

# Discussion

## Effectiveness and impact

***The picture that emerges from the data collected and analysed for this evaluation is that of a highly targeted, very integrated intervention program that was highly successful despite the pressures of drought, deregulation and initial low interest.***

The implementation of the four year program was delayed by 6 months as funds were made available and staff were recruited and trained. The limited staff was required to work across the state within an environment of concern about encroaching government regulation and with an issue – water efficiency – that was not high on the agenda of many growers. Severe drought conditions in some regions and deregulation effects and concerns in two of the major irrigation industries limited the ability and interest of many irrigators to participate in changes.

## Participation

Despite these adverse conditions, the Rural Water Use Efficiency Initiative and its associated industry specific programs achieved an awareness rate amongst irrigators across the state of over 90%. The independent survey supported the figures from industry milestone reports that in the order of 50% of irrigators were actively involved in activities run by the RWUEI. This combination of awareness and participation is an incredible achievement in any circumstances.

## Practice change

The concept of Best Management Practice (BMP) was never satisfactorily resolved. Drawing a line in the sand to define Best Management Practice is static and is against the principle of continuous improvement. Many industries reported on numbers of irrigators *engaged in the 'Best Management Process* which would appear to be a more useful description. On that basis, irrigators who made informed changes in their equipment or practice to improve water use efficiency on their farms is a good indicator of impact. Industries reported involvement of irrigators in BMP (or having reached BMP) ranging from 30% (lucerne) to 85% (sugar). 87% of respondents to the survey reported that they had made a change in practice over the life of the RWUEI. Most attributed the RWUEI as having made some level of contribution (averaging a “moderate impact”) to their decision to make a decision to change. Those that didn't directly identify the program as influencing decisions could also have benefited indirectly by the “ripple effect”. This includes: neighbours looking over the fence at a grower and taking action as a result of their participation in the initiative; suppliers being more informed as a result of the program and thus giving better options/designs to growers; and growers swapping notes about things that the program has concentrated on without knowing that the program is influencing them. ***This is a very high impact rate for an extension program – or any commercial marketing program.***

The Financial Incentive Scheme figures also provide hard data on the segment of irrigators who applied for subsidies to make changes. The March 2003 Ministerial reply documented 4618 irrigators who were successful in their bid for a subsidy. It reported that...*the Government to date has contributed \$10.5 million, 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 (or more correctly, added investment) has been three dollars from landholders. This figure is as at 3<sup>rd</sup> March 2003, and the figure is subject to increase by 30 June 2003, as all approved applications have not been paid as at 3<sup>rd</sup> March 2003.* The survey results also showed that almost as many irrigators invested in irrigation improvements without help from the FIS (this was also highlighted in the May 2002 horticulture survey). Those that did receive subsidies rated the FIS as having a high impact on their decision (and ability) to make the change – demonstrating the importance of the FIS in increasing the overall capacity for change.

### Water Use Efficiency

The industries invested significant resources and effort in benchmarking efforts to collect data on water use efficiency and changes in the face of few water meters and little initial accurate data. Estimations of improvements were made from various methods including sampling on-farm, using models, trial and demonstrations and extrapolating from changes in equipment and management changes. Although imperfect, and with acknowledged error, the weight of evidence supports the indications that comparative improvements in water use efficiency (given common climatic, disease and economic conditions) is certainly in the order of the overall objectives of the program – a 'saving' (or equivalent extra water available for productivity) of 180,000 ML across all industries per year from the end of the program. The indications from the Industry Milestone Reports are that the actual gain may be much higher. The sheer weight of documented changes of improvements through the FIS supports this level of improvement. The survey respondents estimated that the impact of improvements they had made to their irrigation over the 3-4 years of the Initiative had resulted in gains of 16.5% on average – which compares to the overall gains of 11% targeted in the Initiative.

### Dollar Benefits

The dollar benefits were estimated through a number of approaches earlier in this report. It was concluded that the Milestone Report estimates were conservative and that the annual industry level dollar benefit was in the order of that targeted by the initiative. The simple benefit/cost was in the order of more than 6/1 (taken over 1 year) or 23:1 over 4 years – however with the many assumptions behind such a number it has doubtful utility.

The impact on jobs in regional Queensland likewise depends on the accuracy of the multiplier used to calculate it. Based on the assumptions made at the outset of the Initiative, the target would have been close to having been reached. More likely, given drought and deregulation, the saving of existing jobs may have been an outcome of the program. As pointed out earlier, a positive marginal impact on jobs in the irrigation equipment service and consulting industries could have been expected.

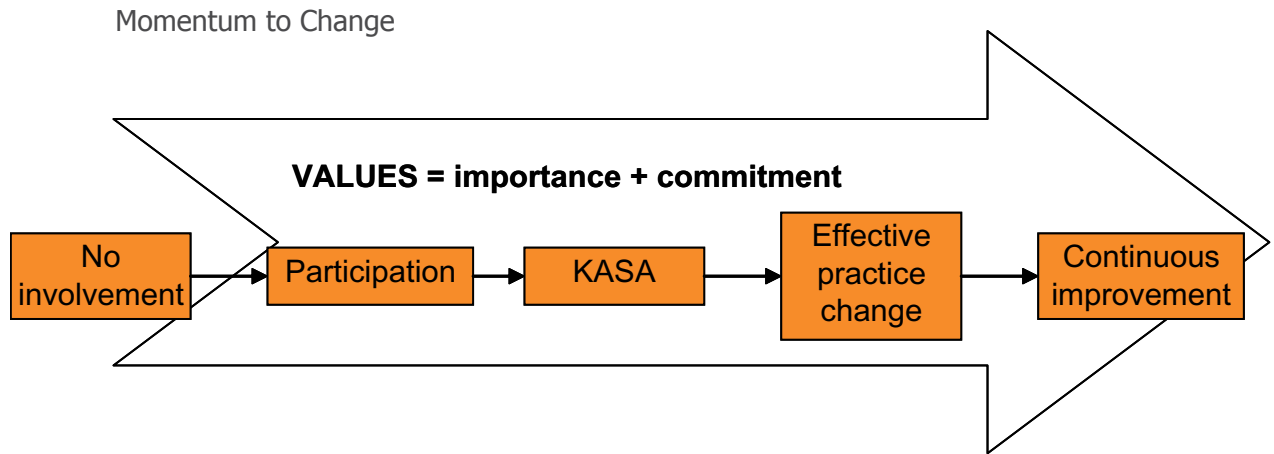
### Other Impacts and Benefits

A number of other benefits were identified in this evaluation. A major benefit was raising irrigation efficiency as an issue of importance and urgency across industries in Queensland. It has also developed a legacy in information, research equipment and human capacity in understanding and dealing with irrigation issues and improvements. Although not directly measured, there is a reasonable conclusion that improved water use on farms will have a flow on benefit to the catchment and environment in general.

### Momentum to Change

Perhaps more important than the actual physical changes made to date, are the changes in people's 'values' in relation to water use efficiency. In some ways, immediate equipment and practice change are the easy gains. Sustainable change – or continuous improvement in water efficiency – will depend more on irrigators' understanding and motivation about the issue. The survey asked about whether respondents' thinking had changed in relation to irrigation and water use efficiency. Eighty percent indicated that they had undergone changes in their thinking (and its possible that some of those who indicated that they had not made a change were already committed to maximising WUE): 23% indicated "a little change"; 35% "a moderate change" and 22% "a lot". Respondents indicated on a scale of 1-10 that the RWUEI had contributed "a moderate amount" to this change of thinking (approximately 5 on the scale).

The self assessment of respondents' scope to further improve their irrigation systems showed that over 90% saw scope for further improvement: 63% "some"; 23% "moderate"; and 6% "a lot". This correlates with the changes in thinking and indicates that irrigators both understand and see the need for further on-farm improvement. This will assist in the momentum for change – or continuous improvement in irrigation efficiency. This is represented in the following diagram:



Bell K & Coutts J 2003 Evaluating the Impact of a Program through Multiple Methods: Case Study of the Rural Water Use Efficiency Initiative (RWUEI) in Proceedings Farming Systems Conference, Toowoomba September 2003

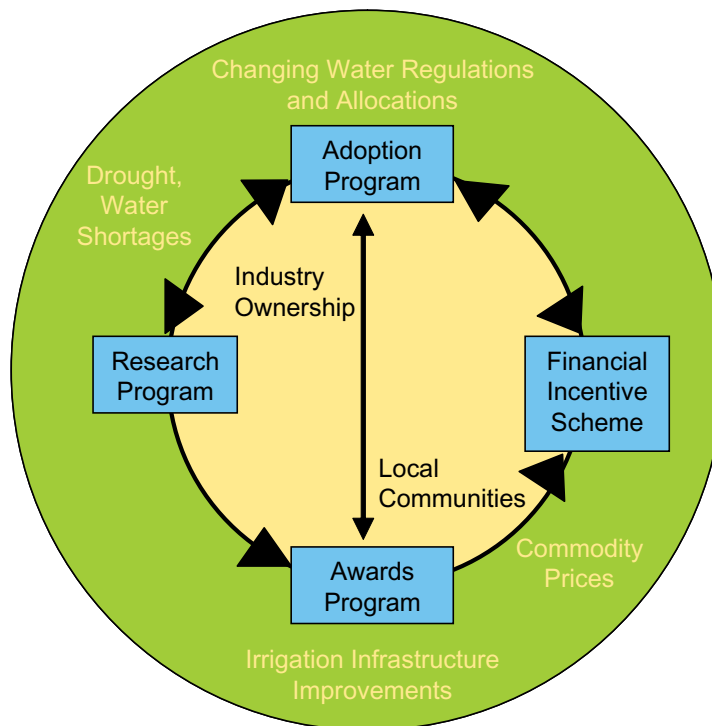
### Contributing Beneficial Factors

From the evaluation analysis, the major reasons contributing to the success of this program included:

1. The integrated nature of the Initiative - extension, research and incentives in an environment of increasing regulation;
2. The scope of the Initiative in terms of funds and human resources;
3. The clear goals and contracts given to industry coordinators to focus their efforts;
4. The effective mix of extension approaches – including a strong on-farm presence, training, groups, demonstrations and visits; and
5. The effective industry-government partnerships with a high level of regional industry involvement and ownership.

Integrated nature

The following diagram shows the relationships between the extension, research & development and incentive programs (Awards program and Financial Incentive Scheme).



It was clear that in this Initiative these factors provided a powerful mix which impacted strongly on change. All Milestone Reports referred to the impact of the Financial Incentive Scheme as it linked in with the extension activities in facilitating change. The 2003 Sugar Milestone Report, for example, stated that

*...The incentives program has been a huge success with 1898 growers, or around 63% of irrigated cane growers, purchasing items and receiving funding under the scheme. It has been hugely successful over the last few years at promoting the program, getting farmers involved in an enthusiastic way and substantially improving on farm practices. Many of the growers who have received funding have subsequently become keenly involved in the WUEI Adoption Program and have lead to increased adoption. (p12)*

This was supported through the independent survey where the influence of both aspects of the Initiative were said to have 'moderately' influenced decisions to make changes.

