currently used for wine grape production.

### 4.4 - Costs and benefits summary

The aggregated costs and benefits of the project are shown in Table 3. Note these are NPV figures over 30 years, at a discount rate of 7.8 per cent.

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\(^{182}\) (Lower Murray Water, 2015b)

\(^{183}\) (Retallack, 2012)

\(^{184}\) (Winemakers’ Federation of Australia, 2015)
Table 3 – Costs and benefits summary of the upgrades program

<table>
<thead>
<tr>
<th>Benefits</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Value of new crops</td>
<td>$530 million</td>
</tr>
<tr>
<td>Water, energy and labour savings</td>
<td>$27 million</td>
</tr>
<tr>
<td><strong>Total benefits</strong></td>
<td><strong>$557.0 million</strong></td>
</tr>
<tr>
<td>Costs</td>
<td></td>
</tr>
<tr>
<td>Irrigation infrastructure costs</td>
<td>$103 million</td>
</tr>
<tr>
<td>Property reconfiguration costs</td>
<td>$63 million</td>
</tr>
<tr>
<td>New crop production costs</td>
<td>$390 million</td>
</tr>
<tr>
<td><strong>Total costs</strong></td>
<td><strong>$556.2 million</strong></td>
</tr>
<tr>
<td><strong>Project Net Present Value</strong></td>
<td><strong>$0.8 million</strong></td>
</tr>
<tr>
<td><strong>Benefit : cost ratio</strong></td>
<td>1.001:1</td>
</tr>
</tbody>
</table>

The results show that the project has a positive NPV of $0.8 million over 30 years, based on the estimated value of the variables set out in Chapter 3. Key points highlighted by the cost-benefit analysis are:

- The bulk of the project’s benefits (95 per cent) arise from facilitating farmers to switch to new, more profitable crops.
- Water, energy and labour savings form only a small proportion (5 per cent) of the benefits.
- Similarly, the additional on-farm costs of producing the new crops make up the majority (70 per cent) of the project’s overall costs.
- The government and Lower Murray Water also incur significant costs in upgrading the irrigation network (at 19 per cent). The up-front cost incurred by farmers to switch to the new crops are relatively less significant (at 11 per cent).

The final value of the NPV - $0.8 million – is marginally positive, relative to the project’s total benefits and costs. This indicates that the positive valuation is sensitive to small changes in the estimates which underpin the analysis.

4.5 - Sensitivity analysis

The estimated costs and benefits of the upgrades project set out in Chapter 3 were based on available commodity price and production cost data, and the predicted influence of the upgrades on farmer behaviour. There is an inherent level of uncertainty in each of the estimates – reflecting the fact that future commodity prices and farmer behaviour can be unpredictable, and are likely to change in response to variables which are not apparent in the present.
In this context, sensitivity analysis can be used to test how the above results change with variations in the estimates which informed the cost-benefit analysis. The sensitivity analysis serves two purposes; it enables changes in the individual variables and their effects on the project’s value to be considered, and it makes clear which of the variables exert the greatest influence on the project’s value.

The variables tested in the sensitivity analysis were:

- The discount rate;
- Farm gate returns of table grapes, vegetables and citrus;
- The rate of transition to table grapes, vegetables and citrus; and
- The cost of water

The broad effects of variations in each of these prices is set out below in Table 4. More detailed analysis of each variable, including their likelihood of varying and implications for the project’s net present value (which is also characterised hereafter as ‘the value of the upgrades’), is conducted in Sections 4.6 to 4.10.
The results presented in Table 4 show that the project’s value is most sensitive to changes in the price of table grapes, and the rate at which producers convert to them. The discount rate also has a significant influence on the project’s value. The sensitivity of the project’s value to each of the variables is considered in more detail below.

### 4.6 - Discount rate

While the project’s value was calculated using a discount rate of 7.8% (reflecting the weighting of project costs between irrigators and government authorities), the sensitivity analysis considered rates between 5 and 10 per cent. The lower end of the range was chosen on the basis that the costs of capital for private industry are currently low in historical terms, and may stay low for some
The upper end reflects the upper bound of costs of capital for Australian producers since the late 1990s.

The analysis shows that at an increased discount rate of 10 per cent, the project’s NPV falls to -$24.9 million. At a lower rate of 5 per cent, the NPV increases to $57.8 million. In this context, the value of the project can be considered to be highly sensitive to the discount rate used.

4.7 - Crop prices and transition rates

The three alternative crops to wine grapes considered in the analysis – table grapes, vegetables and citrus – have varying up-front conversion costs, production costs and returns. In this section changes in the costs and returns for each commodity are considered, along with their implications for the value of the upgrades.

4.7.1 - Table grapes

Rate of transition

The value of the upgrades is highly sensitive to the rate at which producers transition to table grapes. The base case assumes that 1.5 per cent of the upgraded area will replace wine grapes with table grapes every year. As set out in Chapter 3, these assumptions depend on the willingness – and financial constraints – of producers considering whether to rework their production systems.

While planting table grapes involves significant up-front costs (with new trellis, vines and other infrastructure) and the highest ongoing production costs of any of the commodities analysed (chiefly due to the harvesting labour requirement), the potential returns are equally high. In a scenario where producers transition land to table grapes at an accelerated rate of 2.5 per cent per year, the NPV of the project is increased from $0.8 million to $34.5 million. Conversely, where transition rates only reach 0.5% per year, the NPV falls to -$37.1 million.

Implications for the project’s sensitivity to the table grape transition rate are considered further in the scenarios outlined in Section 4.10.

Farm gate return

The value of the upgrades project set out above was calculated using an average table grape return of $29,869/ha, based on current industry price data. The value of the upgrades is highly sensitive to changes in this return – by lowering it to $25,000/ha (a reduction of 15 per cent), the value of the upgrades of the project falls from $0.8 million to -$61.8 million. A similar increase in the return (to $35,000/ha) would increase the value of the upgrades to $66.7 million.

Jointly, the value of the project as a whole is highly sensitive to the rate at which producers transition to table grapes, and the price they receive for them. Naturally, growth in one of these variables will drive growth in another – as prices rise, transition rates will increase. Further discussion on how such a scenario might unfold is included in Section 4.10.

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185 Centre for Economic Policy Research, 2014
4.7.2 - Vegetables

*Rate of transition*

The base net present value calculations assume the upgraded irrigation area will transfer to vegetable production at an annual rate of 0.5 per cent, reflecting historical land use patterns in the district and the new opportunities created by the irrigation upgrades (see Section 3.5.2).

In practice, the value of the upgrades is only mildly sensitive to changes in vegetable conversion rates and prices. If the annual rate of transition to vegetable production fell from 0.5 per cent to 0.1 per cent, the value of the upgrades would fall from $0.8 million to -$7.1 million. If the annual rate of transition doubled from the base case of 0.5 per cent to 1 per cent, the value of the upgrades would rise to $10.1 million.

