# Queensland Submission
# to
# Productivity Commission

# Rural Water Use and the Environment: The Role of Market Mechanisms

## February 2006

**Table on Contents**

## Abbreviations

| | |
|---|---|
| ABARE | Australian Bureau of Agricultural and Resource Economics |
| DEH | Department of the Environment and Heritage (C'wealth) |
| DP&C | Department of the Premier and Cabinet (Qld) |
| DPI&F | Department of Primary Industries and Fisheries (Qld) |
| EBI | Environmental Benefits Index |
| EFO | Environmental Flow Objective |
| EPA | Environmental Protection Agency (Qld) |
| FIS | Financial Incentive Scheme |
| FMS | Farm Management System |
| GBR | Great Barrier Reef |
| GBRWQPP | Great Barrier Reef Water Quality Protection Plan |
| IGA | Intergovernmental Agreement |
| LWMP | Land and Water Management Plan |
| NAPSWQ | National Action Plan for Salinity and Water Quality |
| NR&M | Department of Natural Resources and Mines (Qld) |
| MBI | Market Based Instruments |
| ML | Megalitre (one million litres) |
| NRM | Natural Resource Management |
| ROP | Resource Operations Plan |
| RWUEI | Rural Water Use Efficiency Initiative |
| SEQ | South East Queensland |
| SEQ-IF | South East Queensland Irrigation Futures |
| WASO | Water Allocation Security Objective |
| WAR | Water Allocations Register |
| WRP | Water Resource Plan |

## 1 Introduction

This Submission has been prepared in response to the Productivity Commission Issues Paper *Rural Water Use and the Environment: The Role of Market Mechanisms* December 2005.

The views put forward in this Submission form the view of the Queensland Government, with the Department of Natural Resources and Mines (NR&M), Queensland Treasury, the Department of the Premier and Cabinet (DP&C), the Department of Primary Industries and Fisheries (DPI&F) and the Environmental Protection Agency (EPA) providing input to the Submission.

The purpose of this Submission is to highlight the fact that Queensland manages its water resources differently to the Southern Murray-Darling States and to outline rural water use and environmental externality issues relevant to Queensland. The Submission also aims to provide answers to the questions asked in the Productivity Commission's Issues Paper.

**Section 2** discusses the Queensland Government's resource planning process under the *Water Act 2000* and the importance of establishing and meeting environmental flow objectives and water allocation security objectives.

**Section 3** explains the characteristics of Queensland's tradeable water entitlement, i.e. the water allocation, and reports on water trading activity to date. The section highlights the fact that certain trades are subject to water allocation change rules to ensure potential externalities are avoided.

**Section 4** outlines Queensland Government's Rural Water Use Efficiency Initiative and any associated changes in farming strategies and efficiencies. The section also discusses factors influencing decisions to invest in water saving technology.

**Section 5** discusses water use externalities currently experienced in Queensland and approaches to manage environmental externalities associated with changes to water extraction as well as changes to rural land and water use. The section highlights the fact that the water planning framework in Queensland aims to avoid environmental externalities by setting environmental flow objectives. The section also identifies areas that may be useful exploring in the Commission study and the key findings of the study 'addressing externalities through water charges' carried out by ABARE for the Queensland Government.

**Section 6** focuses on market based instruments on a national and state level. The section includes information on the mechanism for the release of unallocated water in Queensland and the nutrient trading program in Moreton Bay.

## 2 Water resource planning in Queensland

The *Water Act 2000* (Water Act) provides the legislative framework for meeting Queensland's commitments to the National Water Initiative. It obliges the Minister for Natural Resources and Mines to plan for the sustainable management of water, including providing water for the protection of natural ecosystems and planning for the security of supply to water users. The *Water Act 2000* establishes the water resource planning process as the template for achieving these goals.

Water resource plans (WRP) are based on 'whole-of-catchment' assessments of water availability. WRPs are prepared to:

(a) define the availability of water for any purposes;
(b) provide a framework for sustainably managing water and the taking of water;
(c) identify priorities and mechanisms for dealing with future water requirements;
(d) provide a framework for establishing water allocations;
(e) provide a framework for reversing, where practicable, degradation that has occurred in natural ecosystems, including, for example, stressed rivers.

The plans are developed using hydrologic models based on historical stream flow data. There is input from scientific panels comprising experts in freshwater ecology and geomorphology, and consultation with interest groups through community reference panels.

Two key objectives of the water resource planning process are to create water allocation security objectives (WASOs) and environmental flow objectives (EFOs).

WASOs are performance indicators. They are stated in a WRP to protect the probability of being able to obtain water under a water allocation.

EFOs are flow objectives designed to protect the health of natural ecosystems for the achievement of ecological outcomes.

WRPs are monitored during their ten-year life through a public reporting process to determine whether objectives are being met.

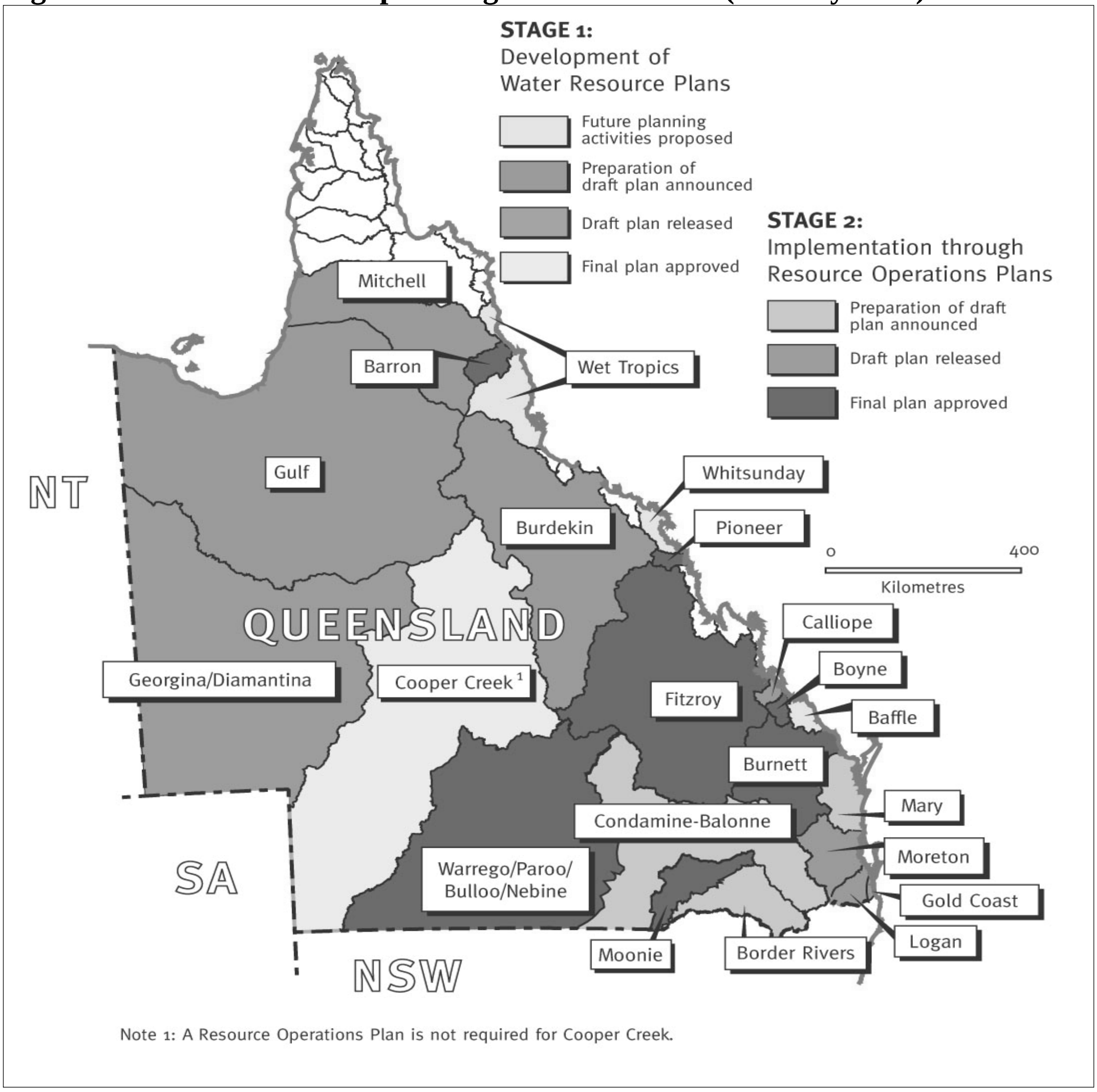
WRPs are implemented through resource operations plans (ROP) that, among other things, establish how relevant water infrastructure and water resources will be managed from day to day to meet WASOs and EFOs.

Together, WRPs and ROPs will:

- allow transparent sharing of water to protect environmental and human interests;
- make sure water users' allocations are secure for the life of the water resource plan;
- ensure that new entitlements will be issued only if they can be sustained without undue environmental harm;
- establish a basis for water allocations in nominated areas to be permanently traded (transferred to another site or use), subject to important safeguards; and
- protect the health of rivers and underground water reserves.

Over ninety percent of Queensland is now covered by water resource planning activities with the finalisation of eleven WRPs and seven ROPs. Many more are in the draft stage.

**Figure 2.1: Water resource planning – current status (January 2006)**



# 3 Queensland water market

## *3.1 Water allocations*

The Queensland *Water Act 2000* authorises the taking of water under various entitlements, the majority of which are attached to land. However, with the completion of WRPs and ROPs, Queensland is progressively separating water from land. On approval of a ROP, existing water entitlements are converted to tradeable water allocations. To date tradeable water allocations have been created in the Burnett, Fitzroy, Barron, Pioneer Valley, Moonie and Warrego/Paroo/Bulloo/Nebine basins.