The awards program was another form of ‘incentive’ or encouragement to irrigators. It publicly recognised achievement in improving efficiency, rewarded people and, through the publicity, reinforced the importance of the issue to the wider community. It also provided “stories” and role models for those seeking to implement changes.

The research program allowed a limited number of local trials to demonstrate that there was a strong scientific basis for making changes to irrigation systems and provided data for irrigators and extension staff in looking at better alternatives.

### Clear goals

The clear goals of the Initiative provided a strong focus for the industry coordinators and staff. It provided the boundaries of the project and the roadmap for management, planning and monitoring. It resulted in extensive benchmarking activities to ensure that on-ground changes and outcomes could be measured at some level and reported on. The inclusion of the Barraclough targets after the contacts were signed with the different industries interfered with the clarity of these goals to some extent – fortunately there was sufficient overlap to allow the integration of the two measures.

### Extension mix

The extension programs approached the task through a strong mix of complementary methods. The following table based on the reported activities of the sugar adoption team demonstrates this mix:

Activity Type	Variations
Consultation	Regional Management Groups.
Mass Communication	Mail outs; radio notices; radio reports; fact sheets; CD based Irrigation resource kit.
Training events	Workshops; CRC training courses; LWMP workshops; Management for Climate workshop; Compass workshops.
Discussion opportunities	Discussion groups; shed meetings.
On site group visits	Bus trips; tour groups of other regions.
One-on-one farm visit	On-farm benchmarking; equipment testing; consultancy.
Demonstrations	On-farm demonstration sites.
Research	On-farm research.
Encouragement	Awards program; Financial Incentive Scheme.

Such a mix maximised the opportunity to involve a range of irrigators in WUE activities. The 2003 Sugar Milestone Report reported a participation rate of 93% of irrigators over the life of the project.

### Industry-government partnerships

The industry-government partnership was seen to be a major success factor by the sugar program – tempered by the fact that not all relevant government agencies were involved (for example EPA). It was also reported that Regional Management Groups and the associated industry leadership were also seen to have worked well as had the BSES/Canegrowers partnership. The Fruit and Vegetables Report also identified good linkages across public and private agencies as contributing to the success of the program resulting in a...*grower interactive approach through the industry representative body, Queensland Fruit & Vegetable Growers Ltd, which has given the program flexibility, credibility and a sense of ownership by growers.*

The cross-industry and agency Advisory Committee also contributed the sense of ownership and partnership.

### Limiting factors

Despite the success of the Initiative, a number of factors were identified that limited its full potential impact.

#### Time frame

The project was slow in starting – so that there was effectively closer to a 3-3.5 year project time frame. This was further exacerbated by the loss of staff towards the end of the program as they sought new employment in the face of uncertainty of on-going funding. The Research and Development components suffered most in this aspect, with some research projects not starting until late in the program limiting their value in supporting the adoption program. Some of these trials also demanded a longer time frame and replication in different soil and climatic conditions.

Dealing with an issue such as water use efficiency also requires time. It is a long term process of increasing understanding, gaining new techniques and encouraging motivation and innovation – both for irrigators and the service industries. As reported earlier...*the 2003 Cotton & Grains Milestone Report found that the program only started to make an impact in the grains and cotton industry after four years with adoption of improved practices varying from region to region. It was noted that one of the major challenges facing the program was the time it took for staff to become sufficiently trained in the often complex irrigation technology. With new staff taking at least one season to become competent and comfortable with the technology, staff changeovers can result in the loss of whole seasons.*

The delay in announcing funding and activities beyond the life of the four year initiative was a factor in a loss of momentum in the final 6 months of the Initiative.

### Limited involvement of the private sector

The focus on the program was on working directly with irrigators to bring about changes. This provided limitations to industry capacity to support on-going changes when supporting services were based in temporary extension staff. The Cotton and Grains Report argued that the irrigation industry needed irrigation specific consultants to provide specific services. *If the project had focused for four years on equipping such consultants with the tools to perform fee for service consultancies, at least some form of work within the industry would continue...even though it may not be as widespread.* Certainly there was a case for a stronger focus on developing capacity of consultants and equipment suppliers as an Initiative outcome. Encouragement for temporary staff trained through the Initiative to move into private irrigation consultancy could have also been an initiative outcome.

### Industry structures

The industries with a strong coordinating infrastructure and extension services – cotton, sugar and dairy (to a lesser extent) - were better able to build new WUE resources to add value to existing programs and to facilitate more rapid changes in their industries. Industries without such coordinating infrastructure – fruit and vegetables and lucerne – were more of a challenge in implementing state-wide WUE activities and programs. This is reflected in participation and impact figures. The progress made in the Fruit and Vegetables Industry was significant in the face of these challenges and deserves to be noted.

### Narrowness of focus

The impact of the program was also limited by the direct focus on water use efficiency only when it was not a high priority for many growers and targeting irrigators rather than including rain-fed growers who also have much to gain by using rainfall more efficiently. [This could also be viewed as a strong point rather than a limiting factor as it reduced “distractions” so that the program remained focussed on what it had to do]. The 2003 Sugar Milestone Report states that...*the cane industry favours a wide water-quality program for the future that would focus on irrigation, drainage, fertiliser use, soil management and riparian management.*

## Future and scope for further improvement

The survey responses indicated that irrigators could still identify scope to further improve their water use efficiency on farms. This is consistent with Milestone Reports and the original Barraclough Report which stated: *Even if targets set by the Industries are achieved then there will still be opportunities for further improvements as nearly 500,000 ML will still be lost.*

As pointed out earlier in the discussion, a momentum has been developed over the four years that provides an excellent basis to build on the gains made. The results of a number of research trials are yet to be fully realised and used, and the information gained through benchmarking, demonstration and working with irrigators has not yet been fully capitalised.

It is pleasing to see that this has been recognised with a continuation (though smaller version) of the program as per the following extract from a Ministerial release:

*The Beattie Government will broaden and strengthen its Rural Water Use Efficiency Initiative (RWUEI) over the next two years to further assist Queensland farmers improve their on-farm water efficiency.*

*Natural Resources and Mines Minister Stephen Robertson told a Parliamentary Estimates hearing he had approved a continuation of the government's highly successful \$41 million four-year incentives program which was originally scheduled to end in December 2003.*

*The RWUEI provides financial assistance to primary producers through their industry organisations to purchase water equipment and the latest irrigation technology and services to achieve best practice in irrigation water management*

The challenge will be in effectively using the learning gained over the original four year Initiative in targeting the new program and building in on-going sustainability of continuous improvement in water use efficiency.

# Conclusions

- i. There is sufficient evidence that the Rural Water Use Efficiency Initiative Adoption Program has successfully achieved the original objectives of the program and those outlined by Barraclough and Co.
- ii. The Benefit/Cost analyses demonstrate that the outcomes of the Initiative have resulted in a strong return for Queensland industries for the public dollars invested in the initiative with regional and state-wide benefits.
- iii. There is good evidence that the Initiative has impacted strongly on the values of irrigators in relation to the importance of water use efficiency resulting in a strong momentum for further improvements.
- iv. A number of other benefits that have been identified as a result of the Initiative include: increased human and social capacity in the irrigation industries; reduction of the need for extra dam storage capacity; and some environmental benefits.
- v. The success of the program can be attributed to the highly integrated approach of the Initiative in terms of: government-industry partnerships; industry ownership at the regional level; the synergy between the R&D program, the extension program and the incentive scheme (including the awards program); the mix of extension methods – including a strong on-farm approach; and firm negotiated goals.
- vi. Factors limiting the impact of the program included: the delay in commencing and uncertainty of continuation; insufficient time to fully complete research and consolidate gains; insufficient attention to developing private sector in the service sector; and the narrowness of the focus on irrigators and irrigation.
- vii. There is clear potential to fuel the momentum commenced in the Initiative and make significant further gains in water use efficiency on farms.
- viii. It is noted that the program has been extended for a further 2 years, on a reduced basis, providing opportunities to build on and consolidate gains made in the program to date.

# Recommendations

The following recommendations emerge from the data and are provided in the light of an announced further 2 years funding of the program.

1. The RWUEI team – comprising of NRM management, industry coordinators and teams and participating growers – should be commended on the success of the program under difficult climatic and industry conditions.
2. The focus of the extended program should be on sustainability of industry capacity to engage in continuous improvement of water management, incorporating aspects of natural resource management. This would include further building the capacity of the private sector as well as building on the changes in understanding and commitment towards water use efficiency amongst landholders and industry organisations. Training should be given to temporary staff specifically in business management to permit a potential transition into the irrigation consultant sector at the end of the program.
3. Approaches to improve on-farm water use efficiency should go beyond irrigators to include those who rely on rain-fed agriculture. The rainfall simulator is one approach to education about how to maximise the effective use of rainfall.
4. An holistic approach should be used to put water use efficiency approaches in the context of overall management of landholdings and allow multiple entry points to exploring improved systems.
5. A targeted incentive program over the next phase should focus on the more strategic and systemic improvements to improved irrigation and rain ‘harvesting’ equipment and approaches.
6. On-farm extension approaches should be continued to be strategically used to assist in the critical mass of landholders having a greater understanding of assessing existing systems and applying new approaches. The use of “roadshows” – workshops and demonstrations at different locations across the state based on existing knowledge – should be encouraged.
7. Funds should be provided to complete research projects commenced in the initial initiative and to extend successful trials to other areas and crops.
8. Clear realistic goals should be negotiated for the extended phase of the Initiative. These should be linked to a transparent evaluation process.

# Appendices

## A. Sugar Industry Report

Adoption Program funding allocation: \$4.9 Million

Impact Level	% Participation	% BMP	ML/Year	\$M
<b>Target Barraclough Modified</b>	85%	70	72,660	90
			18,165	22.5
<b>Reported</b>	93%	85	30,275	9.7

Integral to the RWUEI was the recognition of outstanding performance by growers. Rewarding the successes made by irrigators who have adopted change acknowledged their initiative and raised the awareness of the water efficiency project.

Throughout the Sugar Industry, the Irrigation Awards have been received positively. They have showcased farm management practices which have achieved efficiency in water usage often during times of climatic difficulties.

The Central District suffered continued dry weather throughout 2002-03 which resulted in below potential cane production but the RWUEI Awards contributed to continued grower interest in WUE. Twenty applications for the awards were received representing a variety of irrigation techniques and water availability.

One Award recipient is in the position of having to make hard decisions every time he irrigates because of the shortage of irrigation water. His management practices - including: monitoring water quality; green cane trash blanketing; irrigation timing; and capturing storm-water runoff - have seen high productivity despite the lack of water.

Another grower was rewarded for his good understanding of his 3 soil types and their water holding capacities. By matching each soil type with the best irrigation system for this soil type, he has optimized his water efficiency.