*Farm gate return*

In the event that vegetable returns per hectare fell from $19,225 to $16,000 (a decline of 15 per cent), the project’s net present value would fall to -$13.0 million. A corresponding increase in the vegetable price would see the value of the upgrades climb to $16.9 million. Accordingly, the value of the upgrades is more sensitive to price changes than changes in the transition rate – but as in the case of table grapes, these variables are not independent as any movement in the price in either direction is likely to stimulate changes in the transition rate.

4.7.3 - Citrus

*Rate of transition*

Farmers’ rate of transition to citrus crops affects the project’s net present value in a similar fashion to that of vegetable crops, in that its influence is not significant relative to that of table grapes. If the rate of transition was to fall from the projected 0.5 per cent to 0.1 per cent, the value of the upgrades would fall from $0.8 million to -$1.8 million. However, in the event that the rate of transition to citrus doubled to 1 per cent, the value of the upgrades would climb to $4.0 million.

*Farm gate return*

Consistent with table grapes and vegetables, the sensitivity analysis shows that the project is more sensitive to changes in the farm gate returns of citrus than the rate of conversion to citrus. A fall in farm gate returns per hectare of citrus production from $15,000 to $12,000 would lower the project’s NPV to -$12.0 million. Conversely, an increase in returns to $18,000 would increase the project’s value to $13.6 million.

In summary, the project’s value is moderately sensitive to the price of citrus, and only slightly sensitive to the rate at which producers convert to citrus production.

4.8 - Water price variations

The cost-benefit analysis calculates the cost of production for each of the three commodities (table grapes, citrus and vegetables) based on a combination of water costs and other input costs. In the analysis, an average water cost per megalitre was calculated using survey data from Retallack (2012). This average cost is effectively a proxy value for the combined costs of water licenses, drainage fees...
and other access costs, which fluctuate in step with changes in market water prices. For further discussion, see Chapter 3.

Water is a key input for all producers in the MOIA; however, different crops require different amounts of water. The production cost estimates in the cost-benefit analysis use industry data on average rates of water application for wine grapes, table grapes, vegetables and citrus, as outlined in Chapter 3.

While the annual water requirement of crops varies significantly (from 5.1 megalitres for wine grapes to 9.8 megalitres for table grapes, with citrus and vegetables falling in between), the cost of water as a proportion of total costs remains roughly constant for each commodity (around 15 per cent of combined operating and overhead costs per year)\(^\text{186}\). The result is that moderate variations in the price of water do not have a significant impact on the net present value of the project.

In this context, the sensitivity test shows that a 20 per cent reduction in average farm water costs would increase the value of the upgrades project from $0.8 million to $5.4 million, as farm input costs for the new crops would decrease. A proportionate increase in average farm water costs would reduce the value of the project to -$3.8 million. The effects of larger variations in the water price are considered in the scenarios set out in Section 4.11.

4.9 - Other input price variations

As noted in Section 3.6, the estimated savings from reduced farm labour and input costs associated with the upgrades project are subject to a high degree of uncertainty. Accordingly, the sensitivity analysis tests the effect on the project’s net present value of increasing and reducing each of these estimates by 50 per cent.

In the event that savings associated with reduced farm labour from the irrigation upgrades are increased by 50 per cent, the project’s net present value is increased from $0.8 million to $2.4 million. Conversely, if the farm labour savings are reduced by 50 per cent, the project’s value falls to -$0.8 million. This demonstrates that the project’s value is not particularly sensitive to changes in the value of farm labour savings.

However, a 50 per cent increase in the estimated energy efficiency savings from the new pumps has the effect of increasing the net present value of the project from $0.8 million to $8.4 million. Reducing these estimated savings by 50 per cent reduces the project’s value to -$6.8 million. This illustrates that the value of the project is moderately sensitive to changes in the value of the energy savings created by installation of new pumps.

\(^{186}\) (Retallack, 2012)
4.10 - Scenarios

While the sensitivity of the project’s value to changes in individual variables is described above, in practice, any such changes are not likely to be confined to one variable. For example, if the market price of table grapes increases significantly, farmers are likely to plant table grapes more quickly. In this example, the combined effect would create a significant boost to the value of the upgrades project. Conversely, a proportionate fall would result in a similar reduction in the project’s value.

Examining these kinds of combined changes is beyond the scope of the sensitivity analysis presented above, which is limited to individual variables. However, scenario analysis enables multiple changes to be modelled at once, giving a better insight into the likely effect of broader, real-world scenarios on the project’s value. A series of such scenarios are set out in this section. The scenarios have been selected for plausibility, in the context of current trends and historical fluctuations in the prices and costs faced by growers in the MOIA. The scenarios considered are:

- A prolonged drop in interest rates;
- A fall in the price of table grapes;
- A fall in the Australian dollar exchange rate;
- The introduction of government exit subsidies for MOIA producers; and
- A long-term increase in the price of water.

4.10.1 - Prolonged drop in interest rates

Following a period of increases in global real interest rates in the late 1970s and 1980s, rates have resumed a long-term trend of decline, as set out in Figure 16.\(^{187}\) This has raised questions amongst industry observers of whether the world’s advanced economies are entering a phase of prolonged low interest rates, where rates which would seem low by historical standards become normal.\(^ {188}\)

\[\text{Figure 16 - Global real interest rates, 1970-2012 (IMF World Outlook, 2014)}\]

\(^{187}\) (Hamilton, Harris, Hatzius, & West, 2015)

\(^{188}\) (Jericho, 2015)
A prolonged low interest environment would have implications for the borrowing costs faced by
governments and businesses, including farm businesses in the MOIA. The average interest rate on
outstanding lending for Australian small businesses (which make up the majority of MOIA producers)
has fallen from around 10 per cent in 1997 to 6 per cent in 2015, as shown in Figure 17.

![Graph showing lending rates for small and large businesses from 1997 to 2015](image)

Figure 17 - Australian Business Lending Rates, 1997-2015 (RBA, 2015)

In the event that lower real interest rates persist for the 30-year timeframe of the cost-benefit
analysis, the appropriate discount rate to apply to the project would be significantly lower (for
example, 6 per cent instead of the current 7.8 per cent). The reduced interest rate would also
increase the incentive for irrigators to convert their properties to new crops, as the required
borrowing would be at a lower cost. The potential changes this would create for the value of the
upgrades project are set out below.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Base case estimate</th>
<th>Low interest rate estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discount rate</td>
<td>7.8%</td>
<td>6%</td>
</tr>
<tr>
<td>Table grape transition rate</td>
<td>1.5%</td>
<td>2.5%</td>
</tr>
<tr>
<td>Vegetable transition rate</td>
<td>0.5%</td>
<td>1.0%</td>
</tr>
<tr>
<td>Citrus transition rate</td>
<td>0.5%</td>
<td>1.0%</td>
</tr>
<tr>
<td><strong>Net present value</strong></td>
<td><strong>$0.8 million</strong></td>
<td><strong>$93.8 million</strong></td>
</tr>
</tbody>
</table>

Table 5 – Low interest rate case

In the event that a prolonged period of low interest rates changed the estimated outcomes as set
out in Table 5, the effects on the upgrades project’s net present value would be profound – it would
increase from $0.8 million to $93.8 million. This reflects irrigators’ increased willingness to invest in more profitable crop types, and the increased real value of the future income stream from those crops.