A water allocation is an entitlement separate to land and can be bought and sold independently to land. Water allocations are well specified (including the risk for supply volatility) and they are registered on the water allocations register (WAR). The WAR is an accurate and secure register that centrally records the ownership of, and interests and dealings in, water allocations. The register also records the attributes of a water allocation, such as location, purpose and priority group.

Water allocations are secure and bankable assets and trading them forms an important new business-planning tool for holders. Tradeable water allocations can be tailored to users' needs, thus creating greater flexibility for individual water users in the following way:

- Allowing people to see clearly the value of their allocation, thus enabling them to take advantage of emerging business opportunities.
- Providing financial incentives for investment in water use efficiency by allowing allocation holders to sell, lease or seasonally assign spare water allocations.
- Enabling retiring landholders or marginal producers wishing to cease production, to sell their water allocation without selling their land.
- Allowing water users to increase supplies and bolster reliability of current allocations, as well as providing opportunities to switch to crops that generate higher returns. The resultant rise in farm profitability can benefit regional economies.
- Enabling intensive water-use industries, such as power generation and mining, to acquire water without jeopardising the state's responsibilities for meeting environmental flows, or reducing supply security for existing users.

To date a total of nearly 7,300 water allocations have been created on approval of six ROPs.

**Table 3.1: Number of water allocations granted, by catchment**

| Resource Operations Plan | ROP commencement date | Number of water allocations granted |
|---|---|---|
| Burnett | 2 June 2003 | 1,697 + 364* + 1,689** |
| Fitzroy | 12 January 2004 | 910 |
| Pioneer Valley | 20 June 2005 | 746 |
| Barron | 20 June 2005 | 1,769 |
| Moonie | 23 January 2006 | 32 |
| Warrego/Paroo/Bulloo/Nebine | 23 January 2006 | 76 |
| **Total** | | **7,283** |

Note: The Burnett ROP was amended in late 2005 and additional water allocations were created associated with Kirar Weir near Eidsvold* (21 November 2005) and Paradise Dam** (15 December 2005)

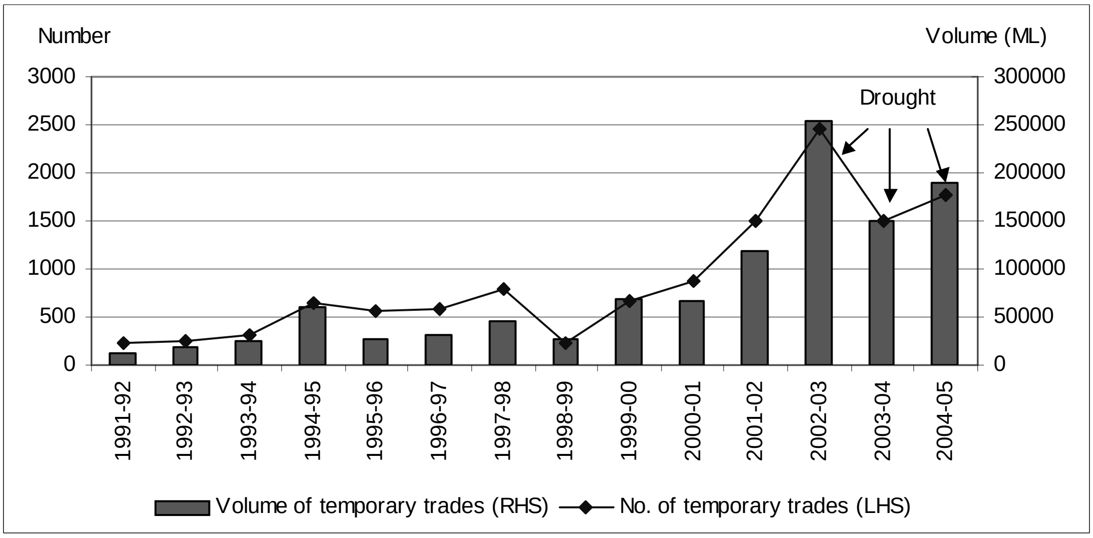
## 3.2 *Water trading*

### *3.2.1 Intrastate water trading*

In Queensland, water can be traded on the permanent or temporary water market. To permanently trade water means to transfer ownership of the *entitlement* as opposed to seasonally assigning some or all of the water that may be taken under a water entitlement in a water year (temporary trade). With seasonal water assignments, ownership of the water entitlement and the associated rights to supply in future years remains with the water entitlement holder.

The seasonal water assignment market has been operating in Queensland since the early 1990s and as such is well established and understood by market players. The temporary market is primarily driven by seasonal conditions as is illustrated in figure 1. Seasonal water assignments of supplemented supplies (i.e. water delivered from storage infrastructure) are managed by water supply scheme owners (e.g. SunWater). Seasonal water assignments of unsupplemented supplies, i.e. natural flow that is not dependent on public water infrastructure, are managed by NR&M.

**Figure 3.1: Temporary trading in Queensland***




**in SunWater schemes*
*Source: SunWater Annual Reports*

Prior to the approval of the Barron ROP, permanent trading of interim water allocations was possible in the Mareeba Dimbulah Water Supply Scheme, (MDWSS). Interim water allocations were able to be traded independently to land, though they re-attached to land after the transfer was complete. Price data for permanent transfers of interim water allocations in the MDWSS was not collected but it appears that the value ranged from $300/ML to $1,000/ML.

**Table 3.2: Transfers of interim water allocations in MDWSS**

| Water Year | Number of trades | Volume transferred (ML) |
|---|---|---|
| 1999/00 | 4 | 179 |
| 2000/01 | 9 | 275 |
| 2001/02 | 25 | 912 |
| 2002/03 | 35 | 1,001 |
| 2003/04 | 17 | 694 |
| 2004 – 20 June 2005 | 46 | 1,748 |
| Total | 136 | 4,809 |

Note: the water year for this catchment is from 1 July to 30 June.

Since permanent trading of water allocations is only possible in basins where ROPs have been approved and tradeable water allocations have been created, the permanent water market in Queensland is only in its infancy. While the market is expected to expand as the planning process in Queensland continues, the market is expected to remain thin initially with few active buyers and sellers.

The Queensland water market is narrow compared to the southern states, which are characterised by the existence of large interconnected systems with numerous water users such as the Southern Murray-Darling Basin. In Queensland, catchments are not hydrologically connected thereby limiting trading to schemes within catchments.

The Queensland water market is expected to become more deep and sophisticated with the development of brokering services. To date mainly real estate agents and stock and station agents are facilitating water trades. This principally reflects the fact that real estate agents often facilitate the selling of a farm which includes both land and water. Stock and station agents increasingly aim to provide a complete service to rural water users by acting as water brokers. The managers of supplemented water supply systems (e.g. SunWater) are already brokering temporary trades of water between their customers and they are likely to offer more formally organised brokering services as the market matures.

Table 3.3 below provides summary statistics of permanent water trading activity in Queensland.

**Table 3.3: Transfers of water allocations in Queensland**

| Basin | Period of time | Number of transfers | Total volume transferred | Typical price ($/ML) |
|---|---|---|---|---|
| Burnett | Jun 03 – Dec 05 | 98 | 8,570 | $1,300/ML |
| Fitzroy | Jan 04 – Dec 05 | 65 | 8,950 | $2,000ML |

Notes:

1. There have only been a small number of transfers in the Barron and Pioneer Valley basins.
2. No transfers have yet been recorded in the Moonie and Warrego/Paroo/Bulloo/Nebine basins as tradeable water allocations were only granted on 23 January 2006.
3. This table does not include water allocations associated with the sale of enterprises as a whole, e.g. the sale of land and water comprising an irrigation farm.

Even though water allocations are tradeable independently to land, the majority of trades involve the sale of an irrigation farm, where land and water are sold as a 'going concern'. Most permanent trades of water in Queensland are in systems supplemented by releases from storage infrastructure.

The price of water ($/ML) is significantly higher in the Fitzroy basin ($2,000/ML) than in the Burnett basin ($1,300/ML). The reasons for this price differential are not clear and there are likely to be numerous reasons for it. Availability of water is likely to be a dominant factor. Announced allocations[1] have been close to 100 per cent in the Bundaberg water supply scheme (Burnett basin) over the last few years and the majority of allocations have not been used to full capacity. As a consequence, a lot of water has been made available on the temporary trading market. The excess supply of water is likely to have had downward pressure on the price of water traded on the permanent market. In comparison, existing allocations in the Fitzroy Basin (especially in the Emerald region) tend to be used to full capacity. The limited supply is likely to be a key factor in keeping the price of water in the Fitzroy basin relatively high.

[1] The announced allocation is a percentage which is applied to the nominal volume of a water allocation to calculate the volume of water that may be taken under the water allocation in the given year. The announced allocation is set on the first day of the water year and revised during the water year in response to any inflows that would increase the announced allocation percentage by 5% or more. The calculation of the announced allocation takes into account the total available usable volume in storage and diversions by allocation holders in the current water year up to the time of assessment.

Another possible factor may be the differing fortunes of the industries in the respective basins. Some sugar growers in the Burnett basin have been selling their water allocations as part of ongoing restructuring in the sugar industry (thereby increasing the supply of water on the market). In the Fitzroy basin, greater demand for water from highly profitable coal mining industries and the water-intensive cotton industry may have contributed to higher water prices in that region.

### *3.2.2 Interstate water trading*

Queensland is not part of the Southern Murray-Darling Basin and the opportunity for interstate trade is limited to the northern end of the Murray-Darling Basin on the NSW border. Therefore, Queensland is not included in the exchange rate trading system of the Southern Murray-Darling Basin. Queensland supports the adoption of a tagged trading system in the Border Rivers catchment, which means that each State's water entitlement retains its characteristics when traded to a person located in another jurisdiction and each State's water entitlement remains registered in the state of origin. The establishment of works for the diversion and use of water is subject to approvals of the receiving state.