Another grower demonstrated that with efficient furrow irrigation and using water efficient practices such as recycling of irrigation tail water, good productivity could be achieved. Decision making was also enhanced with the use of tensiometers.

Each Award winner throughout the State has contributed significantly to the practice of water efficiency and served as a role model in both attitude and application.

*Sourced from Milestone Report Five for The Sugar Industry, June 2003 pages 39, 40*

## Industry Context

The Sugar Industry has been undergoing an extended period of declining yields and increased pressure on productivity and profitability. The industry is also in the process of further deregulation. The 2003 Milestone Report noted that...*the threat of regulatory change in recent years as well as the sugar package has made it difficult to focus the industry's attention (on WUE) during this period (p1)*. The report also refers to water pricing and other regulatory issues impacting on the implementation of the RWUEI.

Orange rust is reported to have had a major impact on cane yields (p6) in recent years – although this impact has reduced in the last year as a result of the use of less susceptible varieties. The Bundaberg/Isis district experienced a severe drought during the 2001/02 year.

There is on-going pressure on management of sugar production in the context of the Great Barrier Reef.

## R&D Projects

A number of R&D projects were developed to provide research support for the adoption program. These are listed below together with the intended and indicative outcomes.

- ***Management of Furrow Irrigation to Improve WUE and Sustain the Groundwater Resource – a case study in the Burdekin Delta***

**Leaders:** Jessica Klok, Gary Ham

**Location:** Burdekin Delta

**Objective:** Comparison of conventional and best management practice (BMP) irrigation systems on crop water use, productivity and long-term sustainability of the Burdekin Delta groundwater system.

Field trials were established on six sites representing different soil types of the delta. The BMP applied was site specific and was determined by consultation with BSES extension officers and the individual grower.

**Outcomes:** The trials demonstrated that improved irrigation management can reduce the volume of water applied to the sugar crop and that improved management of furrow irrigation can achieve higher yields and increased CWI (Crop Water Index). The project also concluded that it was possible to reduce amount of deep drainage and chemical loading on the aquifer.

- ***Towards Best use of Limited Irrigation in Sugarcane.***

**Leaders:** N.G. Inman-Banber, C.Baillie, J.Willcox. S.Attard, M.F Spillman

**Location:** Bundaberg, Childers

**Issues addressed:** How much supplementary irrigation is needed and when to apply it?

The research was undertaken in a participatory action-learning manner.

**Outcomes:**

- A computerised technique for scheduling limited irrigation based on the APSIM-Sugarcane model was developed and tested by field experimentation.
- The need to recognise deep soil water extraction and lodging effects when considering response to increased supplementary irrigation was highlighted.
- Preliminary results show that improving irrigation practices reduced volume of water applied to individual blocks, achieved higher crop yields (four out of six sites) and increased CWI (five out of six sites).
- There is less drainage under BMP irrigation than using conventional irrigation practices.
- Concern with amount of nitrate lost from system although better irrigation, fertiliser and crop management may overcome issue.

- ***Burdekin Delta Soils – A Basis for Sustainable Planning***

**Leaders:** Nev Christianos, Jim McClurg, Christine Jeurgensen

**Location:** Burdekin Delta

**Objectives:**

1. Provide a database of soils infiltration, chemical and physical characteristics for input into the Burdekin Delta groundwater model.
2. Provide industry stakeholders with GIS maps (Soils, Acid Sulfate Soils, Good Quality Agricultural Land) and develop planning principles for strategic planning and development.
3. Provide the RWUEI extension program with information to formulate best practice irrigation guidelines in consultation with growers and industry stakeholders.
4. Produce Guidelines/Master plan for Burdekin Delta.

Mapping of the area of the South Burdekin Water Board commenced in April 2003

**Outcomes:**

- Soil mapping of approximately 43000 hectares has been completed (the area of the North Burdekin Water Board).
- 47 soil types have been identified.
- Mapping of sandy soils considered the most important as these soils have significant impact on groundwater recharge.
- Also important from water management perspective to develop best practice irrigation guidelines which use water efficiently.

### RWUEI Structure

Overall direction of the program was provided by 5 sugar WUE Regional Management Groups across the state – which met 3-6 times per year. These were in the Atherton Tablelands, Burdekin, Mackay/Proserpine; Bundaberg and Isis/Maryborough. Each group or committee is made up of around 10-15 people including representatives from canegrowers, mills, BSES, NR&M, EPA, local government and environmental groups. The chair of each group is a cane grower.

The Sugar WUE team has comprised of (around) 13 staff made up of a project manager (Canegrowers) and 6 extension staff and 6 assistants (BSES) with each pair responsible for managing each designated region under the appropriate Regional Management Group (RMG). The total team – all staff and chairs of the RMGs – met as well (twice in the final year).

The 30 June 2003 Milestone Report from the industry coordinator reports that the participative approach has resulted in...*tremendous industry ownership* (p2).

## Social indicators

**Reported participation Rate: 93%**

Activities to promote exposure to, or participation in, WUE activities included the following:

Activity Type	Variations
Consultation	Regional Management Groups;
Mass Communication	Mail outs; radio notices; radio reports; fact sheets; CD based Irrigation resource kit.
Training events	Workshops; CRC training courses; LWMP workshops; Management for Climate workshop; Compass workshops.
Discussion opportunities	Discussion groups; shed meetings
On site group visits	Bus trips; tour groups of other regions.
One-on-one farm visit	On-farm benchmarking; equipment testing; consultancy
Demonstrations	On-farm demonstration sites
Research	On-farm research
Encouragement	Awards program; Financial Incentive Scheme

The 2003 Milestone Report records that approximately 2700 cane growers – or 93% of irrigated cane farmers (ranging from 85% in the Burdekin to 98% in the Southern region) – participated in WUE activities. It was asserted that most growers participated in at two or three WUE activities (p3).

A total of 1898 cane growers directly participated (received funds) from the Financial Incentive Scheme (p12). This equated to \$3 678 000 received by cane growers towards purchases costing \$16 005 000.

The 2003 Milestone Report considered that...*the single most successful aspect of the project is the observation of the change in attitude to irrigation...as the small successes rolled out and the confidence of the growers in the extension staff and their abilities grew, more calls were received* (p10).

## Best Management Practice

### **Reported Growers at BMP: 85%**

The 2003 Milestone Report provided survey results that showed that **85% of participating growers** were...*substantially meeting, or at, (irrigation) Best Management Practice* – up from 63% from a similar survey in 2001.

The survey was based on BMP criteria contained in the COMPASS workbook. Irrigation BMP in the workbook is based around irrigation scheduling; irrigation systems and irrigation management.

- Irrigation Scheduling:** scheduling with limited water and scheduling with limited capacity.
- Irrigation system:** minimising deep drainage in furrow irrigation; recycling and minimising run-off with furrow irrigation; maximising uniformity with overhead irrigation; maximising uniformity with drip irrigation and minimising deep drainage with drip irrigation.
- Irrigation Management:** weather and climate forecasting; soil management; irrigating from bores; irrigating with effluent water; farm planning.

A score is given on a 1-5 scale where 1 and 2 were defined as being at irrigation BMP, 2 and 2.5 as being substantially at BMP, 2.5-3 as meeting the minimum requirements, and 3-4 as not meeting the minimum BMP requirements. The survey was completed by 255 cane growers (8% of irrigators), randomly selected across all regions either by face-to-face interviews or by phone.

Level of BMP reached	Number growers
BMP	60
Substantially meet BMP	25
Meet minimum requirements	10
Don't meet min BMP	5
<b>Total growers surveyed</b>	<b>255 (8% of total irrigators)</b>

Eighty-five percent of growers surveyed either were operating at industry BMP or substantially BMP requirements – based on the current base line. As pointed out earlier, BMP is a moving target as more knowledge is gained about improved practices for irrigation efficiency.

Specific mention was made of changes in the Burdekin Delta in terms of the widespread adoption of increased inflow rates with the furrow irrigation systems used in the area – improving water use by about 15%.

The Financial Incentive Scheme figures showed that 1898 canegrowers (63% of irrigated cane growers) received funds for documented physical improvements towards WUE on their farms. It was noted that...*many of the growers who have received funding have subsequently become keenly involved in the WUE adoption program* (p12). Of these participating farms, it was reported that funds were used to subsidise improvements in the following areas:

System improvements	734
Recycling systems	936
System change	101
Scheduling equipment	77
Water meters	42
Consultancies	6
Weather stations	2
<b>Total</b>	<b>1898</b>

It was noted that almost 60% of funds related to system changes which had the highest potential for sustainable improvements to WUE. Particular attention was drawn to the Atherton Tableland where 34 (25%) received funding and purchased systems.

## Water Use Efficiency

### Reported gain WUE:

The 2003 Milestone Report looked at changes in the Cane Water Index (CWI) over the years since the start of the Initiative. *CWI is defined as...the tonnes of cane produced per megalitre of water applied* (irrigation plus effective rainfall – calculated through the computer model APSIM) (p5). The CWI adjusts for changes in rainfall and links productivity changes to changes in irrigation performance. It is described as the best measure available to quantify irrigation efficiency for the sugar industry. Effective rainfall is based on rainfall information and converted to effective rainfall through the APSIM model. Considerable effort is made to accurately assess irrigation usage on a significant number of farms in each region.

When comparing the changes in CWI since the project baseline in 1997/98, it is noted that orange rust and drought in the Bundaberg-Isis (and other areas) had an impact in recent years. The (adjusted) CWI was calculated for each year and the change compared to the CWI in 1997/98 (base line and pre-rust, pre-drought). The CWI in 1997/98 was 8.0. The CWI in 2001/02 was calculated as 8.2. This was a gain of 0.2 between the two years (this assumes the entire gain is equal to an improvement in water use efficiency which may not be the case). Alternatively, assuming the improved ratio was due to more efficient use of water, then there was a water efficiency gain of 2.5% of the original 1,211,000 ML or 30,275 ML. 0.2 extra tonnes per ML over the total water used for cane irrigation of 1,211,000 ML is 242,200 tonnes. 1 tonne of cane is valued at \$40 (to the cane and miller), so the extra value of cane production from the gain in CWI can be calculated as M\$9.68.

Calculations were also made based on the improvements to irrigation management, equipment and systems made through the Financial Incentive Scheme (p13). 1898 growers (60% of irrigated cane growers) obtained \$3 678 000 in subsidies to purchase a total of \$16 005 000 of improvements of existing systems. The impact on the CWI for each category of improvement was estimated with the explanation...*we have purposely been conservative about the impacts and benefits of the incentives program...in reality the impact...is at least what we have reported but could be anything up to double this* (p13). The total % increase in CWI for the cane farms involved was calculated at 2.22%.

## Issues and Learnings

An industry resource kit is being developed on CD containing the irrigation related information developed through the Initiative.

