Rural Water Use Efficiency for Irrigation Futures
Final report 2013–17
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Introduction

Rural water use efficiency programs were first implemented in Queensland in 1999 to assist the irrigation sector in improving the efficiency of on-farm water use, and to help transition irrigators through national and state government water reforms. The current program, Rural Water Use Efficiency for Irrigation Futures (RWUE-IF), is an industry-delivered, Queensland Government-funded program designed to promote water use efficiency on farms. This report covers the four-year RWUE-IF program from July 2013 to June 2017, and reports on the cumulative outcomes from the four years.

The overall aim of RWUE-IF is to improve the use and management of on-farm irrigation water in an effort to achieve improved productivity and sustainability of rural industries, support departmental initiatives and to achieve natural resource management outcomes. Assistance to irrigators is primarily provided through technical advice, irrigation system evaluations, limited financial assistance, field days, workshops and exposure to web-based technologies.

RWUE-IF adopted the overarching theme of ‘precision irrigation’ to promote and deliver the uptake of improved practices, efficient irrigation equipment and contemporary technologies. Delivery of services to irrigators is primarily on the basis of participation in their industry’s best management practice (BMP) or farm management system (FMS) initiatives, through the adoption of relevant BMP/FMS modules.

Industry partners include CANEGROWERS, Growcom, Queensland Dairyfarmers’ Organisation, Turf Queensland, Flower Association of Queensland, and Nursery and Garden Industry Queensland. Industry partners are supported by Irrigation Australia Ltd and the National Centre for Engineering in Agriculture (NCEA). They provide enhanced outcomes by improving the technical capacity of service providers to deliver competent services. Additionally they have developed and promoted the uptake of new technologies and practices.

RWUE-IF, and its unique framework, have produced valuable outcomes. RWUE-IF established close linkages with departmental programs such as water planning and the state-wide non-urban metering initiative. It focused in areas where the condition of land or water resources is degraded, or at risk of becoming degraded, through irrigation development.

The four-year program realised significant outcomes despite adverse weather conditions, including increasing drought conditions in many parts of the state and two cyclones with significant associated flooding.

This report was developed using information contained in milestones and final reports submitted by industry bodies and support organisations.
More than $8m invested over 4 year-program to improve irrigation and land management practices, promote efficient irrigation equipment and contemporary technologies.

A software application for mobile devices that allows irrigators to use water meter data to ensure that they are irrigating to meet the crop’s water requirement.

Initiated the development of industry codes of practice for the design of rural irrigation systems to guide irrigation designers, consultants, suppliers, contractors and irrigators in achieving best practice.
Cane

CANEGROWERS delivered projects in the Lower Burdekin, on the Atherton Tableland and five other irrigation areas.

In the Lower Burdekin, a number of strategies were piloted to contribute to lowering the water table and prevent land salinisation. Projects included:

- irrigation system assessments
- financial incentives for conjunctive use bores, which allow surface water and bore water to be mixed for irrigation use, reducing the amount of surface water used and contributing to lowering the water table
- replacement of piping (for example, using piping instead of an open channel for irrigation)
- soil moisture equipment, to assist growers in matching water use to need
- system change and upgrades to recycle pits, which allow irrigation run-off water to be stored and re-used
- automation and implementation of on-farm telemetry systems.

On the Atherton Tableland, on-farm technical extension activities and financial assistance were provided to assist irrigators to mitigate against water table rises.

Information systems for improved irrigation scheduling, which provide local real-time data to growers to make better decisions on irrigation, have also been installed in the five peak irrigation areas of the Burdekin, Tablelands, Proserpine, Mackay, Plane Creek, Isis and Bundaberg.

<table>
<thead>
<tr>
<th>Burdekin Financial Investment Scheme</th>
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<tbody>
<tr>
<td>No. successful applicants</td>
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<tr>
<td>Total incentive committed</td>
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<tr>
<td>Average $/project</td>
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<td>Area affected</td>
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<td>Average area affected per project</td>
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<td>Total water saving</td>
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<td>Average annual saving</td>
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<td>Average investment</td>
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<tr>
<th>Burdekin Conjunctive Use Investment</th>
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<tr>
<td>No. bores</td>
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<tr>
<td>Investment $ on bores/monitoring &amp; tests</td>
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<tr>
<td>Investment $/bore</td>
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<td>Max ML pumped/annum for 6 bores</td>
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<td>Investment bores $/ML pumped</td>
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<table>
<thead>
<tr>
<th>Tablelands Financial Investment Scheme</th>
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<tr>
<td>No successful applicants</td>
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<td>Incentive</td>
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<td>Average $/project</td>
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<td>No of ha affected</td>
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<td>Average area affected per project</td>
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<tr>
<td>Saving ML/project</td>
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<td>ML saving/annum</td>
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<tr>
<td>Average investment /ML saved annually</td>
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<td>Average investment /ha</td>
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The Queensland Dairyfarmers’ Organisation engaged with dairy and fodder growers in targeted areas including the Callide Valley, where irrigators are dealing with reduced water allocations. Growers are engaged through visits to demonstration farms, provision of on-farm technical advice, irrigation system assessments and performance-based financial incentives, and were encouraged to change irrigation and water reuse systems. Projects have achieved:

- water use efficiency gains of approximately 10 per cent of the dairy industry’s existing water use
- an average of 47 per cent reduction in energy use
- 130 producers adopting improved water, energy or nutrient practices
- 10 training events involving 100 producers
- 72 water, energy and/or nutrient assessments and/or completed evaluations
- 44 enterprises receiving financial assistance for system change and improvements.

It is calculated that the Dairy and fodder project has delivered water use efficiency or productivity gains of 2991 ML per year. Extrapolated over the life of the program, this equates to a water use efficiency gain of almost ten per cent of the dairy industry’s total water use. In addition, fodder growers have achieved efficiency gains of 1367 ML per year.
The Jordison family operates a 730 hectare dairy farm between Jambin and Goovigen, located on the flood plain to the north west of Biloela in the Fitzroy Basin in Queensland.

Approximately 25 hectares are under centre pivot irrigation, which is sourced from groundwater in the Callide catchment. Impacts of extensive flooding from Callide Creek and its tributaries caused damage to a hard nose boom irrigator in 2013. The DFWP program included a grant to assist dairy farmers to engage professional skills to assess on-farm irrigation and water reuse management systems.

The assessments highlighted the need for better energy and water efficiencies. Through consultation with DFWP, the Jordison family chose to purchase a Valley 180 metre centre pivot. The pivot was chosen to cost-effectively irrigate an area of up to 25 hectares at a lower operating cost per hectare than the previous system.

A post-implementation evaluation report of the upgraded system by DFWP was provided to the farmer based on the performance of the centre pivot system, so they could rectify any inefficiencies.

Data collected from the evaluation was highly accurate regarding water use and energy efficiencies derived from the project. In addition, the evenness of water application was improved, avoiding over or under supply in targeted areas, and enormous labour efficiencies were gained.

The assessment recommended that the farm should start scheduling irrigation events to avoid under or over watering. Results have significantly decreased pumping costs while increasing crop yields.

There are many tools available to assist farmers in scheduling their irrigation events. One approach is by measuring actual soil moisture. EnviroPro soil moisture probes were chosen for this demonstration site to continuously monitor soil moisture, soil temperature and soil salinity at intervals of 10 centimetres down the soil profile. Telemetry data logging provides continuous measurements, which are sent via bluetooth-capable TainData Tierra soil moisture data loggers to a smartphone and the web. Connecting to the EnviroPro probe gave the farmers the ability to make irrigation decisions ‘on the go’ via data retrieval from their smartphones.

“It was really interesting to see how the moisture profile changed and the soil temperature function was useful”, said Mr Jordison. “Using the soil temperature data assisted with planting the summer sorghum crop a month earlier than would normally occur”.

“The advice we received through the program was provided in a very clear and easy-to-understand, we changed the way we irrigated based on the data from the monitoring equipment and now water with 15 mm applications each week, rather than in large dollops”.  

“The installation of the soil moisture meter was a worthwhile project”, Mr Jordison said. “My main expectation was to learn more about irrigation scheduling and how to better manage our precious water using the new pivot, and this expectation was certainly met”.

Pat Daley of Daley’s Water Services shows Robert Jordison how to retrieve continuous soil moisture readings from the EnviroPro probe and TainData Tierra logger using his smartphone and the Jordison Centre Pivot.

(photo courtesy of Qld Dairyfarmers’ Organisation)

Robert Jordison, Goovigen (photo courtesy of Qld Dairyfarmers’ Organisation)
Growcom engaged with growers through Hort360, the BMP program for horticulture. RWUE-IF provided individual risk assessments for growers and a framework for addressing the on-farm assessments. The on-farm assessments included pump, irrigation and fertigation system performance evaluations, which continue to be of great value to growers. The project provided:

- on-farm technical extension advice for 108 farms
- 206 irrigation system evaluations
- 103 farm management system water use modules
- 66 farm water use reports
- training to 108 growers in irrigation scheduling and fertigation techniques
- preparation of 22 case studies, demonstrating significant gains in water and energy and natural resource management outcomes.