Administrative protocols for compliance and enforcement, metering, and work and use approvals will be determined in an Intergovernmental Agreement (IGA). The IGA will also establish principles for effectively coordinating water trading rules across jurisdictions. The development of trading arrangements in the Border Rivers catchment, which covers territory in both Queensland and New South Wales, necessarily involves co-ordination of the institutional arrangements for supply, and associated financial viability and pricing issues.

## ***3.3 Trading rules***

Under the Queensland *Water Act 2000* all WRPs that provide for the establishment of tradeable water allocations are required to include performance indicators in relation to EFOs and WASOs. WRPs require that any decision made under a plan is consistent with the EFOs and WASOs and the trading rules included in ROPs are developed accordingly. Consequently, any trading of water allocations must ensure that EFOs and WASOs can be met.

During the development of each ROP, modelling is undertaken for certain trade scenarios. This identifies different trading options that could occur within the limits set by the EFOs and WASOs. A ROP includes rules that allow, for example, for certain volumes to shift from one trading zone to another, with the certainty that these trades will not affect environmental outcomes and reliability of supply. This allows water users to readily identify trades that can be easily approved thereby simplifying the trading process. Trades beyond these pre-tested limits may also be allowed, but only after testing determines that the trade will not breach the EFOs and WASOs.

In Queensland the transfer of ownership of a water allocation must be registered but it is not subject to approval. However, if the trade involves a change to the water allocation, the change must be approved. To 'change' a water allocation means to modify one or more of its attributes, such as the location from which water may be extracted, purpose of use, priority group, or flow conditions.

Each plan area is broken into zones based on hydrological considerations. Generally a water allocation will allow the holder to take water from anywhere within the specified zone. This allows the allocation to be sold to another water user within the zone without needing to change the allocation. If the purchaser of the water allocation is in a different zone, the allocation needs to be changed in accordance with the rules in the ROP. A plan usually includes pre-tested volumes of allocation that may be location in each zone, without impacting on reliability of supply and the achievement of environmental flow objectives. If the change can be made within these limits then the change will be approved. If the change would cause the limits to be exceeded, then an individual assessment and the public advertisement of the application are required.

While these rules may limit water trading, they are necessary to achieve EFOs and WASOs. The creation of trading zones in the ROP ensures potential externalities are avoided.

Table 3.4 below provides a summary of the number of changes to the location of water allocations.

**Table 3.4: Changes to water allocations by basin**

| Basin | Period of time | Number of changes (location) | Total volume of changed water allocations (ML) |
|---|---|---|---|
| Burnett | Jun 03 – Dec 05 | 37 | 1,878 |
| Fitzroy | Jan 04 – Dec 05 | 12 | 3,890 |

Note: As at 10 January 2006 there have not been any changes registered in the Barron or Pioneer Valley basins.

Water allocations can only be sold as a whole. If part of an allocation is to be transferred, the water allocation needs to be subdivided before the transfer can occur. Table 3.5 below provides an indication of the number of subdivisions registered on the WAR. Anecdotal evidence indicates that many water allocations are subdivided in preparation for a sale.

**Table 3.5: Subdivisions of water allocations in Queensland**

| Basin | Period of time | Number of subdivisions |
|---|---|---|
| Burnett | Jun 03 – Dec 05 | 203 |
| Fitzroy | Jan 04 – Dec 05 | 63 |
| Barron | Jun 05 – Dec 05 | 9 |
| Pioneer | Jun 05 – Dec 05 | 18 |

### *3.4 Market information*

An active and effective market requires that good price and other market information is available to all market participants.

Price information for temporary transfers is available from SunWater's online exchange. The exchange is a water trading tool aimed at facilitating temporary water trading for SunWater customers and providing market information for people seeking to trade water in Queensland. Price information on seasonal water assignments of unsupplemented supplies or any temporary trades not arranged through the online exchange is not currently captured.

The commercial value of water allocations (i.e. permanent trades) is also determined by the market. Such information is important when water users seek to use the value of their water allocations as collateral in raising debt finance, or when buying or selling water allocations.

Prices paid for water allocations are publicly available and the sales information can be obtained at NR&M service centres throughout Queensland. The NR&M website also has summary information on water trading.

Options for reporting water trading statistics online, are under consideration. NR&M will be publishing periodic reports on the departmental web site. Such information will include the locations of where water has shifted and the price paid per megalitre. This information will be provided on a scheme-by-scheme or water management area basis (i.e. for both supplemented and unsupplemented supply).

### *3.5 Water trading in Queensland – a progress report*

In 2005, NR&M conducted a survey of water allocation holders in the Burnett and Fitzroy basins who have registered a water allocation dealing on the water allocations register.[2] The survey was aimed at identifying what motivates water allocation holders to trade their allocation; how they experienced the permanent water trading process; and how trading has influenced their knowledge of the permanent water trading framework in Queensland.

#### *3.5.1 Key Survey Findings*

<u>Water allocation trading process is operating smoothly</u>

Based on their water trading experience to date, the majority of survey respondents would trade water allocations again in the future. Those respondents who are unlikely to trade water again cited lack of need rather than any difficulty with the trading process. The following reasons for buying and selling water allocations were mentioned by survey respondents:

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[2] A water allocation dealing refers to (a) subdivision of a water allocation; (b) amalgamation of two or more water allocations; (c) change to a water allocation; (d) sale of a water allocation; (e) purchase of a water allocation; or a combination of any of these.

- Water allocations are primarily sold because existing water entitlements are superfluous to current water needs.
- Water allocations are purchased mainly to address historical water shortage issues, to expand the business enterprise and/or for domestic use.

Generally parties to water allocation dealings feel confident that appropriate assistance is available when needed. Real estate agents play an important role in facilitating water trades by matching sellers and buyers. Word of mouth is also an important means of finding interested buyers/sellers. In terms of the operational and conveyancing aspects of the water trading process, assistance is mainly sought from NR&M, SunWater and solicitors.

<u>Water allocation trading is facilitating structural adjustment in the industry</u>

Water allocation trading is principally used to match water availability to existing need, but there is some early evidence that water trading is facilitating structural adjustment in the industry. For example, one third of respondents changed their main water-using industry after selling their water allocations. In particular, water allocation holders in the Burnett basin moved out of the sugar industry and into less water intensive industries such as livestock and small crops.

<u>There is no evidence of speculators or "water barons" in the permanent water market</u>

Landholders are sometimes concerned that non-landholders can buy water allocations and sell water back to irrigators at a higher price. To date there is no evidence suggesting that this concern is warranted. Only one respondent expressed an interest in trading water allocations for investment purposes and this respondent was a landholder and a water user in the region.

<u>The awareness level of water allocation holders is high in terms of water allocation trading</u>

The majority of survey respondents were aware that (i) non-landholders can hold water allocations; (ii) trading rules exist; and (iii) trading can have implications on tax obligations and wills.

# 4 Rural Water Use Efficiency

## *4.1 Rural Water Use Efficiency Initiative*

### *4.1.1 Current status, achievements and challenges*

To assist industry in dealing with water reform, the Queensland Government has launched the Rural Water Use Efficiency Initiative in September 1999. Stage 1 of the Initiative was completed in 2003 and Stage 2 is currently being implemented. To date the total investment by the Queensland Government has been $41million. A third stage has been announced, providing $2.5million over the period from 2005/06 to 2006/07. In addition, the Government is providing $1.5million per year for 4 years (with a possible extension to 10 years) from 2005/06 to address rural water use efficiency in the South East Queensland region.

Through the Rural Water Use Efficiency Initiative, the Government and industry have taken important steps in improving on-farm water use efficiency through both extension programs and financial assistance in improving irrigation systems.

The Initiative has saved at least 135,000ML per year in Stage 1 which is expected to grow to as much as 180,000ML per year by the end of Stage 2. These annual savings have been achieved whilst productivity levels have been maintained or enhanced. The value of additional production possible from this volume of annual water savings has been estimated at $280million per year.

Furthermore, it has been estimated that:

- up to sixteen hundred (1,600) jobs have been created in regional Queensland;
- farm profitability and hence viability of Queensland's rural industries has improved; and
- there have been reductions in the run-off and drainage of pesticides, salts and nutrients into the State's rivers, aquifers and streams.

Looking at the water savings that have been made, it is estimated that it would cost up to $270 Million to provide the same volume of water through the development of conventional irrigation water supply infrastructure, excluding the cost of distribution works such as pipes and channels.

An independent evaluation report commissioned in January 2003 critically assessed the performance of the first phase of the Initiative. The report concluded that the Initiative:

- had reached or was on target to achieve all it objectives;
- had provided a positive return on the public dollars invested;
- had a significant impact in improving grower attitudes toward water use efficiency;

- had demonstrated that a strong Government-industry partnership was a successful formula for the delivery of an effective mix of extension, incentives and research and development; and
- provided the momentum for making further significant gains in water use efficiency through a continued program.

Key findings of the evaluation report are in attachment A.

Stage 2 broadens the scope of the Initiative to include on-farm water-related practices with the potential for off-farm impacts.

A key part of Stage 1 and to a lesser extent Stage 2 is the Financial Incentives Scheme (FIS), a $12million program launched in January 2001. This assists farmers to achieve best practice irrigation water management by facilitating the adoption of water efficient approaches, such as the use of soil moisture monitoring equipment and upgrading to more efficient irrigation systems. At present, every dollar invested by government under the FIS has been matched by irrigators with $3 of their own.