In terms of learnings about what was effective in terms of the program, the 2003 Milestone Report reported on a focus group and workshop review about what worked and did not work. The industry/government partnership was seen to be a major success factor – tempered by the fact that not all relevant government agencies were involved (for example EPA), the distrust of government agencies by growers. Regional Management Groups and the associated industry leadership were also seen to have worked well as had the BSES/Canegrowers partnership. The focus on irrigation rather than the whole industry was seen as a limitation as had the lack of ‘environmental credentials’ (p9). The low importance given to R&D was also seen as a limiting factor.

In terms of the extension activities, aspects that were highlighted as being effective included:

- Extensive consultation with growers to determine priorities;
- Workshops, meetings and discussion groups and using grower champions;
- Benchmarking performance using BMP surveys and CWI;
- PR using a communications consultant in Mackay/Proserpine and having a ‘water month’; regular weekly radio reports; fact sheets;
- Demonstration sites, bus trips;
- Irrigation awards;
- Focusing on productivity gains; and
- Integrating WUE activities with other industry activities.

Activities that were highlighted that did not work so well included: focusing only on irrigation when it was not a priority in some areas (low use, good rain etc) – focusing on the overall farm system was more beneficial in these cases; BSES driven discussion groups – rather than grower driven groups; and one-off mail outs or radio announcements – as opposed to a regular report.

## Future

The 2003 Monitoring Report concluded that...*one of the most important issues is to ensure that any future program is truly a partnership between key government agencies and industry rather than just NRM and industry* (p 9). A wider focus was also seen as required to ensure that critical outcomes were achieved. The report states that...*the cane industry favours a wide water-quality program for the future that would focus on irrigation, drainage, fertiliser use, soil management and riparian management*. This was seen as needed to address concerns about the off-farm impact of sugar growing and would require a wider environmental monitoring program. Resources to review the existing code of practice and COMPASS program were also seen as needed. A separate R&D program was not seen as essential but funds could be used for R&D consultancies as desired by the industry.

## B. Fruit and Vegetables Industry Report

*Adoption Program funding allocation: \$3.4 Million*

Impact Level	% Participation	% BMP	ML/Year	\$M
<b>Target Barracrough Modified</b>	Not set	40	30000 7500	147 37
<b>Reported</b>	80-90%	45*	11073	113.3

\*Involvement in BMP process

*While attending the workshop series, we gained valuable experience in measuring soil textures and moisture, which has helped us and our staff to become more aware of the benefits of water use efficiency.*

*(Lettuce and Celery Grower, Southern Qld)*

This vegetable grower and his family farm 40 hectares producing fresh market lettuce and celery for wholesale markets in Brisbane as well as the Southern States. A variety of irrigation methods (e.g. centrifugal pumps, overhead sprinklers, trickle system) are used depending on the stage of the crop. Water for Profit officers measured the distribution uniformity of both the overhead (83%) and trickle system (80-90%). The farmer was impacted by these measurements and was keen to maximize uniform irrigation.

Previously the trickle system was only used on the celery crop but trialing showed that it used 25% less water than the overhead irrigator. Because of the water use efficiency of this system, the farmer decided to expand it to the lettuce crop as well.

By being aware of the issue of water efficiency through attending Water for Profit workshops and having system demonstrations on his farm, this vegetable grower has made informed decisions to improve the water efficiency of his enterprise.

*Sourced from Queensland Fruit and Vegetable Growers 2003 Milestone Report, Draft June 2003, page 62*

## Overall statement about the project outcomes

The 2003 Milestone Report summarised the achievements of the Horticultural program as at June 2003 during the four year program Water for Profit as having:

- *a high level of recognition in the horticultural industries with over 90% of growers aware of the program and the drive to increase irrigation efficiency;*
- *had almost 45% of horticultural growers participating in changed irrigation management practice and improvements;*
- *had over 6000 attendances at activities and workshops, aimed at assisting growers improve irrigation efficiency;*
- *had almost 1500 individual growers participate in BMP activities;*
- *assisted over 1400 growers through the Rural Water Use Efficiency Initiative, Financial Incentive Scheme;*
- *generated more than \$162 million (since modified to \$113 million) of gains in water savings and productivity;*
- *significantly, has returned \$23 in efficiency gains for every \$1 invested in the program by the State Government [these figures require further explanation]; and*
- *produced over eighty information sheets to assist growers improve irrigation efficiency.*

A significant event noted was the nomination of the Water for Profit program for the Training and Education section of the 2003 Queensland Primary Industry Awards. The program went on to win this section at the Award presentations during April, 2003.

## Industry context

The Milestone Report stated that there has been a strong growth in the value and output of the Horticultural Industry in Queensland over the life of the project based on the difference between the \$850 million dollar industry reported by Barraclough in 1999 to one of over \$1.2 billion industry according to the Queensland Department of Primary Industries in the 2002/03 year. The original proposal however (assumed to be based on DPI figures at the time) referred to the Horticultural Industry as being then...*worth more than \$1,357 Million annually*. This highlights the diversity and decentralisation of the industry and the difficulty in collating data and drawing its boundaries. It is reported (by DPI) to now have 7000 growers, 3500 farms and over 140 types of crops. Ninety-five percent of horticulture is said in the report to rely on some form of irrigation. The range of different crops and their spread makes it a very challenging sector to work with.

It was noted that...*drought conditions during recent times have placed a greater emphasis on irrigation efficiency, but at the same time, many growers have had greatly reduced production and income, so have not been able to make changes. Wide variations in prices and uncertainty of the security of water in some regions, has also been quoted by some growers as impediments to make changes, even if they wish to do so.*

The original proposal noted that...*over 90% of the industry relies on some form of irrigation ranging from supplementary irrigation to full-scale irrigation. It is becoming increasingly difficult to build new water infrastructure in many regions and there is greater competition for water and land - particularly in areas where water is available. The main opportunities for growth in the Industry rest in F&V growers using their current water supplies more efficiently, protecting valuable agricultural land from unnecessary developments, replacing other less productive industries and in recycling wastewater.*

## R&D Programs

The following R&D projects were implemented to support the Adoption Program.

- ***Could deficit irrigation Improve Water Use Efficiency, Profitability and Environmental outcomes in vegetable production?***

**Leader:** Craig Henderson

**Discussion Objectives:** Irrigating vegetables in an economic context; Research encouraging practice changes; The complexities and challenges of the real world.

**Outcomes:**

- Lettuce increased profit from 20% water saving from \$33k to \$54k (scenario - 40 ha, 3000 cartons/ha\$7/carton, 120 ML water)
- A sweet-potato experiment demonstrated effective rain capture and use. Deficit irrigation delivered root yields and quality equivalent to sweet-potatoes where the root zone was refilled at each irrigation.
- An onion experiment irrigating onion at different deficit severities, showed moderate deficit, reduced bulb expansion and total yields compared to fully irrigated treatments. However, full irrigation also increased bulb defects (splitting and doubles) therefore marketable yields of moderately deficit irrigated crops were equivalent to those fully irrigated.
- Need to build capacity of local producers and agribusiness to develop and implement complex irrigation solutions.

It was noted that conserving water resources by investing in improved irrigation has a markedly increased impact on profitability in circumstances where water is a limiting resource that restricts the area cropped, or the intensity or irrigation over that area. Deficit irrigation can create a soil environment more capable of retaining rain, compared to a strategy of completely refilling the soil profile at each irrigation.

The project was rated as 'good-excellent' by peers at the R&D workshop in 2003. Such comments as: *good economic analysis; production functions used extensively; industry focused; demonstrated complexity of irrigation management; and applicability to a wide range of crops* were made.

- **Sustainable Horticultural Irrigation Project: Queensland Horticulture Institute, Department of Primary Industries**

**Leaders:** Chris Searle and Peter Hockings

**Aim:** To improve water management in macadamia and avocado

**Location:** Bundaberg, Queensland

#### **Macadamia Outcomes**

- Mature macadamia trees could successfully be converted from a sprinkler to a dripper based irrigation system.
- The drought compromised trial plans due to reduced water allocations for sites.
- Similar yields on 15% less water – slight reduction in vegetative growth but not significant – no strong flush as insufficient water in both standard practice and PRD.
- Engagement process has resulted in grower offering to take over running of trial with assistance with monitoring and data analysis – long term trial – run in conjunction with mulch treatment.

#### **Avocado Outcomes**

- No significant difference in yield among treatments – mean 68.6 kg/tree
- No significant difference in fruit no – mean 293 trees
- No difference in \$value return/tree
  - mean week 16 - \$259.23/tree = \$57,549/ha
  - mean week 33 - \$191.00/tree = \$42,402/ha

The project has identified a number of issues relating to runoff, compaction and subsoil acidity in macadamia. A need was identified to develop better ways of targeting change drivers such as: a market research approach (devising strategies to bring about change); research, economic, social – integrated package – cross organisational; and targeting when receptivity is heightened; improved media processes to raise profile.

The project was rated as 'good' (4/5 on a scale of 1-5) based on peer review at the R&D workshop in 2003. Strengths highlighted included: *the potential of the simple models developed, relevance of the options and the economics*. Limitations included the need for a longer trial period and the need to take environmental issues more into account. The final report had yet to be completed at the time.

## RWUEI structure

The Horticultural program was administered and operated by Queensland Fruit & Vegetable Growers Ltd in partnership with the Department of Natural Resources and Mines. The success of this partnership approach was seen to have been due to:

- A grower interactive approach through the industry representative body, Queensland Fruit & Vegetable Growers Ltd, which has given the program flexibility, credibility and a sense of ownership by growers.
- Field activities backed by a Financial Incentive Scheme.
- A fresh and proactive approach to implementing change on farm.
- Utilising a number of methods to identify growers' needs that would lead to gains in irrigation efficiency.
- Employing a variety of relevant extension methods, to assist growers making change.
- Making good use of existing resources.
- Linkages to other government agencies such as the DPI, EPA and private sector interests.
- Following through the process of change with growers.

(source: 2003 Milestone Report)

The brand used for the program was "Water for Profit". This was for quick and easy recognition of the program. The 2003 Milestone Report found that more than an estimated 90% of horticultural growers were familiar with the program.

A total of 11 staff positions were involved in the program in its final year: Program Manager; Principle Irrigation Scientist; 4 full-time and 3 part-time irrigation field officers; and 2 assistant Field Officers. Field Officers were seen as central to the success of the Water for Profit program.

Local Management committees were established in the 7 regions where separate regional plans were developed. Across the geographical regions however, there was good unity in the Water for Profit teams. *During the last year, team meetings were held in October, February and May to review progress, focus on the direction of the program and allow communication between staff. In addition to these were conferences and training meetings where team members got together on a less formal basis. Monthly teleconferences were held for the Water for Profit team.*

A significant external survey was undertaken in 2002 to gauge the awareness and impact of the RWUEI in Horticulture.