While scenarios of this type present more nuanced outcomes than those put forward in the sensitivity analysis, they remain partial analyses at best. The period of prolonged low interest rates presented in this example would likely be accompanied by a period of prolonged low growth, with implications for the price farmers in the MOIA receive for their crops. Second-order changes such as these are not considered in the scenario.

4.10.2 - Fall in the price of table grapes
Table grape production has grown steadily in the Mildura region over the past 18 years, from a crop value of $117 million in 1997 to $202 million in 2014\(^{189}\). Table grapes are the largest crop in the Mildura region by value and area of production, with the number of hectares producing table grapes overtaking wine grapes in 2012\(^{190}\). As a consequence, the Mildura region produces approximately 69 per cent of Australia’s table grapes, in competition with other grape-growing regions including southern Queensland and the Carnarvon and Busselton regions of Western Australia\(^{191}\).

The table grapes produced in Mildura are sold on a mixture of domestic and international markets, with the latter having the most potential for premium pricing\(^{192}\). However, variations in each of these markets creates significant potential for price shocks:

1. The sudden closure of international markets can force exporters to offload product onto the domestic market, affecting prices. An example of this can be seen in January 2015, when the Vietnamese government shut off market access worth $32 million annually to Australian table grape exporters. Some Australian growers were compelled to sell the product on the domestic market, forcing down prices and returns\(^{193}\).

2. Increasing competition from international imports can also force the domestic price of grapes down, as was the case in late 2014 when a glut of table grape production in California was sold on the Australian market, reducing the price received by Australian growers\(^{194}\).

Despite producing the bulk of Australia’s table grape crop, growers in the Mildura area are essentially price-takers (both on export markets where Australia produces less than 1 per cent of the world’s crop\(^{195}\), and domestic markets where they face competition from international imports). Accordingly, MOIA producers typically have limited ability to pass the effects of price shocks on to consumers.

In the event that one or a combination of shocks created persistent downward pressure on the farm gate price of table grapes in the MOIA, farmer revenue from table grape production would fall, as would the rate of farmer transition to table grapes. However, it is likely that producers would choose to substitute away from table grape production into another commodity – such as

\(^{189}\) (Argus, 2014)  
\(^{190}\) (Argus, 2012)  
\(^{191}\) (WA Department of Agriculture and Food, 2015b)  
\(^{192}\) (Garnett, 2014), (Felton-Taylor, 2015)  
\(^{193}\) (Jasper, 2015)  
\(^{194}\) (Sampson, 2015),(Felton-Taylor, 2015)  
\(^{195}\) (Australian Table Grape Industry Association, 2012)
vegetables or citrus. The implications of this scenario for the upgrades project’s value are set out in Table 6.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Base case estimate</th>
<th>Low table grape price estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value of table grapes ($/ha)</td>
<td>$29,869</td>
<td>$20,000</td>
</tr>
<tr>
<td>Table grape transition rate</td>
<td>1.5%</td>
<td>0.5%</td>
</tr>
<tr>
<td>Vegetable transition rate</td>
<td>0.5%</td>
<td>1.0%</td>
</tr>
<tr>
<td>Citrus transition rate</td>
<td>0.5%</td>
<td>1.0%</td>
</tr>
<tr>
<td>Net present value</td>
<td>$0.8 million</td>
<td>-$64.3 million</td>
</tr>
</tbody>
</table>

Table 6 – Low table grape price case

This illustrates the sensitivity of the project’s NPV to a fall in table grape prices, and the fact that the effects of such a fall would not be likely to be wholly offset by farmers transitioning into alternative crops. A smaller fall in table grape prices (to $25,000) still yields a project NPV of -$42.9 million. This highlights the susceptibility of the upgrades project’s value to future falls in commodity prices.

4.10.3 - Fall in the exchange rate

While Australia experienced a period of historically elevated exchange rates following 2004, there are signs that rates may be reverting to levels seen throughout the 1990s, as shown in Figure 18:

![Figure 18 - Australian Dollar trade-weighted index, 1985 – 2015](#)

196 (Reserve Bank of Australia, 2015a)
Under a prolonged low exchange rate scenario, a lower exchange rate would increase the price farmers receive for trade-exposed crops, particularly table grapes and citrus, as shown in Table 7.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Base case estimate</th>
<th>Low exchange rate estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value of table grapes ($/ha)</td>
<td>$29,869</td>
<td>$35,000</td>
</tr>
<tr>
<td>Value of citrus ($/ha)</td>
<td>$15,000</td>
<td>$18,000</td>
</tr>
<tr>
<td>Table grape transition rate</td>
<td>1.5%</td>
<td>2.0%</td>
</tr>
<tr>
<td>Citrus transition rate</td>
<td>0.5%</td>
<td>1.0%</td>
</tr>
<tr>
<td>Net present value</td>
<td>$0.8 million</td>
<td>$127.1 million</td>
</tr>
</tbody>
</table>

Table 7 – Low exchange rate case

Under this scenario, the value of the upgrades program increases significantly – from $0.8 million to $127.1 million. This highlights the sensitivity of the upgrades program – and of the fortunes of the MOIA as a whole – to changes in the value of trade-exposed goods, which benefit both in international markets and the domestic market (as competing imports become relatively more expensive).

It is important to note that this scenario does not consider secondary effects of a reduction in the exchange rate, including the increased cost for farmers of fertiliser and other imported inputs.

4.10.4 - Government introduces exit subsidies to the MOIA

The ongoing declines in farm profitability in the MOIA outlined in Chapter 2, and their broader implications for the Mildura community, have been a focus of attention for several cycles of local, state and federal governments. The solutions have typically focused on addressing the area’s underlying small block problem, by facilitating irrigator exit in order to assist those who remain to achieve economies of scale. This is a common government response, as the World Bank notes:

‘….since the 1970s, the Australian government has implemented income smoothing and farm exit policies, to alleviate hardship and to provide a financial incentive to exit.’

An example of this type of intervention came in September 2008, when the Commonwealth Government announced that small block irrigators would be eligible for government-funded exit grants. Under the scheme, irrigators on blocks smaller than 15 hectares (later expanded to 40 hectares) could access exit payments of up to $150,000, supplemented by grants of up to $20,000 to access training and remove their existing crops. All water entitlements realised from the sale were required to be sold to the Commonwealth Government. The scheme was discontinued in 2009, but exit grants and subsidies have been regularly put forward as a policy tool for subsequent governments looking to address the same issues.