Stage 2 continues to promote rural water use efficiency but in the context of broader natural resource and environmental management outcomes, such as the protection of the Great Barrier Reef, the National Action Plan for Salinity and Water Quality (NAPSWQ), and Queensland's commitment to better management of the Murray Darling Basin. It includes the development of a Farm Management Systems (FMS) framework, aimed at improving resource management practices of all cropping industries.

The research and development component of Stage 2 includes a set of 'deep drainage' research projects, in the Condamine, Emerald and in the Burdekin delta and evaporation mitigation trials[3].

### *4.1.2 Future Programs*

As noted above, a third stage (RWUE3) has been announced, providing $2.5million over the period from 2005/06 to 2006/07. In addition, the Government is providing $1.5million per year for 4 years (with a possible extension to 10 years) from 2005/06 to address rural water use efficiency in the South East Queensland region. This latter program is called SEQ-Irrigation Futures.

For RWUE3, partnerships are expected to be established with the cane industry, fruit and vegetable industry (with the additional target of water use efficiency in associated packing sheds), the dairy industry (with the additional target of water use efficiency in

[3] Given the number of small and shallow farm dams in Queensland, the total of the evaporation losses from these dams is substantial. It is estimated that farm dams in Queensland have a total capacity of two and a half Million megalitres (2.5million ML). Given that the vast majority of these farm dams are shallow in depth (4 to 5 metres), the annual evaporation losses are as much as 40% of this capacity. That equates to one million megalitres (1million ML), sufficient to irrigate about one hundred and twenty five thousand hectares (125,000 Ha) of cotton, say, generating an annual gross value of between three hundred and seven hundred and fifty million dollars ($300 - $750million).

the fodder industry), the cotton industry, the cut flower sector, and the production nursery sector. There is little cotton and sugar cane production in south east Queensland, so these industries are not involved in the SEQ-IF program. However, all the other industries listed above are involved in SEQ-IF, as well as the turf production sector of the lifestyle horticulture industry and the SEQ Catchments Regional NRM Group.

Both programs are intended to address water use efficiency and water resource management at the farm level, as well as the impact of these issues at the catchment and regional levels. It is expected that the programs will be based around the following priority regional-level activities (as listed by Coutts (2005)) as well as a wide range of more specific farm-level activities:

1. Farm Management System (FMS) Program Design and Delivery with an emphasis on land and water aspects
2. Benchmarking of current industry water use and collation of information to give a regional picture
3. General Water Use Efficiency information and education
4. Assistance to primary producers to develop Land and Water Management Plans (LWMPs) utilising user-friendly tools and templates, pre-planning workshops, and utilising findings of on-farm irrigation system assessments
5. Collective Equipment Purchasing (eg enviroscans & other expensive scheduling tools) and establishment of service delivery by either:
    a. Consultants to farmers
    b. One Industry to other industries
6. Facilitating access to base spatial information via Multi User Licence agreements
7. Analysis of base data through an Integrated Area-Wide Monitoring approach to provide feedback to producers, R & D, and SEQ Science Network
8. Exploration of the potential to value add to activities by CRC-IF involvement in R&D

### *4.2 Investment in irrigation*

There are many reasons why an initial investment in irrigation and irrigation infrastructure may occur. Some of these include:

- to establish a new enterprise, i.e. to exploit an opportunity to profit;
- to diversify a farm business;
- to improve productivity of existing enterprises;
- to value add to current production, possibly by complementing existing production (e.g. a beef producer investing in irrigation to value add to beef production by irrigating pasture or feed-lotting etc);
- to aim to “drought-proof” existing production or to provide income security (e.g. water harvesting as a contingency plan for dry years);
- to improve the capital value of a property, for example, as opposed to purchasing a neighbouring property; or
- for taxation/investment purposes.

#### *4.2.1 Investment in water saving technology and other water-related farm management strategies*

There are many factors that impact on the decision to invest in water saving technology. Existing irrigators and water users will invest in water saving technology in response to a number of factors, including:

- information regarding the extent of current and future water availability;
- changes in commodity prices;
- environmental considerations; and
- water prices (either through the cost of purchasing additional water or the opportunity to profit by selling excess water).

Most existing water users will invest in water saving technology because water scarcity is impacting on business activity. When water becomes a limiting factor in production water users will adjust their water-related infrastructure and farm management strategies. In the absence of a market price, information regarding the quantity of water available for use is the main driver of investment in water saving technology.

Furthermore, investment will occur mainly in regions where water is an economically scarce resource. For example, in Stanthorpe (Border Rivers catchment) water is an economically scarce resource, so there is a large incentive to invest in water saving technology. In many areas of Northern Queensland water is abundant, so there is less incentive to invest in water saving technology.

#### *4.2.2 Economically efficient levels of investment in water saving technology*

Principally, there are two factors that are considered crucial to an on-farm decision to invest in water saving technology:

(A) The scarcity value of water

Information regarding the scarcity of water (the demand for water available for productive use) is the most important information affecting on-farm decisions regarding investment in efficient irrigation and farm management strategies. Well working markets for water will help establish the scarcity value of water through the price mechanism. The water-scarce regions around Emerald, for example, have seen a sustained increase in the price of supplemented water from Fairbairn Dam as the interplay between buyers and sellers of water pushes the price higher to reflect its scarcity value.

Taking account of its scarcity value, water users should direct water towards its most valuable use. For example, water trading in the Burnett basin has facilitated structural adjustment. Demand for water from small crop farms (tomato, capsicum) has pushed the price of water above the price feasible for some cane farmers and has seen some water traded from cane into small crop production. SunWater's approach of keeping an online register of water trading activity in the various trading zones is considered an effective way of providing information to water users on the value of water allocations (see Section 3.4).

The Queensland government commissioned a study undertaken by external consultants, the Centre for International Economics; ‘Addressing water scarcity with charges’, to inform the review of water charges in 2004. This report directly examines the issue of water scarcity in Queensland, including case studies, in the context of a range of policy approaches including market based approaches. As such, it is highly recommended that the Productivity Commission consider this report carefully. The report concluded that a state wide uniform scarcity charge was inappropriate. The report can be viewed at http://www.nrm.qld.gov.au/water/reform/pdf/cie_report.pdf.

Without a transparent and freely tradable market for water, the true scarcity value of water may not be found, resulting in two potentially inefficient outcomes:

1. Users may systematically under-value water in relation to other production inputs (labour, capital, etc). This will lead to economically inefficient levels of investment in water saving technology and other farm management strategies.
2. Users may systematically over-value water-intensive production in relation to less intensive activities. This will lead to an economically inefficient industry structure, with consequences for productivity, profitability and the environment in the longer term.

(B) Information regarding the characteristics of the water product

The efficacy of the price mechanism depends on the information open to the market. For a market to work effectively, irrigators and other water users need to have accurate information regarding the characteristics of water products available. Characteristics include:

- tradability of allocations/entitlements (i.e. water rights decoupled from land ownership);
- reliability of the water product (probability of availability);
- priority group and purpose of use; and
- quality of water.

In many areas of Queensland this information is contained in regional WRPs and ROPs (see Section 2.1). Of particular interest will be how the long-term reliability of water supply for different water products is rated in response to possible future climate change.

The price of water in an efficiently operating water market is a key signal influencing investment and resource allocation decisions, and is determined by the scarcity value of water and information regarding the characteristics of water products available. It must be emphasised that all on-farm investment decisions are made in relative terms, i.e. by comparing the returns of investment in different types of capital or changes in production systems. Under-valued water will lead water users to compare irrigation technology more on upfront price, and not to also consider the physical efficiency of their investment. This would be tantamount to the purchaser of a piece of farm machinery making a decision based only on the upfront cost of different options without considering their operating costs.

# 5 Externalities in Queensland

## *5.1 Water Use externalities*

Types of water use externality experienced in Queensland include:

- externalities associated with the extraction, storage and delivery of water;
- externalities associated with application and return flows to watercourses; and
- stormwater and overland runoff externalities.

The water planning framework explicitly aims to avoid environmental externalities from the extraction of water from systems by setting environmental flow objectives to protect the health of natural ecosystems for the achievement of ecological outcomes.

Some specific externalities experienced in Queensland (this list is not necessarily exhaustive) include changing groundwater levels, salinity in both groundwater and surface water systems, seawater intrusion, nutrient discharge, return flows from irrigated and dryland agriculture, and changes in irrigator pumping costs arising from the behaviour of other irrigators. For example, in the Great Barrier Reef (GBR) Region runoff quality is considered to be a significant threat to reef health.

The Great Barrier Reef Water Quality Protection Plan (GBRWQPP) is exploring a range of measures to improve water quality entering the GBR region. These range from self-management, education and extension, economic incentives to planning and regulatory measures. In terms of market-based mechanisms, Actions C2 and C3 deal with (1) identifying and recommending changes to existing policies, incentives and subsidy schemes having a detrimental impact on the water quality of the GBR, and (2) identifying and recommending policies and incentives (both regulatory and non-regulatory), to encourage the uptake of best management practices for GBR water quality outcomes. The Department of the Environment and Heritage (DEH) has funded a consultancy by ABARE to build on existing work and provide some of the background research and analysis work necessary for the implementation of Actions C2 and C3. ABARE is yet to deliver its final report. Action C8 of the GBRWQPP looks at auction approaches, while Action D10 investigates opportunities for an offsets policy.

The Queensland Government and the Queensland Farmers' Federation have developed a memorandum of understanding to promote the development and adoption of integrated farm management systems. It is expected that this could be potentially useful in addressing some water use externalities.

While the use of market based mechanisms to address water use externalities is relatively limited in Queensland (as supported by an ABARE report (see below) that concludes that the majority of water use externalities in Queensland are addressed under existing frameworks) one particular example is provided by the Final Pioneer Valley Resource Operations Plan. This plan includes details of the release process for unallocated water through a market based mechanism – with bid evaluation including evaluation criteria focused on environmental objectives.