## Social indicators

**Reported level of awareness: 80-90%;**

**Reported level of participation: 6000 recorded attendees at activities.**

Activities and outputs used to engage and inform fruit and vegetable growers included:

Activity Type	Variations
Consultation	Local Management Committees; teleconferences within team; information summaries circulated; conference presentations.
Mass Communication	Newspaper articles; information sheets; QFVG News; Radio Interviews; television news stories; CD based Irrigation resource kit.
Training events	Workshops; Field days – soils & water for irrigation; irrigation management and scheduling; System evaluation; Issues in irrigation planning for profit.
Workbooks and resources	Issues in Irrigation Management self evaluation booklets; Water for Profit Resources Collection Interface.
Discussion opportunities	Discussion groups; shed meetings.
One-on-one farm visit	On-farm benchmarking; equipment testing; consultancy; technical specialist interaction with advanced systems.
Demonstrations	On-farm demonstration sites.
Research	On-farm research.
Encouragement	Awards program; Financial Incentive Scheme.

An overview of the Water for Profit field day and workshop program was given as per the table below:

Component	Awareness/Introduction	Understanding	Process
Soil and Water for Irrigation	Field days; information sheets	“Soils in Irrigation” Workshop; Information sheets	Continual improvement leading to Best Management Practice
Irrigation management & scheduling	Mass media; field days; shed meetings; industry meetings; agribusiness promotion; information sheets	“Irrigation Management” Workshop; Information sheets	
System evaluation	Mass media; field days; industry meetings; shed meetings agribusiness promotion; information sheets	“Irrigation Performance Evaluation” Workshop; Information sheets	
Issues in irrigation planning for profit	Mass media; industry meetings; information sheets	“Irrigation: Planning for Profits” Workshop; Information sheets	

It was noted that...*the workshop activities have been developed to fit within the continual improvement approach to best management practices which is an integral part of the Water for Profit program approach. While a structured approach to the workshop activities has been developed, the presentation of these workshops is characterised by an adult learning strategy which values the grower’s practical experience and encourages the grower to utilise materials and examples which are relevant to their own operation. Workshop participation is normally limited to a maximum of 20-25 growers to encourage meaningful interaction with session length variable (from 1.5 hours to whole day) depending on grower requirements.*

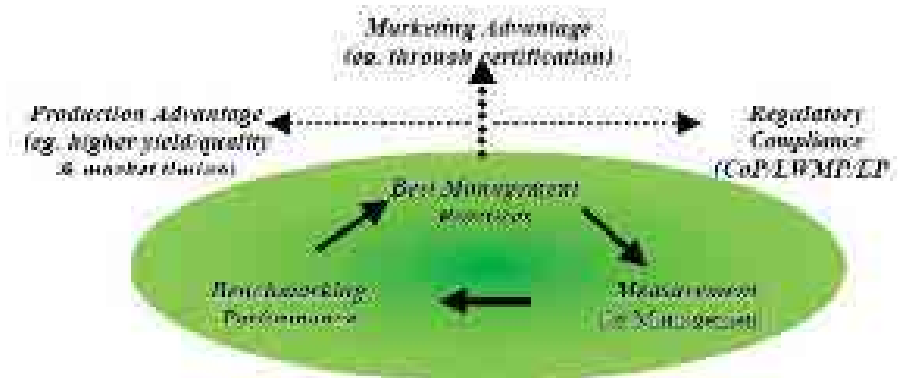


Figure 5: Continual improvement framework for the identification of on-farm water use efficiency, best management practices and increased profitability.

(Source:2003 Milestone Report)

Based on actual and estimated figures of participation in RWUE activities, the 2003 Milestone Report summed-up field officer assessment of the awareness of the Water for Profit program as being over 90%. The 2002 survey showed that 80% of respondents (across all size ranges) had participated in activities or were aware of the program at that time.

## Best Management Practice

**Reported level of changes made: 40-50% of growers**

**Reported involvement in BMP Process: 40%**

**Reported involvement in the FIS: 40%**

The 2003 Milestone Report refers to the aim of having 40% of growers involved in the *BMP process*. It reported that field officers had assessed that almost 30% of growers were involved in the BMP process in 2002 with up to half expected to be involved by the conclusion of the program. The 2002 survey indicated that 52% of respondents had made changes to improvements in irrigation efficiency with two thirds attributing the RWUE program as influencing the change.

*It notes that...the Financial Incentive Scheme has been an integral part of the RWUE Initiative. Importantly, the number of applicants that have been paid through the FIS is equivalent to 41% of fruit and vegetable growers in the state. The incentive available through the horticulture program was deliberately designed to target at least 40% of fruit and vegetable growers as the QFVG contractual target for change in irrigation management is 40% of growers changing practices. The number of growers paid through the FIS supports meeting the specified target.*

*It was pointed out that...the FIS complemented the activities of the field officers and was often the main "accelerant" for ensuring growers made a change to their irrigation. As only limited funds were available through the FIS, many growers made it a priority to make changes and take advantage of the funding through the FIS. Additionally, a substantial number of growers have commented that they would not have been able to make any changes, due to financial or other restrictions, except that the FIS was available.*

The following details were provided for the FIS as at the end of May, 2003:

- ◆ *There had been about 2100 applications for the Horticulture FIS;*
- ◆ *1500 of these applications have been approved (others did not return completed application forms);*
- ◆ *1440 approvals have been paid, averaging \$1700 each (other approvals have been expired or insufficient funds available). Total paid is over \$2.4 million; and*
- ◆ *There was a small waiting list, pending any further FIS funding being available*

This was summarised in the table provided below:

	Number of applications per region	Number of approvals by region	Approvals by category			
			Consultancy and training	Irrigations systems improvements	Scheduling equipment	Water meters
Far North Qld	182	132	0	52	69	11
North Qld	420	293	4	103	175	14
Central Qld	128	92	2	50	38	3
Lower Burnett	303	205	4	114	78	9
Central Burnett	193	153	17	81	43	11
Sunshine Coast	323	225	0	150	70	5
South Qld	524	394	2	249	134	6
<b>Totals</b>	<b>2073</b>	<b>1494</b>	<b>29</b>	<b>799</b>	<b>607</b>	<b>59</b>

The following table summarises involvement in BMP.

	Target	How Met
<b>Changes in Management Practice.</b>	40% of Horticultural Growers involved in the BMP process.	<p>Horticulture RWUE Survey in 2002 indicated that 52% of growers have made changes to improve irrigation efficiency, with two thirds of these being influenced by the RWUE program.</p> <p>Excellent attendances at Water for Profit activities with over 6000 recorded attendees.</p> <p>Field officer assessment indicates that over 40% of growers are involved in the BMP process with up to half expected to be involved by the conclusion of the program.</p> <p>Over 40% of growers have made changes through the Financial Incentive Scheme.</p>

This is based on farmer numbers rather than farm area/returns. The independent irrigator survey provides some information on the relative farm/income size of those involved in the program and/or made changes to practice (see appendices).

## Water Use Efficiency

**Gains in WUE: 11073 ML/year**

Gains in water use efficiency were provided from each region. These were calculated based on the 'level of contact' between field officers and growers. The four levels of contact are intended to indicate the level of potential error and are described as below:

Level	How	Possible Examples
Direct	Measured data (eg 5% error)	Trials; Benchmarking; Case Studies.
High	Accurate estimates (eg 15% error)	Using "irrigation issues"; individual contact; grower report.
Medium	Best guess (eg 25% error)	Workshops; Discussion Groups; Uptake of scheduling; using FIS.
None	Little or no contact (eg 75% error)	Possibly little change; third party reports, applied to FIS.

These estimates for changes are then used to calculate water gains, productivity increases and then 'Calculated Total Gains'. Reliability factors were put to each level based on the premise that...*the greater the contact, the greater the reliability.*

The Milestone Report noted that field officers calculated the gains by two methods: by grower number; and by area. They noted that the results were generally similar, though some variations did occur. For simplicity, one type was presented *in the report* being the "by grower" method.

Using this approach, the following gains were derived and reported for the whole of program period:

Contact Level	Number of growers	ML savings/ grower	Overall ML savings	Error Margin %
Direct	166	55.2	9157	5
High	628	16.5	10386	15
Medium	1218	7.2	8738	25
Low	1265	1.6	2086	75
<b>Total</b>	<b>3277</b>		<b>30367</b>	
<b>Per year (/3)</b>			<b>10122</b>	

\* The totals were divided by 3 in recognition that the results were achieved over effectively 3 years and are meant to reflect the savings per year from the end of the program

The above table referred specifically to estimated water efficiency gains independent of productivity. The Milestone Report had a separate estimation (using the same approach) to estimate improved productivity by using water more efficiently on top of these figures. To be consistent with the approach taken in this report (that is to consider the total improvement in water use efficiency in terms of to potential increase in productivity, this figure was added to that in the table. This increased the improved total overall efficiency by a further 9.4%. On this basis, the gains in total water per year available for improved productivity would be **11073ML (10122 plus 9.4%)**. This is the annual ML savings used for Horticulture in this report. This is equal to a gain of 4%.

As an example of the potential for WUE improvements as demonstrated in practice, the 2003 Milestone Report refers to one of the Award winners:

*The State winners for the 2003 Water for Profit Irrigation Efficiency Awards were David Fisher and Bridget Ramalli from Bundaberg. Their farm has undergone some significant irrigation efficiency improvements during the last year or so with input from the local Water for Profit field officer, resulting in greater than a three fold productivity increase per megalitre.*

According to the Industry Coordinator...*in practice, most of the gains we have measured are in the later half of the program. The program was still being put together for most of 1999/2000 and thus had not a chance to make any gains. The QFVG/IR&M contract acknowledges this as it states that the Adoption program is "to commence on 1 March 2000" Additionally, the "assessment is conservative as it is difficult to accurately assess productivity gains due to seasonal influences" thus there has been a tendency to underestimate the productivity gains in Horticulture. Regional reports suggest that productivity gains of 10 to 15% being common with specific case studies citing productivity gains of up to 40%.*

A calculation of potential industry economic gains used in the Milestone Report was based on a productivity of 867 tonnes/ML. Produce was given a value of \$11.8/tonne. On this basis the resulting \$ gain to the industry would have been \$M113.3 (11073ML\*867t/ML\*\$11.8/tonne).

## Other impacts

Another benefit arising from the program according to the 2003 Milestone Report was the environmental gains made – reduced off-farm impact.

*It was noted that...the principal focus of the Water for Profit program has been on the identification and promotion of irrigation management practices to improve water use efficiency. While the monitoring of irrigation practices undertaken by this project has typically targeted the farming system components which are most influenced by irrigation practice (eg. crop response, soil-water movement, surface run-off) some significant environmental benefits including reductions in deep drainage, accessions to groundwater tables and saline seepage discharges and improving soil structural conditions have been identified as part of the current program activities.*

It was also identified in the 2003 Milestone Report that the program is a source of technical information (in terms of management and equipment choice and use) and has been ...able to offer assistance in times of severe drought in many regions during the last year or so. It has also been used by many growers to assist in the transition process of shifting from low input irrigation crops into Horticulture. It is suggested in the report that anecdotal evidence points to employment opportunities being created as a result of the program.