197 (World Bank 2012, p.3)
198 (Australian Government, 2009)
199 (Farming Ahead, 2011)
Exit grants incentivise less productive farmers to leave the land, prospectively enabling it to pass into the hands of more productive farmers\(^2\). The introduction of a new government exit grant would effectively accelerate the transition of land into new crops in the MOIA, as land ownership would shift into the hands of farmers with the capital reserves or risk appetite to change their production systems. The potential effects of this on the irrigation upgrade project’s NPV are presented in Table 8.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Base case estimate</th>
<th>Exit grant estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table grape transition rate</td>
<td>1.5%</td>
<td>2.0%</td>
</tr>
<tr>
<td>Vegetable transition rate</td>
<td>0.5%</td>
<td>1.0%</td>
</tr>
<tr>
<td>Citrus transition rate</td>
<td>0.5%</td>
<td>1.0%</td>
</tr>
<tr>
<td>Net present value</td>
<td>$0.8 million</td>
<td>$29.0 million</td>
</tr>
</tbody>
</table>

Table 8 – Exit grant case

By transitioning land into the hands of more productive producers, the cost-benefit analysis shows that an exit grant would increase the NPV of the upgrades project to $29 million.

While this highlights the potential benefits created by increasing the producer transition rate, any benefits should be viewed in the context of the cost to government of funding the exit grant.

4.10.5 - Long-term increase in the price of water
Horticulture production in the MOIA depends almost wholly on a ready supply of affordable irrigation water. The area receives relatively low average annual rainfall of 290mm\(^2\); this combined with the area’s warm climate and high rates of evaporation means that the bulk of water for crops is provided by irrigation.

Water makes up an important part of the input cost mix for irrigators (although it is lower than might be initially supposed, given the high costs of other inputs such as labour, machinery and fertiliser). While producers can minimise this cost to some extent through the use of more efficient watering regimes (as discussed in Chapter 3), many of the easy gains in that area have already been achieved. In years where producers receive 100 per cent water allocations, and have sufficient water entitlements to supply their crops, the operating costs of water are relatively low. In years where allocations are low – or for producers who rely on purchasing temporary water on the open market – fluctuations in the price of water can be very costly.

This market is susceptible to significant price fluctuations, in response to climate variability and competition from water users in other parts of the Murray-Darling Basin. The price of water in MOIA trading zone (both temporary allocations and permanent water shares) over the past eight years is shown in Figure 19:

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\(^2\) (Zuo, Wheeler, Adamowicz, Boxall, & Hatton-MacDonald, 2014)

\(^2\) (Bureau of Meteorology, 2015)
Water prices in the MOIA trading area, 2007/08 – 2013/14

While the price of both temporary and permanent water has fallen significantly since the end of the Millennium Drought, future dry periods could force water prices back to these levels and beyond. In the context of the cost-benefit analysis, this could have two effects – increasing the cost of water to irrigators, and reducing the willingness of irrigators to diversify into more water-intensive crops (particularly table grapes). The effects of this are presented in Table 9.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Base case estimate</th>
<th>High water price estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water cost for irrigators ($/ml)</td>
<td>$148</td>
<td>$300</td>
</tr>
<tr>
<td>Table grape transition rate</td>
<td>1.5%</td>
<td>1.0%</td>
</tr>
<tr>
<td>Net present value</td>
<td>$0.8 million</td>
<td>-$35.4 million</td>
</tr>
</tbody>
</table>

Table 9 – High water price case

A twofold increase in the cost of water for irrigators (and corresponding decrease in table grape plantings) would reduce the project’s NPV to -$35.4 million. This loss would be compounded if the increased water price restricted the planting of other crops.

The net loss created by an increase in the water price would remain if the rate of conversion to table grapes remained unchanged. If the rate of land conversion remained at 1.5 per cent, as in the base case, the NPV of the project would still fall to -$22.8 million in the event that the water price doubled. While this is a significant change, at first glance it is less significant than might be expected when the price of water doubles in an industry reliant on that water. This reflects the fact that while irrigators have a fundamental reliance on water availability, other expenses – particularly labour and

\(^{202}\) Victorian Water Register 2015
capital equipment – are equally important parts of their cost mix. For irrigators, the chief risk in water stems from its pricing volatility and unpredictability.

4.10.6 - Summary

The cost-benefit analysis indicates that the upgrades program has a marginally positive net present value over 30 years. This positive value would become negative in the event of an adverse movement in any of the underlying variables (such as commodity prices, producer transition rates or the discount rate). In particular, the project’s benefits are highly sensitive to the price of table grapes, and the rate at which producers transition to them, and the discount rate used.

As the scenarios outlined above show, the benefits of the upgrades vary widely in line with fluctuations in the broader economic environment - such as domestic interest rates and the exchange rate. This point highlights that the eventual success of the upgrades program is largely beyond the ability of government to influence. This and other implications are discussed in Chapter 5.
Chapter 5 - Discussion

In this chapter the objectives of the cost-benefit analysis are summarised, along with its key findings and their implications for the irrigation upgrades. The broader consequences for government, the regional economy and the community are then considered, with conclusions about the merits of the project as a whole.

5.1 - Summary of findings

The analysis sought to quantify the projected costs and benefits of the upgrades over a 30-year period. The main benefit of the upgrades was the ability they created for farmers to diversify into new, more profitable crops. Further benefits were water savings realised through replacement of leaky channels, and energy and labour efficiencies associated with automation of pumps and meters.

The project’s main cost was the additional crop production expenses to be incurred by irrigators in growing new, more profitable crops. Further costs were the $120 million cost of the upgrades, and one-off establishment costs to irrigators associated with planting the new crops and installing the associated infrastructure.

Estimates for the type, costs and benefits of the various crop production options were based on industry and survey data. The estimated rate of transition to new crops was based on historical rates of transition in the district over the past 15 years, adjusted for the new incentives for adjustment created by the upgraded irrigation infrastructure. Estimates for the project’s construction cost were taken from Lower Murray Water project documentation.

The cost-benefit analysis estimated the project’s NPV to be $0.8 million over 30 years, with $557 million of benefits offset by $556.2 million of costs. This represents a benefit: cost ratio of 1.001 : 1.

The sensitivity analysis highlighted that the project’s value is highly sensitive to changes in the price of table grapes, and the rate at which producers transition into table grape production. The value is also highly sensitive to changes in the discount rate, and moderately sensitive to changes in the market value of other crops. Finally, the project is only slightly sensitive to changes in the market price of water, reflecting the fact that water is one of several variables in an irrigator’s cost mix.

5.2 - Reflections on the findings

As set out in Chapter 1, the thesis seeks to test the likely effectiveness of the upgrades program using cost-benefit analysis. Secondary tests are whether the program’s value is commensurate with that of competing large-scale infrastructure investments identified by the Commonwealth Government, and whether the upgrades satisfy the Commonwealth’s own stated criteria for funding irrigation upgrades in the Murray-Darling Basin.