There are a number of useful areas that may be worth considering exploring in the Commission study.

- Externalities in the context of variable or relatively low levels of water scarcity – and the likely response of farmers to measures to address externalities under these conditions. Unlike the Southern Murray Darling Basin, much of rural Queensland does not experience constantly high levels of water scarcity.

- Feasible, practical and cost effective measures that the water using community are likely to understand and support.

- Externalities in irrigation areas where a single crop accounts for the great majority of water use.  For example, this is the case in some irrigation areas in Queensland for sugar cane.

### *5.2 Externalities and water charges*

In 2004, ABARE conducted a consultancy, entitled 'addressing externalities through water charges', on behalf of the Queensland Department of Natural Resources and Mines to inform the review of future water charges. This report was completed and made publicly available as part of the review. It is recommended that the Commission read this report thoroughly as the report considers the conceptual basis for addressing water use externalities, contains case studies of a number of specific water use externalities in Queensland, and produces recommendations on approaches to address water use externalities – including consideration of market based mechanisms. The key findings of the report are set out below.

- The majority of externalities arising from rural water use in Queensland have been addressed under the existing framework established through the *Water Act 2000*, and subordinate legislation. Many of the remaining externalities are not associated with water use, but are caused elsewhere within the environment. Water often provides the vehicle that delivers the outputs of suboptimal land management to waterways where they impose social costs. For example, suboptimal fertiliser applications and stocking rates may lead to sedimentation and eutrophication of waterways, resulting in a number of externalities. The interruption or use of natural watercourses for storage and delivery on supplemented systems may also fall outside the scope of the *Water Act 2000.*

- Avoiding the generation of externalities through the establishment of well defined property rights in the first instance is more effective than trying to deal with them through regulation or market intervention. The unbundling of water property rights in Queensland has done much to help achieve this. It provides a framework to account for the full social costs of accessing water resources, storage and delivery facilities as well as the impacts of water use. The creation of trading zones in the ROP is an example of how potential externalities have been avoided rather than dealt with once they occur. However, it should still be recognised that institutional arrangements that simply prevent an externality, such as an increase in upstream use that reduces the security of a downstream water user's access rights, may not be as effective as a system that in principle allows users to compensate or be rewarded for the cost or benefits imposed. That is, the action that generates an externality may generate a return that is more than sufficient to meet both the direct and transactions costs of compensating those that are adversely affected.

- Even when there is a rationale for government intervention, the net benefits of the intervention must be greater than the costs of the intervention so that the action leads to a net benefit to society as a whole. For example, if the costs of monitoring and enforcing a site specific charging regime exceed any potential benefits, the optimal solution may be to use a second best instrument, or to do nothing.

- Further, the existence of an externality does not, on its own, warrant intervention. An externality problem may be amenable to private resolution (a property right solution). This is especially the case where there a small number of identifiable people affected.

- Some externalities may not be amenable to private resolution, as the external effects of the use of that resource by one individual are imposed on or shared by many others. Under these circumstances it is extremely difficult, if not impossible, for an individual seeking a reduction in these external effects to either arrange for payments from all potential beneficiaries or exclude those not contributing financially from the benefits of mitigation. This free rider problem means that resolution of an externality through private collective action is typically more costly and complex than for a private externality. Hence, government intervention on behalf of all affected parties may be more cost effective.

- Information requirements for each of the policy tools discussed can be high, and to use these instruments efficiently, governments must know the true cost of the damage as well as the costs of abatement to set optimal regulatory frameworks, charges, subsidies or abatement targets. It is important to assess the costs of getting the policy setting wrong and the potential for adopting an adaptive approach that allows for the review and revision of policy instruments that may be set conservatively in the first instance.

- The use of economic instruments to address externalities associated with water use may be limited by the high opportunity cost of water in the short to medium term. On-farm water use is often associated with large and irreversible investment in private infrastructure and a reduction in the availability of water resources can impose substantial opportunity costs. A levy or subsidy must change these opportunity costs to change the behavior of water users. Therefore, the level of the levy or subsidy may need to be high to get water users to change their level or manner of water use until the water storage, drainage or delivery infrastructure reaches the end of its economic life.

- An important consideration for introducing charges for externalities is that the externality charge will only reduce the quantity of water demanded if the imposition of this charge removes any existing scarcity rents.

- Where charges are unlikely to affect the behavior of resource user, charges may be justified if the revenue can be used to mitigate the impact of an externality through, for example, an investment in improved infrastructure.

- Economic instruments can be more effective when they allow producers to adjust production practices in response to changing economic and environmental conditions. Further, economic instruments can be used to target those with the lowest costs of abatement or mitigation, and to achieve a better allocation of water resources at a lower cost. However, increased flexibility may not be appropriate if it allows water users to exceed threshold standards that impose costs in excess of any additional water use benefits.

- Regulation is the most appropriate policy option when the costs of compliance are to be directed to water users and when the individuals generating the externalities can be readily identified. Regulation is often appropriate where governments wish to impose minimum standards, or where there are thresholds that, when crossed, could generate catastrophic and/or irreversible outcomes.

- Policy intervention to correct for market failures can also fail if it does not reflect the full production and environmental value of land, water and ecological resources, including nonmarket values. There are a number of techniques available to evaluate nonmarket values, such as choice modeling. However, the robustness of these techniques is often subject to criticism. The risk of failure is high if information that governments have to act on is highly uncertain. Further, this uncertainty is not symmetric; policy options tend to impose relatively immediate and certain costs for the longer term while promising to deliver relatively uncertain benefits. Consideration should, therefore, be given to those who bear the costs if the prescribed actions do not deliver the desired outcome.

- Within Queensland there is some scope to use fixed charges to account for externalities associated with infrastructure and watercourses used for the storage and delivery of water. The revenue generated could be invested in mitigation of these externalities — for example, investing in fish ladders on dams, weirs and barrages.

- There is potential to use charges to deal with leakage and seepage in delivery channels as irrigation authorities do not face the full costs associated with the losses. That is, collectively irrigators could subsidise SunWater, or come to a cost sharing agreement, to undertake water saving investments on their behalf.

- The possibility of charging irrigators for emissions to waterways or establishing offset trading is likely to be limited, and would be better dealt with directly through Land and Water Management Plans (LWMPs). There is the potential to use compliance charges when emissions exceed a target level. There are already some existing indirect charges in the form of compliance costs associated with developing LWMPs.

The final report (which can be viewed at http://www.nrm.qld.gov.au/water/reform/pdf/abare_report.pdf) was used to help inform consideration of future water charges in Queensland. In particular, the report findings supported not using a uniform form of externality charge in Queensland.

# 6 Market based instruments

## *6.1 National MBI Pilot Scheme*

The National Market Based Instruments (MBI) Pilot Program was established to explore and trial the use of market-like approaches to the management of natural resources and the environment. The framework for the Program was endorsed by the NRM Ministerial Council in May 2002. The aim of the pilot program was to increase Australia's capacity to use MBIs to deliver natural resource outcomes. All jurisdictions committed to the process.

The Program is jointly funded by the Commonwealth, State and Territory Governments within the National Action Plan for Salinity and Water Quality (NAPSWQ). States and Territories financially contributed on a 50:50 basis with the Commonwealth. Round 1 with an initial funding round of $5 million is drawing to a close this year and there will be a further call for projects shortly from a further allocation of $5 million.

Eleven projects were funded in the first round. They included tradeable pollution permits, auctions, offset schemes, attracting private funds and insurance markets. They addressed dryland salinity, irrigation salinity, water quality and biodiversity in most states, including Queensland. A number of final reports from Round 1 projects can be found on the NAPSWQ MBI web site and other reports are being added as they are endorsed[4].

The potential use of market based policy instruments to apply to environmental goods more broadly has been canvassed for some time. MBIs are policy mechanisms and frameworks that use a range of market-like approaches to positively influence the behaviour of people in making resource use decisions. The attraction of MBIs is that they have the potential to deliver NRM or environmental outcomes at a lower cost than traditional policy and legislative instruments involving explicit directives. The challenge is to harness market forces more effectively to achieve public interest environmental outcomes through individuals acting in their private interest.

MBIs can operate by altering market prices, setting a cap or altering quantities of particular goods, improving the way a market works, or creating a market where no market currently exists (for example in the provision of environmental services, or in the supply of land use change or management actions which, in some methodical way, equates to a quantum of environmental output).

However it is acknowledged that creating markets in environmental goods is complex. The use (in the broadest sense) of the environment and natural resources is characterized by hidden or unrevealed information and actions, conflicting objectives among the interest groups and individuals, varying environmental benefits from

[4] http://www.napswq.gov.au/mbi/index.html The site contains an evaluation of Round 1 of Market-based Instruments Pilot Program undertaken by Professor Quentin Grafton as well as an Interim Report by the MBI Working Group summarising the findings and lessons from completed or nearly completed pilots.

similar actions (such as land use change) across landscapes, different costs across landscapes of achieving similar environmental outcomes, and the interdependence of environmental goods. Issues of market failure (where markets have either failed to emerge or are inefficient) arise from the public good characteristics of environmental goods (specifically the properties of non-rivalry and non-excludability), the related issues of externalities, ambiguity in and inadequately specified property rights, and, importantly, information asymmetry (where information is hidden from one party in a potential exchange making it hazardous to do business).

MBIs work best where there is heterogeneity among participants in the costs of supplying environmental outcomes so that market exchanges can be facilitated (those with lower abatement costs can supply abatement services more cheaply and potentially on behalf of others if the market can be established to recognize and support such transactions). Efficiencies can also be obtained if the mechanism allows flexibility in the way participants choose to respond to the instrument. Similarly MBIs encourage change by those who can achieve the change or can supply valuable environmental services most cheaply.