## Issues and Learnings

The 2003 Milestone Report attributed the success of the program to a number of factors including (p6):

- The flexibility of working through the industry body and ownership being taken by growers.
- The variety of extension methods being used including a strong on-farm/site approach with trials and demonstrations;
- Good linkages across public and private agencies; and
- The backing of the Financial Incentive Scheme.

## C. Cotton and Irrigated Grain Industry Report

Impact Level	% Participation	% BMP	ML/Year	\$M
Target	Not set	70	60,000	27
Reported		78*	68,000	57

\*Involvement in BMP process

RWUEI Project Officers deal with many enquiries pertaining to water efficiency issues – from evaporation and calculating evapotranspiration to scheduling tools to deep drainage/salinity issues. A peanut grower in the Emerald district approached his local officers with regard to water infiltration problems. The farmer was faced with the issue that the ideal soil type (sandy loam) for his peanut crop was not handling the pivot irrigation system that was being used on his crop. Insufficient organic matter in the soil also meant that the resultant surface sealing from water impact caused significant water runoff from the furrows. Baling the rest of the crop after the peanuts were harvested contributed significantly to lack of organic matter.

The control trial calculated that over a peanut season 7.8ML could be lost due to this runoff problem. By reversing this, water use efficiency on the grower's farm could be improved significantly.

A number of varying trials were conducted (e.g. conventional tillage, zero tillage, stubble retention from the winter's wheat crop) with minimal positive results. Further trials (e.g. blocks, millet grown in furrows, use of wetting agent) were undertaken with the results indicating that blocks in the furrows were the most effective way to prevent water runoff.

The farmer, in conjunction with the RWUEI officers, planned to use this strategy to manage water use efficiency in the short term. The farmer purchased an Ellis Shovel which is designed to construct the blocks. A long term strategy was also identified (improving the organic component of the soil through growing millet) which would serve to improve the efficiency of water usage on his farm over time.

*Sourced from Cotton and Grains Adoption Program - Milestone Four Report, June 2003 page122*

## Industry context

The Cotton Industry is a relatively new industry which is very coordinated and integrated. It is serviced by a cotton extension team funded through the CRC for Sustainable Cotton production and the Cotton Research and Development Corporation. The industry also has a high use of consultants for insect and irrigation management. Severe drought affected much of the industry in the later stages of the RWUEI and pressure on prices was also evident.

According to the 2003 Milestone Report the objectives of the Adoption Program *...was to increase, by June 2003, irrigation efficiency in the cotton and grain industries by at least 10% and have 70% of growers adopting Best Management Practice guidelines for irrigation (p.7).*

There is pressure on the industry in terms of perceived off-farm negative environmental impacts from chemicals and nutrient run-off. Improved environmental health was seen as a significant benefit of the program in the 2003 Milestone Report. The 2003 Milestone Report also noted that the program contributed to an improved public image of the Cotton and Grain Industries.

## R&D Projects

The following R&D projects were developed to support the Adoption Program:

- ***Sub-Surface Drip irrigation (SDI) on heavy clay soils an opportunity to increase WUE and reduce off-farm environmental impacts of cotton production.***

**Leader:** Jack McHugh

**Location:** Emerald

**Objectives:**

- Compare SDI WUE with furrow irrigation on heavy clay soils.
- Compare environmental impact of SDI with furrow irrigation, with particular reference to runoff sediment and chemical transport from rainstorms.
- In collaboration with RWUE adoption program, identify incentives and constraints to adoption of SDI using on-farm action learning techniques.
- Incorporate (SDI) irrigation into BMP guidelines for cotton industry.

The CRDC provided funds to replicate sites. Peer review noted that the project provided a very detailed and accurate recording "best example of collated data from CQ". It has also provided infrastructure that will have benefit in years ahead. The limitation was noted that data based on a small scale and the impact on larger scales at above average rainfalls was not covered. There was potential seen for positive impact on Great Barrier Reef Catchment as a result of the project.

Peer review at the R&D workshop in 2003 rated this project as *Good to Excellent*. Strengths included: *high quality of data; relevant to producers; link to broader NRM and catchment issues*. The main weakness identified was *the limited economic analysis*.

- ***Investigation of In-field Irrigation Management Practices that Improve Irrigation Efficiency of Furrow Irrigated Cotton Production Systems.***

**Leader:** Paul Dalton

**Location:** Goondiwindi

**Objectives and outcomes**

1. To understand the effect of irrigation management parameters on the water balance and irrigation efficiency of furrow irrigated cotton production systems.

*Year one and two conclusion – better management to improve efficiency. NB modified practice resulted in a 5% irrigation efficiency increase but a 1 bale/ha yield reduction due to increased water logging and sending the crop to “RANK” vegetative growth. Yield could have been better optimised through agronomic management.*

*In year two there was:*

- \$32 per megalitre greater return on water investment,
- 5% increase in irrigation efficiency
- 16mm per season reduction in tailwater
- 33mm per season reduction in deep drainage
- extra .45 bales per hectare of crop production

2. To understand the surface irrigation water balance (in particular deep drainage) through physical measurement of all irrigation water balance parameters.

*Year one and two conclusion – understanding the water balance and in particular deep drainage. NB used lysimeter vs volume balance vs SIRMOD model methods of deep drainage measurement. High reliance on lysimeter that failed regularly. Relatively unsuccessful through failure of the lysimeter equipment and drought limiting irrigation water availability and data.*

3. To demonstrate research findings to industry through E&A program.

*Year three (current) – focus on measurement of deep drainage under irrigated vertisols.*

**Overall Conclusions**

- Irrigation efficiency improvements can be made through simple management optimisation to modify tailwater and drainage volumes.
- Detailed accurate volume balance methodology developed.
- Waiting on soil probe calibrations and other data processing to conclude on deep drainage volume measurements.

The peer review of the project at the R&D workshop rated the project *Satisfactory*. Strengths identified included: *the utilisation of different methods to compare results; the ability to learn from mistakes; and the demonstration that gains could be made in one season*. Weaknesses included: *problems with equipment and trial design and limitations of data*.

## RWUEI structure

Cotton Australia and Agforce had overall ownership of the Program. The Australian Cotton Cooperative Research Centre was the administrating body. A Consultative Committee was in charge of the supervision and overall direction of the project. This committee was led by growers who were representative of all stakeholders including: irrigators, consultants, agribusiness, the Australian Cotton CRC, QDPI AFFS, DNR&M, Cotton Research and Development Corporation, Agforce and the National Centre for Engineering in Agriculture (NCEA).

Two principal AFFS officers supervised the project. One of these officers was the Coordinator who led a team of four Development Extension Officers and a Technical Officer. These officers were located at Emerald, Biloela, Dalby, Goondiwindi and St George. In Toowoomba, a senior Development Extension Officer assisted and established trial sites in the Burnett and Southern Queensland irrigated grain crops.

The Program targeted five major irrigation regions in Queensland. The 2003 Milestone Report described these are extending...*from the town of St George in the South West to the Eastern Darling Downs and from the Macintyre Valley at the New South Wales border to the Emerald/Mackenzie River Region of Central Queensland* (p.13).

Grower groups were established in each region with activities based around on-farm demonstrations. Approximately 29 demonstration or trial (benchmarking) sites were established each season. This was part of an overall education program including the following elements:

- Developing an awareness of water management issues;
- Contributing to developing irrigation model for the BMP manual;
- Developing, demonstrating and promoting implementation of water monitoring systems on the farm;
- Establishing an annual award system with regards to WUE; and
- Conducting benchmarking surveys evaluating performance and outcomes

## Social indicators

### **Reported level of awareness:**

Program activities included the following:

- Grower meetings (grower organisations and RWUEI Cotton and Grains Management Groups)
- Field days
- Information sessions
- Presentations at area wide management group meetings
- Displays and paper presentation at conferences
- Roadshows – delivered during August and September 2002 by Cotton and Grains Team in Emerald, Dawson/Callide, Darling Downs, Border Rivers and St George. These had excellent attendance.

Promotional activities involving program personnel included:

- Media releases
- TV (media interviews)
- Radio (media interviews)
- Conference papers
- Reviews
- Seminars, workshops and trade shows
- Grower magazines and articles

According to the 2003 Milestone Report, there has been a very high level of enthusiasm and awareness of the program. *The Program has dramatically improved irrigator's awareness of and access to new technologies to improve irrigation management and system performance* (p.8). It was ascertained that in some regions there was 100% awareness and participation in the program.

In the Grains and Cotton Industry there has been a very high level of response to the Financial Incentives Scheme (p.8). \$1.7 million of incentives have been contributed towards the purchase of goods and services totalling more than \$4.3 million, representing a total contribution by growers of 1.5 times the incentives contribution.

## Best Management Practice

### **Reported level of involvement in the BP Process: 78%**

The 2003 Milestone Report provided evidence from a Mid-Term Review (August 2001) that 78% of cotton irrigators had become involved in the cotton irrigators' BMP program.

A draft BMP Land and Water Model has been developed by the Cotton and Grains teams based on trials and experience. The module has so far been reviewed by 10-15 growers from the Callandoon Area Wide Management Group (Border Rivers) and QDPI and DNR&M staff in Central Queensland.

It was noted that the irrigation BMP contained in the module will be further refined and extensively trialled in the Queensland and New South Wales in the first half of 2004. Another highlighted factor was the further funding received by the industry from the government to further develop the module to integrate key natural resource issues.

Despite the lack of a specific irrigation BMP module, the 2003 Milestone Report says that this does not mean that growers are not adopting 'best practice irrigation'. *Through the work of the Water Use Efficiency Cotton and Grains Team and other industry staff, growers are progressively refining their practices to ensure adoption of these practices on which the BMP irrigation module will be based* (p.29).

To further contribute to the BMP process, the cottons and grains team presented the program's learnings and results to grower meetings at all regions towards the end of 2002. Records of attendance kept at the meetings and surveys conducted after, indicated that the meetings were well attended and the information being presented was relevant and required.

It was also pointed out in the 2003 Milestone Report that pilot training programs presented on the Darling Downs instructed consultants and irrigators on best practices and sought to determine future training needs.

### Water Use Efficiency

Each season up to 29 demonstration sites were established. These sites involved the following crops and irrigation systems:

Crops	Irrigation systems
Cotton	Furrow
Peanuts	Centre pivot
Navy beans	Subsurface drip
Barley	Sideroll sprays
Wheat	Travelling gun
Chickpeas	Gated pipe delivery
Soybeans	Maize

Additional trials were established to investigate the following:

- The control of evaporation from farm storages
- Soil characterisation for water holding capacity
- Use of Polyacrylamides (PAM) in sediment control and water penetration.