Horticulture

Nursery & Garden Industry Queensland engaged with ‘core’ growers to develop whole-farm irrigation, drainage and energy management plans to assist growers with the impacts of reduced water allocations. The project:

- engaged with all known production nurseries in Queensland
- achieved 1313 on-farm extension and engagement visits
- developed and supplied 104 Irrigation Drainage and Energy Management Plans
- facilitated 470 growers attending workshops and field days across Queensland.

Outcomes from the project included:

- identified water savings of between 8.15 and 19.35 ML per business, with an average of 14.0 ML per business achieved
- 15 per cent improvement in general crop growth, with quicker and healthier plant growth
- 20 per cent improvement in crop uniformity as a direct result of growing areas constructed to industry BMP, and improved irrigation application uniformity
- 20 per cent improvement in crop health
- 1 per cent improvement in production times due to improved plant health
- 20 per cent reduction in plant losses, due to upgraded growing areas reducing pest and disease incidence and improved irrigation practices reducing crop stress

Production nursery

Flower Association of Queensland engaged growers through workshops and on-farm irrigation and pump assessments. RWUE-IF resulted in significant reductions of 20 to 40 per cent in water and energy use. It has also led to an improvement in grower engagement and awareness about issues related to irrigation, and broader natural resource management issues on their properties. Extension materials were also provided to around 140 growers.

Through RWUE-IF, 18 farms, including two in 2016–17, have worked to refine their irrigation management. These include two new irrigation installations, one upgrade and one new production area.

A total of 18 growers across Queensland have participated in targeted changes based on assessments. These changes have included:

- installation of new pressure gauges
- reconfiguration of pipework from the pump shed
- redesign of systems
- system design for new growing areas
- showcasing of farms as a formal case study.

Eight case study farms were identified, with growers participating based on the information in the case study engagement plan. Growers also agreed to allow the communication of case study information to other growers via fact sheets, workshops and articles in Australian Flower Industry magazine. Case studies related to installing new irrigation systems or upgrading existing systems, and the considerations in each step of the process when doing so.

Production flowers
Production turf

Turf Qld worked with six case study farms and are continuing to demonstrate results across the industry through case studies and field days. Targets for the four year project were:

- water use efficiency gains of 15 per cent
- energy efficiency gains of 25 per cent
- productivity gains of 10 per cent
- fertiliser efficiency gains of 12 per cent

Average gains achieved across the farms were:

- water use efficiency average gains of 69.5 per cent
- energy efficiency average gains of 24 per cent
- productivity average gains of 18 per cent
- fertiliser efficiency gains up to 50 per cent improvement
Support projects

The NCEA was engaged to host and maintain the Knowledge Management System for Irrigation (KMSI) portal, to refine and develop software tools for irrigators, and support the uptake and use of the KMSI suite of tools. The software tools included the development of the Metering Irrigation Management tool on a mobile platform.

Achievements were:
- registration of 108 new KMSI users
- re-release of Scheduling Irrigation Diary to comply with Apple iOS updates
- software promotion, training and support with workshops
- addition of the new Metering and Irrigation Management Tool to the KMSI suite
- development of new mainline Irrigation Hydraulic Assessment tool

Irrigation Australia Limited (IAL) supported the NCEA project through facilitating training and providing technical expertise. Additionally, IAL engaged with a broad range of industry service providers to introduce technologies and to upskill the industry through certification and training.

Outcomes were:
- demonstrations and workshops on management change
- promotion and support for decision support tools
- provision of on-ground technical support and promotion of irrigation standards
- irrigation sector engagement, professional development, industry and irrigator support and training
- promotion and engagement with irrigation service and extension sector
- development of case studies.

Knowledge Management System for Irrigation (KMSI)

The Queensland Government through the Rural Water Use Efficiency-Irrigation Futures Program is investing in tools to assist irrigators manage their water on-farm. Most farms are fitted with water meters that are used to report volumes to the government each year. However, these water meters are also a valuable tool for irrigators to use to assess their on-farm water use, and ensure that they are irrigating to meet the crop water requirement. The NCEA are consulting with stakeholders to develop and refine a tool for irrigators to access on their smart phones to help them best manage their water.

Step 1 - Set up farm, field and meter
The irrigator uses their mobile phone to create an account and adds a farm name and address. The address is used to find the nearest unit office to provide long-term average rainfall and evaporation rates and to access the map interface to enter the field boundaries and enter some water and soil data. The field is linked to a water meter that services each field.