As outlined above, while the cost-benefit analysis estimated that the project would have a positive return, the number was marginally positive, and susceptible to small changes in the underlying variables. The cost-benefit analysis estimated the project’s benefit/cost ratio to be 1.001 : 1. As a thought exercise, Table 10 sets out an extremely optimistic scenario for the future of the project, in order to see how the project’s benefit/cost ratio would be affected.
<table>
<thead>
<tr>
<th>Variable</th>
<th>Existing calculation</th>
<th>Optimistic calculation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discount rate</td>
<td>7.8 per cent</td>
<td>6 per cent</td>
</tr>
<tr>
<td>Table grape revenue/ha</td>
<td>$29,869/ha</td>
<td>$40,000/ha</td>
</tr>
<tr>
<td>Vegetable revenue/ha</td>
<td>$19,225/ha</td>
<td>$23,000/ha</td>
</tr>
<tr>
<td>Citrus revenue/ha</td>
<td>$15,000/ha</td>
<td>$18,000/ha</td>
</tr>
<tr>
<td>Benefit/cost ratio</td>
<td>1.001 : 1</td>
<td>1.37 : 1</td>
</tr>
</tbody>
</table>

Table 10 – Optimistic variables case

A very optimistic projection of the project’s benefits (with a significantly lower discount rate and crop prices elevated by >25 per cent) increases the project’s benefit/cost ratio to 1.37. It is useful to frame this in the context of the typical government approach to assessing infrastructure projects of this type.

5.3 - Government criteria for project investment

Two well-established principles of government’s approach to investing in projects are the need for the project’s benefits to exceed its costs, and the project’s superiority over other, competing investment options. As the Victorian Department of Treasury and Finance summarises:

‘Taking into consideration the merits of this investment, its merits relative to other competing investment proposals and the available budget, should this investment be funded?’203

In this context, it is worth examining what a typical cost/benefit threshold is for governments seeking to prioritise investments amongst competing projects.

Infrastructure Australia is a national statutory body with responsibility for assessing and prioritising significant infrastructure projects. Its current list of priorities for government investment features 13 projects, with a weighted average benefit/cost value of 2.0204. This is significantly higher than the 1.001 figure for the MOIA irrigation upgrades in the cost-benefit analysis, and even the 1.37 figure in the optimistic scenario presented above. This suggests that the upgrades to the MOIA are not likely to satisfy the investment test set out by the Victorian Department of Treasury and Finance, in that it is not superior to competing project options.

5.3.1 - The government’s own test for irrigation investment

As set out in Chapter 2, the initial business case for the MOIA upgrades project failed to satisfy the Commonwealth Government’s due diligence criteria, on the grounds that the proposed water savings were too low205. The 2012 iteration of the business case was subsequently endorsed by the Commonwealth, triggering the release of funding and commencement of the upgrades. In this context, it is worth examining what the Commonwealth’s due diligence criteria were, and whether the 2012 business case is likely to have satisfied them.

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203 (2015 DTF Investment Guidelines, p.28)
204 (Infrastructure Australia, 2013)
205 (ABC Rural, 2011)
The upgrades to the MOIA were announced as part of the original agreement made by the Commonwealth and State governments on the management of the Murray-Darling Basin in July 2008. Several other similar (and larger-scale) upgrade commitments for other areas of the Basin were made in the same announcement, such as the Northern Victorian Irrigation Renewal Project. However, as part of the Commonwealth-State agreement, each of the upgrade projects was required to satisfy a series of due diligence criteria laid down by the Commonwealth. These criteria were:

1. Projects must be able to secure a long-term sustainable future for irrigation communities, in the context of climate change and reduced water availability in the future;
2. Projects must deliver substantial and lasting returns of water to the environment to secure real improvements in river health; and
3. Projects must be value for money in the context of the first two tests.

The ability of the MOIA upgrades project to satisfy these criteria is examined below.

**A long-term sustainable future**

When considering whether the upgrades to the MOIA are likely to ‘secure a long-term sustainable future’ for the local irrigation community, it is useful to consider the sensitivity analysis conducted in Chapter 4. The analysis highlighted that the future fortunes of irrigators in the MOIA will be largely determined by commodity and input prices, and the restrictions created by their existing capital levels. As noted in Chapter 2, the production factors which will be influenced by the upgrades process – chiefly additional crop options – exert a relatively weak influence on producer fortunes.

In this context, it is difficult to conceive that the business case for the MOIA upgrades could demonstrate that the project would ‘secure a long-term sustainable future’ for local irrigators. The future of the MOIA will be largely dictated by commodity and input prices, and the area’s own structural limitations.

**Substantial and lasting returns of water to the environment**

As noted in Chapter 2, the first of the business case for the MOIA upgrades proposed that 4.5 gigalitres of water would be saved as part of the project. This was a low figure in the context of other upgrades programs taking place throughout the Basin, and was singled out as a reason for the Commonwealth’s subsequent rejection of the business case. When the second iteration of the business case was approved by the Commonwealth in 2012, it committed to return 7 gigalitres of water to the environment.

When considering whether this figure is likely to satisfy the Commonwealth’s criterion for substantial and lasting returns of water to the environment, it is useful to consider the dollar cost of the MOIA project per gigalitre of environmental water saved. This figure can then be compared with other Commonwealth-funded modernisation projects throughout the Basin, as shown in Figure

206 (Australian Government Department of the Environment, 2015b)
207 (Australian Government Department of the Environment, 2015c)
208 (Australian Government Department of the Environment, 2015c)
209 (Australian Government Department of the Environment, 2015b)
The water savings generated by the MOIA upgrades come at around four times the cost-per-litre of the Northern Victorian Irrigation Renewal Project (NVIRP) Stage Two, and five times the cost-per-litre of the Basin Pipe project in NSW. In this context, it is difficult to see how the MOIA upgrades could have satisfied the Commonwealth’s due diligence requirement for ‘substantial and lasting returns of water to the environment’ – particularly in the context of the final criterion, which states that ‘projects must be value for money’.

**Integrity of the due diligence process**

It is difficult to reconcile the Commonwealth’s commitment of $103 million to the MOIA upgrades with its own due diligence criteria for investment in irrigation projects in the Murray-Darling Basin. As the business case which secured the Commonwealth’s funding commitment was not made public, it is only possible to speculate on the analysis it put forward to support the MOIA upgrades.

Given the four-year time lag between the announcement of the upgrades and the funding being secured by the second business case, the Commonwealth may have come under political pressure to release the funds. As the president of the Mildura branch of the ALP noted in 2012, following delays in the development of the second business case:

> The money is there. It’s been allocated. They can pick it up whenever they want to.

- Ali Cupper, ALP President Mildura Branch, 6 July 2012

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210 (NSW Department of Primary Industries, 2015)
211 (The Commonwealth of Australia, 2010)
212 (O’Neill, 2012)
5.4 - Shortcomings of this analysis
The cost-benefit analysis which supports this thesis identified the project’s benefits based on project documentation provided by Lower Murray Water. While this documentation is clear about the physical nature of the upgrades, the practical economic benefits these upgrades will deliver are not clearly described, or their value quantified. This has implications for the accuracy of the analysis presented in Chapter 3.