The 2003 Milestone Report looked at the water use efficiency gains in relation to state benchmarks as presented in the Stocktake Report (Goyne et. al 2000). According to these indices, there was an indication that the 10% target increase set for the program was achieved prior to the final summer growing season. However, the 2003 Milestone Report makes mention of the drought and its effect on reducing the yield in 2002/2003.

This ...impacted significantly upon the resulting water use efficiency indices (p.17). The table – Crop Water, Agronomic, Engineering and Economic WUE Indices for the Furrow Irrigated Cotton Benchmarking Sites Across Regions (p.16) – shows some efficiency indices recorded for the 2002/2003 season as being reduced. The 2003 Milestone Report however, points out that this does not mean that the program has been unsuccessful rather it is based on seasonal results. *This demonstrates that the discontinuation of the Program limits its ultimate success. Given time, and favourable climatic conditions, efficiencies well beyond the highest levels shown in the table could be attained.*

According to data provided by the Cotton Industry (similar data was not available from the Grains Industry), the Program’s projected gains (10% increase in efficiency) were reached by the end of the 2001/2002 summer season. See the following table for the results:

Criteria	Projected Gains (Cotton and Grain)	Actual Gains (Cotton only)*
Water Saved	60,000ML	67,855 ML*
\$ Return from \$5.1 million investment in program	\$58 million	\$57 million

\*No estimate was made for irrigated grains because of lack of data.

The 2003 Milestone Report notes that if the grains data was available, the gains for the Program would be even greater.

Water saved was based on comparing the total ML water estimated as being used in 2000/01 to that estimated as being used in 2001/02 assuming the same number of hectares was planted in both seasons. Irrigation efficiency was based on extensive on-farm benchmarking by WUE staff across regions in furrow irrigated cotton farms. Rainfall was not considered though it was noted that average effective rainfall was similar in both seasons. Bales/ha figures were sourced from the Cotton Yearbooks 2000/01 and 2001/02. The gains were estimated as follows: *This saving of 67,855 ML provides the capacity for the production of 113,996 extra bales of cotton with a value of \$57 million (at \$500/bale) (p19).*

As noted above, the crop Water Use Efficiency figure, *irrigation efficiency*, was down in 2002/2003 (1.47 compared to 1.68 in 2001/02 and 1.49 in 2000/01). If this figure was used it would show a gain in water used between 2000/01 and 2002/03. It was not used, according to the coordinator, due to the drought factor where cotton growers...*had much less water available but attempted to maintain the same number of hectares.* As a result irrigation was used to keep crops alive rather than using correct scheduling approaches. This had a major impact on WUE for that season.

## Other Impacts

Other impacts of the Initiative included environmental, employment and the impact of activities/linkages.

Environmental health was described as a significant benefit of the Initiative. This was said to be due to...*greatly reduced runoff of irrigation tailwater into rivers and streams and the associated reduction of nutrient and pesticide contamination in the water* (p.32) – however it was not clear how this was assessed. The 2003 Milestone Report says that the industry's BMP program is playing a role in causing irrigators to be increasingly conscious of the relationship between the industry's economic sustainability and its impact on the environment. Practices in place include:

- Reticulation systems
- Soil conservation methods
- Pesticide management plans
- Precision of water application

Another benefit of improved water use efficiency according to the 2003 Milestone Report is...*decreased water extractions from water sources, [increases in] water availability for environmental flows in rivers and natural recharge of underground aquifers* (p.32) [except where saved water is used for increased production].

Job creation in the rural sector and allied industries has been linked by the 2003 Milestone Report to improvement in efficiency and resulting positive impact on the Queensland economy. Those industries supplying irrigation equipment and monitoring have been particularly affected, with a continual rise in the numbers of companies supplying this equipment. The large number of companies exhibiting at a recent Irrigation Association of Australia conference was cited as an example indicator.

## Issues and Learnings

One of the major learnings from the Initiative was related to the significant training needs of new staff which lead to the...*first year of trials being more of a staff training tool than a useful benchmarking outcome for growers* (p.31). It was pointed out however that subsequent staff appointments had more experienced staff on hand, thus shortening the learning process.

Other issues included the need for greater emphasis from the beginning of the program on building capacity within the industry. The 2003 Milestone Report relates this to the non-continuation of the program in its present form. It argued that the irrigation industry needed irrigation specific consultants to provide specific services. *If the project had focused for four years on equipping such consultants with the tools to perform fee for service consultancies, at least some form of work within the industry would continue... even though it may not be as widespread* (p.31).

It was also pointed out in the 2003 Milestone Report that there was probably too much focus on meeting milestones and promoting the project...*rather than looking at how much potential there was for exceeding the milestone targets* (p.32). The report also concludes that greater interaction between RWUEI management and individual adoption program field staff may have resulted in...*more flexibility, better morale and promotion of some of the more detailed but highly relevant findings from the trials* (p.32).

## Future

The 2003 Milestone Report found that the initiative only started to make an impact in the Grains and Cotton Industry after four years with adoption of improved practices varying from region to region. It was noted that one of the major challenges facing the program was the time it took for staff to become sufficiently trained in the often complex irrigation technology. With new staff taking at least one season to become competent and comfortable with the technology, staff changeovers can result in the loss of whole seasons.

The concern is that at the conclusion of the RWUEI, new staff will be required for any new initiative which according to the Report will result in the loss of accumulated knowledge skills and experience of current staff members. This is excluding the time needed to train new staff. It was also raised that from the growers' point of view, they become... *more disenchanted with this lack of continuity, to the point where many of the most active influential and capable growers now refuse to participate in future activities as they see no reason to commit their own resources to a cause which will ultimately cease activity.*

## D. Dairy and Lucerne Industry Report

Impact Level	% Participation	% BMP	ML/Year	\$M
Target	Not set	40	42,300	12
Reported	72	49/42	43,180	7.3/10.4

The RWUE project incorporates demonstration farms as a way of trialing and investigating water management initiatives. A family farm producing Lucerne and beef cattle in the Texas region provided a site for irrigation management demonstrations.

The irrigation system on the property consists of 3 Zimmatic centre pivots as well as an end tow system. Only one centre pivot (a maintained 25 year old, original system) covering approximately 26 Ha of Lucerne is being monitored. The Lucerne is used mainly for hay production and for cattle grazing when needed. Enviroscan® probes and a Tipping Bucket Rain Gauge were installed on the monitored plot. The initial results indicated that there was accurate crop water use for an established Lucerne crop. Ongoing monitoring of the soil moisture data has allowed the farmer to make optimum management decisions re irrigation scheduling. The farmer noted that: *Despite water supply restrictions, this irrigation strategy allows us to “hold the fort” by keeping soil moisture in the “green zone” and takes care of the crop’s peak moisture demand in this severe summer.*

A system check by Project staff on the centre pivot irrigator indicated a below average distribution uniformity (67.8%) and pump efficiency (63%) compared to the benchmark figures of 90% and 75%. Another problem highlighted was that more water than is required was being applied in the first span. Consequently the Lucerne was becoming water-logged and was dying. In consultation with Project staff, the grower made modifications to the irrigator and a subsequent system check revealed some improvement in all areas. The farmer noted that *...the Lucerne appears to be more even within the circle of the pivot and ...water-logging no longer occurs in the first span.* Although the figures were still below the bench mark, the improvement was positive considering that there was no financial outlay for the changes. According to their hay-baling contractor, the changes adopted produced *...a noticeable improvement in hay yields.*

In this instance, the grower and his family have gained from the input of the project. Their increased knowledge has allowed them to see that the adoption of other system changes (e.g. a new rotary nozzle package) would further improve distribution uniformity and consequently total water efficiency. The grower is maintaining accurate records of his farm’s hay production for a quantitative comparison of paddock productivity before and after system modifications. Such records will allow informed decision making on future water management.

*Sourced from Case Studies and Farmer Learnings “Irrigation for Profit” June 2003,*

## Industry context

The drought was an overriding factor within the Rural Water Use Efficiency Initiative - "Irrigation for Profit". It was stated in the 2003 Milestone Report that...*the success of the RWUE project state-wide is continuing despite the worst recorded weather conditions being experienced* (p.8). With most river/stream and aquifer systems closed to irrigation, and extensive state-wide imposed water restrictions, the Report asserts that adversity was overcome through farmer education and training as well as extension methods.

In addition to water restrictions, the 2003 Milestone Report identifies that normal farm operations have been severely hampered due to the drought and irrigation is being used more strategically. Farmers have been acknowledging that efficiency and Best Management Practices (BMP) are significant issues...*but survival of life on the farm is taking all the financial resources left to them. Irrigation improvement is taking a second place to bread and butter on the table* (p.8).

Other industry factors relating to project are:

- Some farms do not have any stored water at the start of the Spring season. This means a high cost to dairying in purchasing feed;
- There has been good pasture rains from Central Queensland to the Downs, but follow up rain is needed; and
- Queensland Dairy farmers have reduced income due to major cooperative reducing milk income by up to 3 cents/litre.

## R&D Programs

- ***Sustainable dairy farm systems for profit***

**Leaders:** Jeff Andrews, Mark Callow and Sarah Kennan

**Location:** Mutdapilly Research Station, Qld

**Objectives:** Compare five very different systems of tropical dairy farming using five streams of investigation including dairy productivity, water use efficiency, environmental sustainability, business management and social aspects.

Physical models of each farming system with 20-cow farmlets and data from 17 companion farms throughout Qld were used to evaluate systems. The relationships between biomass production and planned water use were not constant during the study suggesting that other factors were affecting water use efficiency.

**Outcomes:**

- Each farmlet close to achieving milk production target. Yields to date in the 02/03 year are better than the first year.
  - Yields in M5 farmlet where cows are in feedlot and milked three times per day approaching yields commonly reserved for US dairy industry suggesting that performances can be achieved in subtropical Australia provided appropriate inputs are maintained.
  - Rain-grown oats by far the most water efficient – due in part to using moisture stored in the immediately preceding 3-month fallow period.
  - Perennial ryegrass the most water use efficient of temperate species.
  - Maize recorded greatest efficiency with 4.3tDM/ML/ha.
- **Diagnostic “toolkits” for mobile irrigation systems**

**Leaders:** Rod Smith, Joseph Foley, Geoffrey Newell

**Location:** Toowoomba

**Aim:** To develop and implement a suite of procedures designed to aid irrigators and extension staff in the diagnosis and correction of design, component, operational or management problems with mobile irrigation systems.

**Outcomes:**

- Published reviews of use and performance of both travelling gun and large mobile machines;
- Field measurements benchmarking the performance of these machines across the range of industries comprising the RWUE program;
- Development of the decisions support program TRAVGUN for the selection of preferred travel lane spacings and nozzle sector angles for travelling gun machines; and
- Evaluation of programs designed to model the hydraulic and irrigation performance of centre pivot and lateral move machines, and detailed testing of the programs selected to comprise a diagnostic system for these large machines.