There are therefore fundamental design and information challenges to be dealt with, and often legislative underpinning frameworks to be established, in including efficient MBIs in the range of policy tools being applied legislatively and on the ground. Although markets therefore do not emerge autonomously for many natural resource management problems, advances in economic theory, new experimental economics techniques and increased computational capabilities mean that it is may now be possible to create mechanisms that perform like markets.

The pilot program was developed for the purpose of casting light on some of the fundamental design and implementation issues associated with particular instruments and to test these conceptually or on a trial basis to specific environmental and natural resource management problems.

There are some key learnings emerging from the MBI Pilot Scheme that have significance for the further creation of water-related markets for environmental goods.

For example, the report of the Working Group notes that auctions can be a cost effective means of increasing the provision of diffuse source environmental outcomes. Several pilots investigated whether auctions for services to provide environmental goods offered by landholders could outperform other instruments used to obtain these goods, such as grants and fixed input price schemes. These pilots found that auctions can be a cost-effective means by which to increase the provision of diffuse source environmental outcomes, including terrestrial biodiversity, salinity mitigation, aquatic biodiversity and water quality.

Important prerequisites for auctions to be run efficiently and demonstrate environmental outcomes include an agency's capacity to:

- *define and measure the environmental goods*, or proxies for these goods, that the auction is designed to procure (for example, through a "metric' such as an environmental benefits index;

- *model or estimate* the anticipated result that a management action will have on the supply of the environmental good as measured above;
- *write efficient contracts* for the environmental good involved, so that government becomes an 'intelligent purchaser' and landholders become 'competitive suppliers' (Stoneham et al. 2003).

There has been considerable effort expended in the program on the development of environmental metrics to quantify or "commodify" the environmental goods (or their proxies) to be transacted. The importance of science in informing the metric has been crucial. The metric needs to be able to define the environmental good in ways which are transparent, replicable and acceptable or defensible.

A number of pilots have formalised metrics that express the environmental goods and services generated. Across all pilots, metrics have been developed for water quality, biodiversity, carbon, surface water flows, nutrient transportation, irrigation salinity, stream bank and riverine quality and water table recharge. In one case (the Victorian EcoTender project), a significant advance has been made in hydrology modelling to provide information to an MBI pilot involving multiple environmental outputs.

Several MBI projects used different approaches to environmental metrics. A number of projects used Environmental Benefits Indexes (EBIs) whereas one pilot (in the Avon catchment in Western Australia) compared an EBI approach with a Systematic Conservation Planning (SCP) approach to see which approach yielded potentially more environmental returns per dollar invested.

Cap and trade mechanisms involve regulatory limitations in applying a cap and the defining of property rights (such as pollution permits) that can be exchanged. Some broad conclusions emerging from the program are that cap and trade mechanism are more problematic for diffuse source problems, regulatory hooks are required, they take time to develop and implement in terms of regulating for the cap, defining the property rights and in securing market exchanges. Stakeholder acceptance of such mechanisms and the science behind them is crucial to their success as are issues of transaction costs if trades are to occur. They can be cost-effective if sources are point source and measurable or can be modelled as if they were point source.

### *6.2 MBIs in Queensland*

Potential opportunities for the use of MBIs among the suite of policy instruments to manage water-related issues in Queensland include the management of both point source and diffuse sources of discharges and to manage deep drainage impacts.

One of the MBI Pilot projects in Queensland specifically examined the potential for a cap and trade scheme to address water quality issues for both point and non-point sources. The Project, "Establishing the Potential for Offset Trading in the lower Fitzroy River", had the objective to assess the potential for offset trading and other quantity-control mechanisms to address water quality issues in the Fitzroy basin. The case study for the project was the Fitzroy basin in central Queensland, which is the largest basin in the Great Barrier Reef (GBR) catchment area, the problem addressed being the large quantities of sediment and nutrient export coming predominantly from diffuse sources in the grazing industry. The focus of the research was on the potential supply of mitigation actions from this group.

Among other things, the research indicated that, while there were significant opportunities for reducing water quality impacts in the Fitzroy basin lying principally with diffuse sources from agriculture, cap-and-trade mechanisms were unlikely to be effective because of a range of identified criteria for successful application were unlikely to be met.

The Reef Water Quality Protection Plan recognises the issue of declining water quality in the GBR lagoon. Actions C2 and C3 deal with (1) identifying and recommending changes to existing policies, incentives and subsidy schemes having a detrimental impact on the water quality of the Reef, and (2) identifying and recommending policies and incentives (both regulatory and non-regulatory), to encourage the uptake of best management practices for Reef water quality outcomes.

The Department of Environment and Heritage has funded a consultancy by ABARE to build on existing work and provide some of the background research and analysis work necessary for the implementation of Actions C2 and C3. ABARE is yet to deliver its final report.

Measures to efficiently address diffuse sources of discharges through market-like approaches either through cap and trade approaches or contracted management changes require the establishment of a metric which can robustly quantify the connection between management inputs (in a site-specific sense) with environmental outputs produced (including off-site outputs). The metric is a measure which informs both buyer and seller in a market situation about the estimated quantum of environmental services (or proxies for them) provided in an exchange.

There is a knowledge gap in this area for quantifying water quality benefits. To address this, NR&M under a grant from the Department of Environment and Heritage (DEH), has recently called for offers to deliver a consultancy to develop environmental metrics to assess water quality benefits from land use change and alternative management actions. The report on this is expected to be completed by the end of June 2006.

Problems of rising water tables and increasing groundwater salinity lend themselves to consideration of market based instruments where the impacts, for example, are known to be irrigation induced, there is spatial variation in the size of the impacts from similar practices and costs of abatement also vary spatially. Sophisticated cap and trade systems are unlikely to be a viable policy option where there is not full knowledge of the problem and its causes and effects.

Rising water tables and increasing groundwater salinity have been recognised in the Mona Park area of the lower Burdekin although the nature of the problem is not fully understood but has been under investigation[5]. It is likely that sophisticated market

[5] http://www.awaozwater.net/watershed/manuscripts/t5275.pdf
http://www.awaozwater.net/watershed/manuscripts/t5274.pdf

based approaches to the problem would require more detailed biophysical information than currently exists.

The potential for a cap and trade approaches to address the problem of irrigation induced salinity was addressed in an MBI pilot in the Coleambally Irrigation Area. The pilot involved establishing an aggregate recharge target and properties for net recharge at the property level. Significant issues were the extent to which such a scheme would deliver benefits compared to the cost of the scheme. Generally the pilot reported small benefits compared to the costs and that irrigators were unlikely to access the gains from trade in the scheme.

The pilot found that, through application of a sophisticated biophysical information base, it was possible "to design tradeable rights to essentially a non-point source pollutant. Importantly the metric used, net recharge, has a direct and measurable relationship with the environmental impact being managed and performance against this metric can be cost-effectively measured".

"Secondly, the analysis highlighted the importance of robust economic analysis in both policy design and the evaluation of alternative policies. Despite the enthusiasm for MBIs, they will not always offer the best policy response. And this may be compounded where property rights cannot be fully defined, as in these instances a market instrument cannot guarantee an improvement in social welfare.

In this study, the available biophysical information indicated a high level of complexity in developing a robust property right. For example, we expected spatial complexity based on previous applications of tradeable rights to atmospheric pollutants and nutrient management in the US. We also anticipated that climate driven stochastic variability would be an issue. However despite the significant knowledge about spatial and stochastic factors the interaction between stochastic rainfall events, biophysical outcomes and thresholds, could not be fully developed in the time available. Until this can be done, the robustness of any recharge rights created will be uncertain."[6]

### *6.3 Release of Unallocated Water*

One market based mechanism or approach that is used in Queensland is the market based release of unallocated water. The National Water Initiative has drawn directly from the Queensland approach in developing its policy in this area.

Unallocated water refers to water that is technically possible to be made available for future consumptive use by urban, rural or industrial sectors without compromising the environment or the security of supply for existing users (NR&M, 2004). Unallocated water is identified under a WRP. The release of unallocated water therefore, should recognise existing planning processes which also seek to maintain the security of supply for the environment and existing users.

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6 Tradable recharge credits in Coleambally Irrigation Area: Experiences, lessons and findings, Final report for MBI project 33*, CSIRO & BDA Group,July 2005*

The release of unallocated water will only occur once alternative options such as water trading, making use of the unused parts of current water entitlements or water use efficiency measures have been fully explored (NR&M 2004).

In specific cases, the release of unallocated water may be made in order to meet economic development or social objectives (NR&M 2004).

Releases should incorporate the use of market based mechanisms and in strong markets, auctions which incorporate the use of a reserve price, are likely to be the appropriate release mechanism. The reserve price should be set, based on a market assessment of the likely value of water.

Where there are large volumes of unallocated water available and low levels of current demand (relative to available supplies), a portion of the water, determined by Government prior to any release, should be reserved for future water uses (NR&M 2004).

The policy principles pertaining to the release of unallocated water have been devised to ensure the greatest community benefit is achieved when the water is made available, in accordance with the Council of Australian Governments water reform objectives. The policy principles can be viewed at: http://www.nrm.qld.gov.au/wrp/pdf/general/unalloc_water_info_sheet.pdf

### *6.3.1 Evaluation Criteria Pertaining to the Release of Unallocated Water to Minimise Environmental Externalities – The Case of Sandy Creek - Pioneer Valley.*

Unallocated water is identified under a WRP however; the specific details of its release are normally specified within the ROP. Within the ROP, there is therefore capacity to set specific guidelines for the release of unallocated water to assist in the management of water use externalities.

For example, in the Pioneer Valley ROP, the market based release of up to 4 000 ML (annual volumetric limit) of unallocated water is subject to a set of conditions and subsequently, all offers (from prospective water users) are evaluated and ranked against a set of criteria that includes their capacity to meet environmental objectives.