5.4.1 - Water savings
The value of water savings created by the upgrades appear to be straightforward, but their actual value may be lower than the figure used in the cost-benefit analysis.

Lower Murray Water has committed to return seven gigalitres of High Reliability Water Shares to the Commonwealth as part of the project’s funding agreement, and this figure is used in the cost-benefit analysis. However, it is not clear that seven gigalitres of water will actually be saved by the upgrades, particularly given the first business case estimated savings to be 4.5 gigalitres. This is highlighted by the language used by Lower Murray Water in relation to the second business case, where the water was assigned to the Commonwealth as a ‘transfer’, rather than a ‘saving’. It is possible that Lower Murray Water offered the additional water to the Commonwealth in exchange for funding the upgrades; without access to the business case, it is not possible to tell.

Irrespective of this, any local water savings created by infrastructure upgrades may not translate to absolute water savings, as the Productivity Commission has noted:

‘Infrastructure upgrades frequently produce water savings at the farm or irrigation district level. Due to hydrological realities, however, these savings can be at least partly at the expense of downstream water users and/or ecosystems. These broader effects need to be taken into account when assessing the merits of recovering water through infrastructure upgrades.’

In the context of the benefit-cost analysis, this may further reduce the benefit assigned to water savings through the project.

5.4.2 - Key crops
The analysis sets out key crops such as wine grapes and vegetables that are likely to benefit from the infrastructure upgrades, and estimates the additional value those crops will create. While these crops were based on the proportion of crop types historically grown in the MOIA, the analysis does not consider the possibility of the emergence of new, highly profitable crops which benefit strongly from the upgraded irrigation infrastructure. This emergence would significantly increase the value of the upgrades project.

Further to this, the future prices of established crops (such as table grapes and vegetables) in the MOIA are modelled in the analysis using current prices, inflated at a fixed rate. In practice, these crops will have divergent futures – the value of some will grow at a rate that substantially outstrips that presented in this analysis, while others will lose value.

213 (Productivity Commission, 2010)
For example, a projection of the future price of Chardonnay grapes conducted in 1999 using this method would have produced an estimate of $2,170/tonne by 2015. The actual farm gate value of Chardonnay grapes in 2015 was around $300/tonne\textsuperscript{214}. This highlights the limitations of accurate cost-benefit modelling where volatile, trade-exposed commodities are involved.

5.4.3 - Transition rates

The transition rates set out in the analysis were derived from a combination of historical transition rates, new incentives created by the upgraded irrigation infrastructure and existing financial and capability constraints affecting producers. While the analysis assumed a base rate of farmer adjustment, predicting how farmers respond to incentives – and the variables involved – is fraught and prone to inaccuracy. As Stayner (1996) notes:

‘...this [economic] framework, however, is insufficient for understanding the actual behaviour of farmers, and therefore for developing adjustment policies. Neither farmers, nor the wider community, nor governments apparently view farming as a purely economic pursuit.’\textsuperscript{215}

In this context, it is possible that the transition rates used in the cost-benefit analysis will be shown with time to be overstated. As set out in Chapter 3, the transition rate is heavily influenced by capital availability, particularly in horticulture, where the up-front costs of diversification are relatively high (both in terms of new plants and infrastructure, and the opportunity cost as plants take time to reach full production).

When assessing the likelihood of farmers in the MOIA transitioning to new crops, local income data is instructive. The latest ABS census (2011) showed that over half of residents in the MOIA had annual incomes of less than $42,000\textsuperscript{216} (in a year when the minimum annual wage was $30,600\textsuperscript{217}). In these circumstances, it is difficult to envisage a substantial number of farmers having the necessary capital to fund property reconfigurations, even in circumstances where the commercial benefits of doing so were clear.

Some of the best evidence of the fortunes of producers in the MOIA can be seen in their use of water. Producers who see a future for themselves in irrigation will tend to hold onto their permanent water entitlements, for obvious reasons (and notwithstanding their ability to sell permanent water and buy temporary water in the future on an ad-hoc basis). Between 2011-12 and 2013-14, producers in the MOIA sold approximately 26 per cent of their permanent water entitlements to buyers outside the district\textsuperscript{218}. This represented the highest proportion of sales across any of the districts serviced by Lower Murray Water, and is a clear indication that many producers see their future as being outside the MOIA.

5.4.4 - Other mechanisms for transition

In light of the factors set out above, it is possible that the estimated rate of transition used in the cost-benefit analysis is over-estimated. While the points above highlight the difficulty many

\textsuperscript{214}(Murray Valley Wine Grape Industry Advisory Committee, 2014)
\textsuperscript{215}(Stayner, 1996)
\textsuperscript{216}(Australian Bureau of Statistics, 2015)
\textsuperscript{217}(Fair Work Commission, 2011)
\textsuperscript{218}(Marsden Jacobs, 2015)
individual farmers will have in changing their production systems over to more profitable crops, an alternative mechanism for achieving the same outcome is the sale of land from capital-constrained farmers to farmers with the means to make those changes. However, capital-constrained farmers have less incentive to sell their properties than is immediately apparent, as set out in the example below.

**Case study - incentives to sell in the MOIA**

A typical wine grape property in Merbein was listed for sale in July 2014, made up of five hectares of Shiraz grapes and three hectares of Chardonnay grapes. The total property size was 17.1 hectares – larger than most farm businesses in the MOIA, where 74 per cent of farm businesses are smaller than 15 hectares. The property included a modern four-bedroom house and 30 megalitre water entitlement, worth $52,000 at 2014/15 prices. It sold for $280,000.

The owner of this property would likely have been under financial pressure, as the price of both Shiraz and Chardonnay grapes have been below the cost of production for several years. However, when considering whether to sell the property, retire from farming and move into town, the owner would have several considerations:

- The proceeds from the sale of the property would likely not be enough to buy a house of similar quality in Mildura;
- The tax concessions available to the farmer as a primary producer would disappear (including the ability to discount the tax paid on fuel, capital investments and other inputs);
- The prospect of finding alternative employment may have been difficult, in a case where the farmer’s skills are predominantly in horticultural production, and the regional unemployment rate is 8 per cent.

In summary, the incentives for marginal producers to adjust out of horticulture in the MOIA may not be as strong as they appear at first glance. Across the MOIA, this may work to reduce property transfer rates – and corresponding rates of crop transition.

**5.4.5 - Broader social costs**

It is important to note that farm poverty has costs which are not confined to the farm’s balance sheet, in the form of the social costs of welfare, mental health problems and other costs. In the event that the upgrades program was not majority-funded by the Commonwealth, it is possible that essential works in the MOIA (such as improvements to the main river pumps) would need to be funded by Lower Murray Water, with the costs to be recovered through irrigator levies. Given the weakened state of irrigator finances in the pumped districts, this could lead to increased local rates of business failure, dried-off land and unemployment, with the latter’s attendant social costs.