## RWUEI structure

Overall industry ownership of the program belongs to Queensland Dairy farmers' Organisation. A consultative committee (steering group) with QDO organisations representation, NR&M, private industry consultants, DPI stakeholders and Dairy consultants, supervise and direct the program. They meet six times a year.

The 2003 Milestone Reports says that as the Initiative is in its final year, with little hope of continuation, current staff are looking for new positions and new staff are difficult to find due to the short tenure of jobs. Recently vacated positions have not been filled with existing staff covering the responsibilities.

## Social indicators

**Reported level of participation: 72%**

The extension activities used by Irrigation for Profit teams included the following:

- Demonstration farm sites
- Field days
- Farm walks
- One-to-one irrigation system audits (Testing current equipment)
- Issue based workshops
- Farm tours
- Seminars
- Road shows
- Newsletters and fliers
- Media releases
- Discussion groups
- Awards program
- Benchmarking
- Given farmers equipment to experiment with
- Gained specialist services as required to aid field officers and farmers
- Developed benchmarks (with DB &B)
- Made strong linkages to other RWUEI adoption programs
- Developed regional data from Demonstration sites
- Strong linkages to Dairy R&D program at Mutdapilly
- Linkages to other extension programs
- Have regular team meetings and phone hook-ups
- Irrigation farm planning advice
- Irrigation web site

(source: 2003 Milestone Report)

According to the 2003 Milestone Report, to June 2003, the project has had 72% participation of irrigators in extension activities including field days, workshops and farm visits. Of these, 18% have had irrigation systems audited for Distribution Uniformity (DU%), pumping costs (\$ML) and application rate, and 42% have used the Financial Incentive Scheme (FIS) phases 1-3.

In the Dairy Industry...*every farmer has been sent publications containing in depth case studies of farmers improving their water use efficiency* (p.7). The following were identified as factors in promoting change:

- An awareness campaign to publicise the benefit and costs of irrigation systems and management practices that improve WUE;
- Developing a Communication Plan to focus communication;
- Developing links with other industry RWUE adoption programs;
- Farmer issue based workshops; and
- Farmer irrigation study tours, interstate and state-wide.

Deregulation and lack of irrigation has slowed the Initiative's progress as well as farmers leaving the industry says the 2003 Milestone Report. The figures shown on p.10, show that since the onset of the project the number of dairy farms (Qld) has fallen from 1600 to 1150 - a drop of 28%. The water requirements of the industry have therefore dropped accordingly with usage dropping 28% as well to 216,000 ML from 300,000 ML. Lucerne producer figures are not as readily available with project databases indicating 454 producers in Queensland rather than the 1600 stated by the ABS. The database...*for this study includes significant commercial enterprises in lucerne growing* (p.10).

The 2003 Milestone Report (p.10) mentions other project initiatives that have shown good farmer participation levels:

- Involvement in the launch of the Dairying Better'n'Better decision support CD (contains major sections on irrigation, fertiliser and effluent management) through provision of benchmarks, rules of thumb and system checking processes. 11 field days (across QLD) resulted in 67% of participants wanting more training on irrigation system improvement and management in a smaller group format. Lucerne grower meetings held at the same time indicated similar support for skills training. Consequently issues based workshops went state-wide.
- Monthly case studies published in the Dairy Times, plus articles published in regional papers advertising lucerne and dairy workshops.
- Development of 'irrigation update' website.
- Papers presented at the R&D and E&A workshop 8-9 run by NR&M.
- Evaluation of farm educational tours show that over 65% of farmers made significant changes in management practices as a direct result of knowledge gained on tours.

## Best Management Practice

### ***Reported level of participation in BMP Processes: 49% dairy; 42% lucerne***

According to the 2003 Milestone Report, 49% of the Dairy Industry use BMP and 42% of the lucerne growers use BMP (a limitation of the figures that they are based on a per farm basis as required by the Barraclough guidelines rather than an area or economic size basis). *BMP in this case...is intended to mean adoption of scheduling practices, and/or recording irrigation, rainfall and hay/pasture production, and managing for agronomic and economic WUE; a significant change in past practice* (p.12). Both the dairy and lucerne industries used the same process to arrive at the BMP adoption levels. The process was conducted state-wide (in both industries) over 350 irrigation system audits to provide baseline data to aid in judging BMP farm improvements. Results for the dairy industry are as follows:

1. The percentages of farmers involved in different levels of contact with the RWUEI Initiative were determined – high, medium, low, and little contact
2. These figures were further developed to identify the percent of farmers who had adopted BMP; and
3. These figures resulted in an estimated BMP adoption level of 49% for the dairy industry farmers.

The below table displays the figures for the Dairy and Lucerne Industries:

	Dairy (49.27%)		Lucerne (42.51%)	
Level of contact	No. of Farms (% of total)	Number at BMP (%)	No. of Farms (% of total)	Number at BMP (%)
High	226 (40.4%)	147 (65%)	153 (34%)	92 (60%)
Medium	212 (37.8%)	106 (50%)	183 (40%)	92 (50%)
Low	108 (19.3%)	22 (20%)	70 (16%)	11 (15%)
Little	14 (2.5%)	1 (1%)	48 (10%)	0 (0%)
<b>Total</b>	<b>560 (100%)</b>	<b>276 (49.27%)</b>	<b>454 (100%)</b>	<b>42.5%</b>

The 2003 Milestone Report said that...*if there has been any reason for the program not influencing more irrigators in the adoption of BMP it has been the climatic conditions and subsequent financial restrictions* (p.13). The FIS has also been a significant aid in knowledge and skill/management change. *Farmers knew a problem existed, but not to what measured effect (loss) this was till this program encouraged knowledge acquisition in this area* (p.13).

## Water Use Efficiency

The 2003 Milestone Report quotes the improvements to Water Use Efficiency figures as being 14% for the dairy industry and 9% for the Lucerne Industry. The following table outlines the numbers for each industry.

Level of contact	Dairy		Lucerne	
	No. Farms	(WUE) water saving & productivity gain (ML)*	No. Farms	(WUE) water saving & productivity gain (ML)*
High	226	20,340	153	5,040
Medium	212	8,480	183	4,410
Low	108	1,620	70	2,520
Nil	14	140	48	630
<b>Total</b>	<b>560</b>	<b>30,580</b>	<b>454</b>	<b>12,600</b>

\* This figure is a composite of their estimated direct irrigation reduction and their estimated increase in the efficiency of existing water through increased production *in a normal year*. The logic is that as a result of total improved efficiencies an equivalent of an extra 4% plus 10% - or 14% - (in the case of dairy) of water is available for extra productivity. It was noted that during 2002/03 many producers were reduced to irrigation levels of less than 50% of their yearly quota supply (2003 Milestone report p 5).

The Industry Coordinator pointed out that...*If the real figures of water savings were looked at it may be 60%+ as many farmers could not irrigate as they had no resource to do it with (dry dams and rivers with little or no water and bores with no water or very little reserve). The water wasn't therefore 'saved' – as it just wasn't there to use.* The issue here, however, is whether improved efficiency helped farmers in drought times make greater use of limited resources.

In the 2003 Milestone Report it was noted that with the WUE data also looked at...*recorded efficiency of production on farm across seasons, crops and pasture types irrigated within the regions and state [and]... used demonstration farm data water use and data collected from statewide system audits of irrigation plants (p.15).*

A survey conducted in 2002 of 500 farmers who have made changes through involvement in the Initiative was quoted in the Report as showing an 8.7% improvement in water use efficiency across the dairy and lucerne industry in 2002. A 30% reduction in water used to grow the same amount of feed at on farm demonstration sites was achieved by:

- Improving the Distribution Uniformity % of the irrigation system and accurately measuring application amount.
- Using scheduling tools to manage frequency and volume of irrigation events. (source: 2003 Milestone Report)

The calculation of industry economic benefits from this improvement in water use efficiency is based on 1 ML of water yielding 1000 litres of milk from irrigated pasture (this was the figure used in the original Barraclough calculations – the amount varies from 450-2500 litres milk/ML in practice and 2000 is a good target, (Waters, W pers com 2003). The assumption is that any extra milk goes into manufacturing milk at 24 cents per litre. The value of the estimated extra 30,580 ML of water then would be M\$7.3 (30,580ML\*1000litres milk\*0.24c/litre).

To estimate industry economic gains from lucerne from the 12,600 ML reported improvements in water use, it assumed that an average of 8 ML water is applied per hectare of lucerne on an annual basis yielding 22 tonnes of dry matter (that is 1 ML yields 2.75 tonnes dry matter) which is then sold for an average of \$7.50/25kg bale (\$300/tonne) at the farm gate (double this in dry times) (Martin M pers com 2003). This would result in an economic benefit of M\$10.4 (12,600ML\* 2.75tonnes\* \$300/tonne).

### Other impacts

Overall one of the most significant impacts of the Initiative reported was its achievements in relation to WUE, BMP and positive attitudinal change, even though it operated through a severe drought year. The 2003 Milestone Report attributes this to the Initiative being well funded. There appears to be great disappointment however that no further funding had been promised after June 2003 to continue the project, even though *...it was noted by all members of the Rural advisory committee that a follow up or continuation of this adoption and FIS would benefit rural industry and continue on with even more gains in the WUE and BMP (p.15).* The argument is that non-continuation of the program would result in lost opportunities and slowing momentum particularly when gains have been worked for so hard.

The Report also quotes figures relating to direct funding for the program. The figures are as follows:

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

Of the total FIS funding of \$1,662,375 released to the Dairy/Lucerne Industries it was noted that industry had invested \$3 to every \$1 of government funding over the first three phases of the Initiative. *Phase 4 data on hand indicates that when monies are released next month this may be as high as \$6 to \$1 (p.16).*

## Issues and Learnings

There were a number of issues and learning presented in the 2003 Milestone Report. They are as follows:

1. The considerable respect gained from the industry may be in jeopardy with a loss in consistency. This leads to a slow down in adoption practices as staff work to rebuild bridges.
2. The FIS scheme played an important part in the adoption process. This is due to a shortage of capital on farm for irrigation updating or repairs, and of irrigation water itself due to the drought.
3. The unregulated and unorganised nature of the Lucerne Industry creates a competitive environment and therefore limits modern extension methods because of the reluctance to share experiences.
4. Due to the drought and consequent lack of water availability and lack of feed, farmers have little interest or time to follow through their increased awareness of improving water efficiency. Dairy farmers have also been financially affected due to decreased milk prices and lack the capital to invest in irrigation systems.
5. The pre-conceived idea of using scheduling as a process line was changed when the condition of many irrigation systems changed the priority to getting these systems to correct performance.

## Future

The 2003 Milestone Report states that...*the program has benefited greatly by all staff and all organisations involvement addressing the issues at hand in a positive and collaborative manner. If this model is developed on any continuing program will be successful* (p.16). It is noted that programs such as this need continuation and should be considered more as a ten year program rather than a three year plan. The Report relates this to funding issues that should be addressed by funding institutions in the future.