Offers are requested by the Chief Executive through newspaper print and the department's website. The reserve price is set prior to the call for offers being made. The reserve price is based on a market assessment of the likely value of water.

All offers must meet the minimum reserve price, be consistent with Section 15[1] of the WRP and demonstrate that the proposed take would not stop water from flowing

[1] Section 15 states that "water in sub-catchment area 12 is to be allocated and managed to reduce saltwater intrusion in the coastal section of the Pioneer Valley groundwater system associated with the area". Sub-catchment area 12 refers to the Sandy Creek area in which the 4 000ML of unallocated water has been identified.

immediately downstream of the place where the water is to be taken and that the proposed take would only occur when flows over a pre-determined point are above a volumetric limit (referred to in Queensland as flow conditions) (NR&M 2005).

All offers that meet these criteria are then evaluated and ranked based on the following criteria:

| Evaluation criteria | Score | Weighting |
|---|---|---|
| **1** Bid price | Score = (price offered/highest price) * maximum rating (5) | 20% |
| **2** Positive impact on seawater intrusion on groundwater in the catchment<br>a) Ratio of substitution of groundwater by surface water (reduction in groundwater take (ML); surface water nominal volume (ML)). The higher the ratio the more favourable the proposal. | Score = (ratio proposed/highest ratio) * maximum rating (5) | 25% |
| b) Volume of groundwater authorisations (ML) that will be substituted by surface water. | Score = (volume proposed/highest volume) * maximum rating (5) | 25% |
| **3** Negative impact on the instream environment including the inundation of habitats, movement of fish and other aquatic species and sediment transport. | 0 to 5<br>Where 0 = maximum impact on instream habitat, and 5 = no impact on instream habitat | 15% |
| **4** Availability of an alternative surface water supply, other than Sandy Creek, for the purpose of which the water is required (proposals that do not have access to an alternative water supply will be considered more favourably). | 0 to 5<br>Where 0 = access to alternative reliable supply, and 5 = no access to alternative supply | 15% |

The Chief Executive is required to assess all offers against the criteria listed above.

This market based approach to the release of unallocated water can directly contribute to the effective management of water use externalities by reducing the likelihood and scale of any negative externalities that may arise through the release of unallocated water.

## *6.4 A Nutrient Trading Program to improve Water Quality in Moreton Bay*

### *6.4.1 Project Overview*

Market-based instruments, such as water quality trading schemes and offsets, are recognised as potentially valuable mechanisms for cost-effectively achieving pollutant reductions and ecologically sustainable development. Nutrient trading is an approach that potentially offers greater efficiency in achieving water quality goals on a catchment basis, by allowing one source to meet its regulatory obligations by purchasing credits created by another source that has lower pollution control costs or which are ceasing operations.

This project aims to investigate the use of offsets and emissions trading between sources to improve water quality of Moreton Bay. The Commonwealth and the Environmental Protection Agency (EPA) divided the initially proposed $400,000 project into two phases, with Phase 1 testing the technical feasibility of nutrient trading and identifying any suitable catchments. In Phase 1, a consultancy investigated the potential of nutrient trading in south east Queensland, possible approaches to such a scheme and select catchment(s) in south east Queensland that offer the greatest opportunity for nutrient trading. Phase 1 was completed in September 2005.

Phase 2 includes consideration of options identified in phase 1 and design of a pilot trading/offset scheme.

### *6.4.2 Progress Summary*

The final report *Scoping Study on a Nutrient Trading Program to Improve Water Quality in Moreton Bay'* included the following findings and recommendations:

- Nutrient trading appears to be feasible in Moreton Bay, with projected environmental and economic benefits for the waters in the region.
- No single catchment offered a suitable number and mix of pollutant sources to make nutrient trading attractive, therefore a 'cluster' of sub-catchments at Bramble Bay is recommended as the preferred region for a pilot study due to the extent and diversity of its sources.
- A 'Bubble Licence with offsets' scheme is the recommended trading structure approach for the proposed pilot study. This would involve having a small number of point sources meet an aggregate nutrient discharge target, statutory based and subject to agreed scheme parameters. It is envisaged that such a pilot could provide the basis for more expansive schemes in the future.

### *6.4.3 Future Activities*

Negotiations between the EPA and the Commonwealth to formulate arrangements for Phase 2 of the study are in progress. Phase 2 is expected to commence in early 2006 and include detailed research into the design, modelling and administration of a potential pilot scheme.

# 7 References


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Queensland Government, Department of Natural Resources & Mines (2004), *Unallocated Water – Principles for Release – Information Sheet*.

## Appendix A: Evaluation of Stage 1 RWUE Initiative

Coutts (2003) undertook an evaluation of the first 4 years of the Rural Water Use Efficiency Initiative. The report was assembled using a range of techniques including analysis of the milestone reports submitted by the industries involved, telephone survey and workshop; and is focussed on the Adoptions Program, with the Financial Incentives Scheme and the Research and Development Program considered only in relation to their impact on the Adoption Program. The following comments and tables are taken from the report and detail the major findings.

### Level of participation in RWUEI activities

All industries reported high levels of participation in RWUEI activities.

| Industry | Milestone reports % involvement | Survey % involvement |
|---|---|---|
| Sugar | 93 | 75 |
| Cotton & Grains | 78+* | 76 |
| Horticulture | 80-90** | 70 |
| Dairy & Lucerne | 72 | 70/63 |

*Based on the number reported to be involved in BMP activities
**43% estimated to be involved in workshops

### Changes in understanding and knowledge

On average each of the industry groups reported that they had improved their knowledge and understanding about irrigation and WUE by between ‘a little’ and ‘a moderate amount’.

Overall there were 57% of respondents who attribute their involvement in RWUEI program activities to changes in thinking by a moderate to a lot. Only 17% did not attribute any of their gains in understanding and knowledge to the initiative.

| Main Income | Not at all | A little | A moderate amount | A lot | Total Respondents | Average Score* | % moderate + a lot |
|---|---|---|---|---|---|---|---|
| Sugar | 12 | 17 | 22 | 15 | 66 | 2.6 | 56% |
| Cotton / Grains | 3 | 5 | 13 | 8 | 29 | 2.9 | 72% |
| Lucerne | 7 | 3 | 3 | 5 | 18 | 2.3 | 44% |
| Dairy | 3 | 10 | 12 | 5 | 30 | 2.6 | 57% |
| Horticulture | 11 | 11 | 13 | 12 | 47 | 2.6 | 53% |
| Other | 3 | | 6 | | 9 | 2.3 | 67% |
| Total | 39 | 46 | 69 | 45 | 199 | 2.6 | 57% |

* The levels were set as 1=not at all, 2=a little, 3=a moderate amount, 4=a lot, and the average of these numbers were reported.

## Changes in Water Use Efficiency

| Industry | Water Use Estimate at start of program | Original Target Improvement to WUE | | Milestone Reports Improvements to WUE against original estimate | | Survey Improve-ments to WUE |
|---|---|---|---|---|---|---|
| | | ML | % | ML | % | |
| Sugar | 1,211,000 | 18,165 | 1.5% | 30,275 | 2.5%*** | 16.5% |
| Cotton & Grains | 600,000 | 60,000 | 10% | 67,855 | 11.3% | 12.3% |
| Horticulture | 274,493 | 7,500 | 3% | 11,073 ***** | 4%***** | 31.5% |
| Dairy &<br>Lucerne | 330,000<br>175,455 | 14,817*<br>33,000 | 5%<br>19% | 30,580<br>12,600 | 9.2%<br>7.14% | 26.9%<br>15.3% |
| **Total** | **2,590,948** | | **7.9%** | | **5.8% ****** | **18.4% ****** |

* Dairy target was modified based on the proposal target of 33,000ML
**The 180,000 ML target saved/year was the overall stated initiative goal
***The sugar target was affected by yellow rust and drought
****Weighted averages
*****This does not include yield and quality improvements

In the view of Coutts (2003), the *actual* gains in water use efficiency would be expected to lie somewhere between the estimates derived from the industry milestone reports and those estimated by respondents of the survey – that is between 152,383 ML (7.9%) and 538,917 ML (20.8%) and would be in excess of the Initiative target of 180,000 ML.

## Estimated $ benefits to industries

There were difficulties in arriving at the estimated economic benefits from the estimated gains in water use efficiency. This is because of the difficulties in clarifying the basis for the original targets, issues associated with the boundaries for calculating the $ benefits (for example, farm gate or further down the marketing chain) and the variation in logic and multipliers used. There is a further issue of gross returns versus net returns. In this case gross returns were used.

| Industry | Target industry gain $million | Gain calculated from Milestone reports* $million. | Gain using multipliers in original Barraclough table** $million. | Gain based on % improvements from grower survey*** $million | Gain based on Goulburn-Murray water table**** $million |
|---|---|---|---|---|---|
| Sugar | 22 | 9.7 | 9.2 | 64 | 6.3 |
| Cotton & Grains | 27 | 57 | 30.5 | 62 | 14 |
| Horticulture | 37 | 113.3 | 27.3 | 884.7 | 11.5 |
| Dairy &<br>Lucerne | 8.5<br>3.4 | 7.3<br>10.4 | 7.9<br>4.6 | 21.2<br>22.1 | 12.6<br>2.6 |
| **Total** | **97.9 $280******* | **197.7** | **79.5** | **1054** | **47** |

*note $ estimates were modified from those actually reported in milestones following further consultation with industry coordinators.
** calculated by dividing estimated benefit by target ML gains in modified Barraclough table at the beginning of this report and multiplying by gains calculated from Milestone reports.