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219 (Mildura Planning Taskforce, 2009)
220 (Victorian Water Register, 2015)
221 (Realestate.com.au, 2014)
222 (Murray Valley Wine Grape Industry Advisory Committee, 2014)
223 Based on sold properties listed in the area in 2014 at www.realestate.com.au
224 (Mildura Development Corporation, 2015b)
225 (Taylor & Saunders, 2002)
The cost-benefit analysis does not seek to identify these potential costs, or ascribe a positive value to having avoided them.

5.5 - Implications for government, the regional economy and irrigators
In this section, the costs and benefits of the upgrades project are considered for three groups of stakeholders – government, irrigators and the regional economy.

5.5.1 - Government
As outlined in Chapter 4, the MOIA upgrades project has a marginally positive net benefit, which is highly exposed to fluctuations in commodity prices and producer adjustment rates. Other Government investments in water infrastructure under the Murray-Darling Basin Plan were structured around regional community benefits and the public good benefits associated with improving environmental water flows. However, the cost per gigalitre of water recovered from the MOIA upgrades dwarfs that of similar projects. In this context, it is instructive to examine alternative mechanisms by which the government could have recovered a similar volume of environmental water.

Data from the Victorian Water Register show that during the 2014-15 financial year, irrigators and other water holders in the water trading zone the MOIA sits within sold a total of 36.7 gigalitres of high-reliability water shares, at an average price of around $1,740,000 per gigalitre. Had the government elected to recover seven gigalitres of environmental water through the open market rather than the MOIA upgrades project, the cost would have been in the order of $15 million (allowing for a price rise of 20 per cent resulting from the increased total demand created by the Commonwealth). This holds true for the past three years of water trading in the zone.

These figures imply that the other benefits to government of investing in the upgrades – presumably in the form of improved crop production in the MOIA – were valued in the order of $88 million (as government’s contribution to the project was $103 million). The public good benefit for the government of investing in this activity is not clear. Standard public good investment rationale states that governments invest in circumstances where natural monopolies exist, or the agency costs of private beneficiaries organising themselves are so high as to render a potentially beneficial project impractical. In the case of the MOIA, the private beneficiaries were clearly identified (irrigators), and a mechanism for their collective investment in the irrigation network already existed (in the form of Lower Murray Water).

The future of the project for government
The future of the upgrades program from government’s perspective is difficult to predict. If irrigators are slow to take advantage of the opportunities offered by the new infrastructure, the government may seek to induce uptake through funding increased farmer extension activities. Alternatively, it may consider offering exit grants to accelerate transition, as was done from 2007-2009, with mixed results. In practice, it is likely that the main adjustment tool of government in the area will continue to be the Rural Financial Counselling Service, which aims to support viable growers while inducing their non-viable counterparts to exit.

(Australian Government Department of the Environment, 2015d)
It is worth noting that some important drivers of past business behaviour in the MOIA – from the decline of dried fruit prices in the 1980s to the subsequent over-investment in wine grapes in the late 1990s – were linked to government policy (in these cases, the removal of tariffs and introduction of tax incentives for wine grapes, respectively). The industry still has access to tax concessions which incentivise production (chiefly the Wine Equalisation Tax rebate\(^{227}\)), but as a whole, the propensity of government to directly influence commodity markets and pick winners has declined since the 1980s. This change may reduce some of the region’s tendency to boom-and-bust commodity investments, as producers base investments solely on their estimation of their commercial prospects, rather than pursuing favourable tax treatment.

5.5.2 - The regional economy

When funding for the upgrades program was announced in December 2012, the local member, Peter Crisp MP, noted that ‘this important irrigation project [will] boost the region’s economy, employment and long-term horticultural future’\(^{228}\). This reflects the region’s long association with irrigated horticulture – as the Victorian Minister for Planning noted in 2010, when intervening to restrict sub-divisions in the MOIA:

‘….agriculture, particularly horticulture...underpins the Mildura economy despite the prevailing conditions of drought, low water allocations and commodity price fluctuations’\(^{229}\).

The connection between the MOIA’s fortunes and those of the broader regional economy is important to consider, as it will influence the extent to which the benefits of the upgrades project flow to the region as a whole.

While irrigated horticulture – and its downstream industries, including processing and transport – have supported growth in the regional economy of Mildura, the physical area which drives that growth has shifted significantly since the 1980s. As outlined in Chapter 2, in the lead-up to the 1980s the MOIA produced the bulk of horticultural production in the area at a time when agriculture played a relatively more significant role in the regional economy\(^{230}\). However, by 2012 this situation had changed dramatically.

\(^{227}\) (Australian Government Treasury, 2015)
\(^{228}\) (Crisp, 2012)
\(^{229}\) (Madden, 2010)
\(^{230}\) (Hansen Partnership Pty Ltd & Essential Economics, 2013)
The regional economy had diversified, with services making up an increasingly significant proportion of economic output at the expense of agriculture (consistent with the trend in many regional centres)\(^{231}\). More significantly for the MOIA, the drivers of regional irrigation production had shifted away from the old, shared irrigation districts. As noted in Chapter 3, the ongoing pressure on farm businesses to increase scale in order to offset their deteriorating terms of trade flowed through to horticulture. Producers seeking to invest in large, commercial-scale irrigation enterprises were looking outside the MOIA, where small block sizes and high numbers of houses crimped growth prospects\(^{232}\). Large producers instead opted to cultivate greenfield sites both upstream and downstream of the old irrigation district, and pump directly out of the river.

![Private diverter almond orchard, 7km outside the MOIA](image)

This effectively created a series of private irrigation networks (or ‘private diverters’), where the operator and the user were the same business – operating on a scale which dwarfed individual MOIA irrigators, as shown in Figure 21. The land irrigated by these private diverters has grown rapidly since 1997, to the point where they dwarf the MOIA producers, both in terms of land area and output, as Figure 22 illustrates:

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\(^{231}\) (Hansen Partnership Pty Ltd & Essential Economics, 2013)
\(^{232}\) (Watson & Cummins, 2011)
Anecdotal evidence indicates that the area irrigated by private diverters in the region has continued to grow rapidly since the above data was collected in 2012, and now represents around four times the area of the MOIA by size.

**The MOIA’s role in the regional economy**

These changes have created a fundamental shift in the balance of horticulture production in the Mildura region. Future growth in irrigated horticultural production will be driven from outside the old pumped districts. Illustrating this, the cost-benefit analysis in Chapter 3 estimated that the upgrades project would stimulate 2.5 per cent of irrigators to transition to more profitable crops every year. At that rate, the same area transitioned to new crops in the MOIA over the course of a year would be transitioned by private diverters outside the district every five weeks.

To frame the contrast another way, over the past 15 years expansion by private diverters has created another MOIA every 5-6 years. This makes measuring any incremental regional economic benefit of the MOIA upgrades difficult, as any improvement is swamped by growth from outside the old pumped districts.