***Based on % gains in efficiency reported in the survey and the same value per ML calculated from the Milestone Reports.
****Based on the table entitled 'Estimate of economic and employment benefits from irrigation' included in the appendices. Multipliers for sugar, cotton & grains and lucerne have been based on the 'farm value per 1000ML' for 'cropping' which would be understating the higher value cropping industries.
*****The original target annual benefits included in the Barraclough report based on 180000ML*$1500/ML. This is greater than the sum of the individual industry targets where some were modified to reflect the annual gain basis rather than gains over the four years of the project.

The main conclusion is that $ benefits are at least in the order of the target benefits of the program. The figures would be significantly increased if the flow-on benefits beyond the farm gate were considered.

**Influence of RWUEI activities on changes reported**
Survey respondents were asked to indicate how much they attributed the RWUEI activities and information to their decision to make practice changes.

Overall, 55% of respondents attribute the influence of RWUEI program activities or information on their decision and ability to make changes by a moderate amount to a lot.

| Main Income | Not at all | A little | A moderate amount | A lot | Total Respondents | Average Score |
|---|---|---|---|---|---|---|
| Sugar | 15% | 31% | 31% | 23% | 52 | 4.8 |
| Cotton / Grains | 21% | 34% | 34% | 10% | 29 | 4.3 |
| Lucerne | 25% | 8% | 50% | 17% | 12 | 4.8 |
| Dairy | 12% | 16% | 40% | 32% | 25 | 5.9 |
| Horticulture | 29% | 26% | 20% | 26% | 35 | 4.4 |
| Other | 29% | 0% | 29% | 43% | 7 | 5.4 |
| **Total** | **20%** | **25%** | **32%** | **23%** | **160** | **4.8** |

The Financial Incentive Scheme subsidy had a significant influence on irrigators to making irrigation practice changes by *a moderate amount* to *a lot*. This reflected a strong linkage and synergies between the extension and incentive programs.

The analysis strongly indicates that the overall program was the major driver in stimulating and facilitating changes to improve on-farm water use efficiency in the irrigation industry in the Queensland irrigation industries over the life of the project.

**Benefit/cost analysis**
The cost-benefit analysis is indicative only. The level of hard quantitative data in terms of outcomes does not lend itself to in-depth economic analysis. Dollar values are taken at face values and adjustments are *not* made for Net Present Values of costs and benefits. Also, no attempt is made to cost out in-kind inputs from irrigators, industry, government agencies and other parties. Because of this the quantitative analysis in this section is more of an indication of the magnitude returns from direct government investment in the RWUEI. Qualitative or less tangible costs and benefits are also discussed in the section.

***(i) Direct funds from NRM***

The Government's investment in the Industry Adoption Programs (including the associated R&D Projects) and the supporting Financial Incentive Scheme totalled $33.5million for Stage 1 (and a further $7.5million for Stage 2).

| RWUEI Element | $million/ 4 year project life |
|---|---|
| Adoption Program (allocated over 4 years) | 23 |
| FIS (to March 2003) | 10.5 |
| Total | 33.5 |

***(ii) Direct investment by Industry (grower and industry body costs) Investment under the RWUEI***

The principal investment in the RWUEI by irrigators was through participation in the Financial Incentive Scheme. The May 31 2003 report on the Financial Incentive Scheme reported that irrigators had provided a further $31.4 – 33.4million into improving irrigation efficiency.

***(iii) Estimated Investment Influenced by the RWUEI***

Adding the government contribution and the direct investment by Industry, gives a total known investment under the FIS of: $33.4million+$10.5million =$43.9million.

Based on the survey responses and FIS application numbers (55% said they were influenced by a *moderate* amount to *a lot* and 52% said they had applied for FIS assistance with 98% of FIS applicants received funding - ie 98%x52%=51% receiving funding), the maximum investment by irrigators under the RWUEI could be assumed as: (55%-51%)/(51%)x43.9+33.4 = $36.8million

***(iv) Estimated investment not influenced by the RWUEI***

The survey responses could also be used to estimate investments made but not (or little) influenced by the RWUEI. Based on the survey responses - 87% said they had made changes but only 55% attributed their actions to the RWUEI (ie influence *moderate* to *a lot*) - the maximum investment by those irrigators claiming to not have been influenced by the RWUEI could be estimated as: (87%-55%)/(51)% X 43.9 = $27.6million.

***(v) Estimated overall direct dollar benefits to Irrigation Industries***

The following table shows the estimated benefits to irrigation industries as a result of annual water use efficiency gains through the RWUEI program based on the Milestone Report calculations.

| Industry | $Million/year |
|---|---|
| Sugar | 9.7 |
| Cotton & Irrigated Grains | 57 |
| Fruit & Vegetables | 113.3 |
| Dairy & Lucerne | 17.7 |
| Total | 197.7 |

The estimated (conservative) economic benefit in *a single year* across all industries was $197.7million/yr.

The estimated industry financial benefits from the RWUEI are a statement of what ongoing expected annual dollar benefits could be expected *from the end of the four years life of the project* into the future.

***(vi) Benefit/Cost Analysis***

An assessment of benefit/ cost (including both the adoptions program and the financial incentives scheme i.e. all of the $41million funding of the Initiative) results in a BCR of 280/41= 6.8:1

The Benefit/Cost Ratios calculated below are based on expenditure over the life of the RWUEI. They do not include costs and returns occurring into the future and hence *have not been adjusted for Net Present Value.* In-kind contributions have also not been costed. Likewise, it is assumed that the total benefits were a result of the project activities (given it has been argued earlier that the RWUEI was the major influence).

***(vii) Benefits/Government Costs***

Given that the total Government inputs into the Adoption/FIS program over the four years was in the order of $33.5million, the following *simple* Benefit/Cost Ratio if only the (direct agency) cost of the project was put against the potential (direct dollar industry) benefits in the first year post the 4 year initiative would be as follows:
*Total direct dollar benefits across irrigation industries in the first year post-initiative/Total direct agency cost over the four years* $197.7million/$33.5million = 6:1

***(viii) Benefit/Government and Industry Costs under FIS***

Total costs to industry and government have been assessed above as ($33.4million + $35.5million) = $66.9million. The *simple* Benefit/Cost Ratio based on the first year of benefit then would be in the order of: $197.7million/$66.9 = 3:1.

***(ix) Benefit/Government and Industry Costs under and outside the RWUEI***

Finally, the least favourable estimate of a *simple* Benefit/Cost Ratio for the Initiative assumes the estimated gains were not totally attributable to the RWUEI. As discussed above, an estimate of irrigator investment based on responses to the Survey indicates that possibly another $27.6million dollars may have been invested and contributed to the overall benefit. If this were the case the resultant calculation for a Benefit/Cost ratio would be: $197.7million/($66.9million+ $27.6million) = 2.1:1

This is a pessimistic estimate of the BCR of the dollars invested, however it remains a very favourable outcome.

***(x) Assumptions/issues***

There are a number of assumptions and premises in these *simple* Benefit/Cost Ratio calculations that would affect the result. These include:

- only one year’s worth of benefits have been used;

- that the calculations which link improvements in ML to productivity and product value have validity;
- that the extrapolations used to estimate ML across whole industries are robust;
- only the direct cost inputs are considered – direct and in-kind costs from the industries and irrigators are not considered; and
- benefits beyond the industry and down the marketing chain are not included.

To some extent it is only speculation as to the length and level of the curve of accrued benefits to irrigation industries. If an assumption was made that comparative benefits were maintained at the same rate beyond those that would have otherwise occurred over time for a period of 4 years (*momentum equal to the length of the project*), the simple benefit/cost ratios calculated above would improve by four-fold, for example: 197.7X4/33.5 = 23.6:1**.** Even if the accrued benefits were discounted to better match the value of the input dollars, the order of magnitude would be similar.

***(xi) Effectiveness of Financial Incentive Scheme***

It was stated in the Ministerial reply concerning the Financial Incentive Scheme that to the 3rd March 2003…*the Government to date has contributed $10.5million, to the FIS element of the RWUEI with matching investment from landholders being $31.42 million. For every one dollar Government has invested, the return has been three dollars from landholders. …*

From these figures, the $31.42million matching funds from landholders can be seen as a cost (extra dollars needed to be invested to obtain the industry return) or a benefit (the $10.5million stimulated a further $31.42million to be invested in improving water use efficiency). It has been argued that this is a cost in deriving the reported benefits from the Initiative and that the fact that government was able to leverage or encourage that investment is separate to the estimated/potential financial benefits of the program.

***(xii) Matching funds from industries***

Some industries provided funding to add value to that provided by NR&M. Funds were provided to extend the locations or treatments of trials or to add value to existing trials. The extent of this funding is not clear, however, its treatment in calculating the Benefit/Cost of the RWUEI would be similar to that of the matching funds from the FIS.

As an example, the Dairy and Lucerne 2003 Milestone report noted that funding came from the following sources:

- $2,032,109 from NR&M
- $435,000 from DPI
- $100,000 from third parties

**Jobs**

Based on the reported improvements in water use efficiency and using the relationship between ML and jobs that formed the basis of the proposed outcomes of the initiatives, the following gains in job numbers were estimated. Jobs relate to on-farm, processing and support industries sectors, are based on estimated multipliers, and are imputed rather than actual figures. Also, the demand for new equipment through the Financial Incentive Scheme would have had a significant flow-on to the irrigation service industries in terms of dollar benefit and jobs.

| **Industry** | **1000's ML gained/year** | **Jobs/1000 ML** | **Total Jobs** |
|---|---|---|---|
| Sugar | 30.275 | 2.75* | 83 |
| Cotton & Grains | 67.855 | 2.75 | 187 |
| Horticulture | 11.073 | 30 | 332 |
| Dairy & Lucerne | 30.580<br>12.600 | 15<br>2.75 | 459<br>34 |
| Total | 152.383 | | 1095 |

*based on 'cropping' figure – may not be totally applicable to sugar