These points notwithstanding, the upgrades program is highly likely to have a positive economic benefit for the Mildura region (albeit one that is hard to quantify). Reduced to its fundamentals, the $103 million injection of Commonwealth money will fund work which would otherwise have been funded by Lower Murray Water (the actual proportion of which is unknown). These costs would need to be met in turn via levies on local irrigators. Avoiding these costs is effectively a boost for irrigators and the local economy.

In summary, the upgrades will benefit the regional economy – but the size of those benefits will be dwarfed by privately-funded irrigation activity taking place elsewhere around Mildura.

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234 (Argus 2012)
235 (Mallee CMA, 2014)
5.5.3 - Irrigators

In a letter to the Sunraysia Daily on 7 February, 2015, former grower Lindsay Leake questioned the benefits of the modernisation program:

‘[Local member] Mr Broad…. was largely responsible for the current federal government releasing the funds for the Sunraysia Modernisation Project, without any evidence there would be an increase in production, or reduction of cost to the grower.’ 236

While Mr Leake’s criticism of the lack of evidence justifying the MOIA upgrades may be reasonable, there is little doubt that the upgrades project will collectively benefit local irrigators. Under a business-as-usual scenario, the costs of necessary maintenance to the main river pumps and distribution network would have been borne entirely by irrigators, via increased levies from Lower Murray Water. While the cost of these works is unknown, it is reasonable to infer it would have been higher than the $17 million Lower Murray Water contributed to the modernisation project. As a result, local irrigators are probably in an improved position even before any productivity benefits from the upgrades are taken into account.

Beyond the avoided maintenance costs and prospects for increased irrigator productivity, the upgrades may have other benefits for local asset values. Anecdotally, many irrigators were waiting for a signal about government’s willingness to invest in the area before proceeding with their own on-farm investment plans. This can be seen as a rational decision, given the historical importance of periodic government investment in the irrigation district (as outlined in Chapter 2), and the signals government’s failure to fund the project would have sent about future support and the region’s prospects. In effect, government’s demonstrated willingness to continue supporting agriculture in the MOIA may be capitalised into land values.

If the upgrades fail to stimulate improved farm productivity, local producers will probably still benefit from reduced future maintenance costs, as outlined above. If the changes lead to productivity gains, producers will benefit – either directly, through the output of their farms, or indirectly, through increasing asset values as the commercial prospects of their farms improve.

As outlined in Chapter 3, calculating the eventual size of the benefit for producers depends largely on the rate at which they transition to new crops, and the future prices of those crops. In this context, the upgrades are not likely to create step-changes in production, or make loss-making producers profitable; rather, they will enable some producers to make incremental improvements, given the right market conditions.

5.5.4 - Summary

If a very optimistic set of assumptions was used to estimate the benefits of the MOIA upgrades, the project is still likely to fail the Commonwealth Government’s own investment tests. This holds true for both for Commonwealth’s broad parameters for large infrastructure investments, and its specific criteria for funding irrigation infrastructure upgrades under the Murray-Darling Basin Plan.

The cost-benefit analysis set out above estimates future crop prices and rates of producer transition to new crops; in practice, both of these variables are difficult to predict, and may differ significantly from the estimated values. Notwithstanding this, the project is likely to benefit local irrigators, and

236 (Sunraysia Daily, 2015)
may create flow-through benefits for the regional economy. Quantifying these regional benefits is
difficult, given the MOIA’s diminishing role as a driver of regional growth. The initial cost of
generating the benefits will be met by Commonwealth taxpayers, with the bulk of future costs to be
met by irrigators.
Chapter 6 - Conclusion

What does this mean for the MOIA upgrades program?

The initial premise of the Commonwealth’s investment in the upgrades program appears reasonable – funding upgrades to create water savings, which are in turn released to the environment. It could reasonably be argued that a more efficient mechanism for sourcing the water would be on-market buybacks, but this discounts the government’s broader objective of maintaining stable regional communities.

The integrity of the MOIA upgrades decision fell down when the Commonwealth’s due diligence criteria for release of the $103 million were publicised – ‘to ensure the stable future of regional irrigation communities’. As the history of the MOIA’s development and the sensitivity analysis in Chapter 4 demonstrate, the future of regional irrigation communities will be determined by their structural advantages and limitations, and the strength of the market for their products. The Commonwealth’s $103 million spend is not likely to have a significant impact on that future either way. In requiring this, the criteria set a bar that was extremely unlikely to be met – or that could be proven to have been met.

Having established that standard, the Commonwealth then appears to have paid it scant attention in its evaluation of the project’s business cases. The first business case was justifiably rejected on the grounds that its proposed water savings were too low. The second business case was accepted and triggered the release of the $103 million; however, it was never made public by the Commonwealth. Irrespective of the low water savings projected by the second business case, it is difficult to envisage how it could have convincingly demonstrated the upgrades would ‘secure a long-term sustainable future’ for the MOIA. The Commonwealth’s signoff on the project in 2012 is more likely to have been a matter of political expediency, an inevitable destination for a journey that began six years earlier when $103 million was earmarked for a project which was yet to be fully scoped.

Criticism of the rationale for the upgrades does not ignore the situation confronting irrigators in the MOIA. The wine grape crash exposed weaknesses in the area’s layout and infrastructure, and has created widespread and severe personal hardship for irrigators. During the nadir of the crash in 2008-09, the Murray-Mallee Rural Financial Counselling Service had around 500 MOIA clients on its books – a fivefold increase in five years. Observers often suggest that affected farmers improve their lot by adjusting out of agriculture. Doing so can be less straightforward than it appears, particularly in shared irrigation districts with their particular sets of deliberate and incidental barriers to exit.

In the context of this hardship, it would be a mistake to assume that the Commonwealth’s upgrades program will reverse the fortunes of irrigators in the MOIA. At a fundamental level, those fortunes will be determined by the price irrigators receive for their products, and the cost of producing them – factors the upgrades have little influence over. In practice, the upgrades will make a marginal difference in a longer story that will play out for many years, as irrigators continue to seek out profitable markets and adjust their crop mixes.

237 (Sunraysia Rural Financial Counselling Service Inc, 2009)
The regional economy has moved on – private diverters will be the drivers of future agricultural growth in the area – but the cultural attachment of Mildura to its Older Irrigation Area is likely to persist for many years. It is difficult to predict whether the range of forces confronting the MOIA will eventually bring about the demise of irrigation collective; at times it appears inevitable, but history has shown growers in the area to be more persistent than modelling may account for.

Put more simply, as the chief executive of the Riverina Wine Grapes Marketing Board noted in 2015 when it was announced that 97 per cent of the area’s growers were still making a loss:

Frankly, I am surprised by the resilience of grape growers.  

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238 (Myers & Naughtin, 2015, p.1)
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Preserving the green oasis: government investment in the Mildura Older Irrigation Area