Step 2 - Enter meter reads
The irrigator then reads the water meter at the beginning of each irrigation. They choose which fields are being irrigated from those set up in Step 1. The tool can accommodate many fields through the same meter or a single meter servicing many fields. The tool calculates the volume applied to each field and converts this into a depth of irrigation applied.

Step 3 - Outputs
The smart phone tool can then be used to provide the irrigator with a report to help them make decisions to reach the field. The irrigator can then be compared to the long-term average crop water requirement to ensure that the irrigator is getting the most out of the irrigator’s water. The tool also calculates the total volume used for the year so calculated and can be compared to the irrigator’s allocation to ensure that they have sufficient water to finish the season or they need to buy or sell water.

Reporting Meter data to DWRAN
The tool can also be used to report meter readings to DWRAN. The irrigator just ticks the box for which meter they need to report and clicks on the send button. The tool then sends the information to the Department.
Irrigation Australia Limited (IAL) case study

Scheduling Irrigation Diary (SID)

A long-time cane farmer in far north Queensland has been irrigating sugar cane with lateral move irrigators for about 15 years, and is considered a leader when it comes to improving on-farm irrigation efficiencies. The grower said that his production was often better than the average for the areas inland of him, but he was always looking for an edge to do better.

The grower said that his production was often better than the average for the areas inland of him, but he was always looking for an edge to do better.

The case study farm is situated on the Kennedy Highway not far inland of the ranges near Cairns, where annual rainfall is approximately 800 mm. In October last year the grower installed a couple of soil moisture units. The grower said he thought he understood his soil water holding capacity reasonably well, but he was surprised by the results.

The grower undertook a system capacity calculation using the fact sheet developed by IAL, which revealed that the system daily capacity was 2 mm below what would be required to meet the average peak demand. This finding was the trigger for the grower to start scheduling irrigation with more precision. Prior to this he used an extension service that provided advice on how much irrigation was needed and how often, based on Mareeba Bureau of Meteorology (BOM) data. This was a good service for some years, but the information was not specific to the farm.

The grower is now using the Scheduling Irrigation Diary (SID) program, which will do a similar calculation as the extension providers. In addition, SID allows for the on-farm rainfall to be used and the grower is able to break farm sections up according to soil texture. Irrigation, rainfall and crop yield can all be recorded in the diary, instead of on paper. The grower will continue using all sources of information, including his gut feel, until he gets more confident. The grower has already noticed the difference between using his own rainfall instead of the BOM rainfall data. As a result of using the soil moisture monitoring and SID, adjustments have also been made in the use of the irrigator to manage the low system capacity.

His advice to other growers is to make sure they understand system capacity. “It is hard to manage what you don’t know and you cannot have too many sources of information.” He recommends having someone show you how to interpret graph data if needed.

The grower believes that without the aid of the soil moisture monitor, SID and the text/email provided by cane grower extension services, he would not have the crop he does, considering the lack of wet season rainfall.
## Projects supported 2013–17

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<tr>
<th>Organisation</th>
<th>Project</th>
<th>Funding $ (2013–17)</th>
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<tbody>
<tr>
<td>Canegrowers</td>
<td>Burdekin: on-farm irrigation system efficiency; dewatering bores; climate and soil/water information systems. Tablelands: work with the Northern Gulf NRM group to promote practice change for irrigation system efficiencies in Arriga basin. Whitsundays/Proserpine, Mackay/Sarina and Bundaberg/Childers—development of climate and soil/water information systems.</td>
<td>$2,877,600</td>
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<tr>
<td>Queensland Dairyfarmers' Organisation</td>
<td>Upper Johnstone and Herbert: maintain/improve productivity through water and nutrient use efficiency and irrigation system change. Callide Valley: maintain/improve productivity through water and nutrient use efficiency and irrigation system change. South East Queensland: maintain/improve productivity through water and nutrient use efficiency and irrigation system change.</td>
<td>$1,218,500</td>
</tr>
<tr>
<td>Growcom</td>
<td>Lakeland: maintain/improve productivity through irrigation system evaluations and irrigation scheduling. Upper Herbert and Johnstone, Lockyer, Burnett, Central Highlands and Mareeba-Dimbulah: improve productivity and sustainability through irrigation system evaluations, irrigation scheduling and fertigation techniques.</td>
<td>$1,200,000</td>
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<tr>
<td>Nursery and Garden Industry Queensland</td>
<td>Queensland: improve productivity and sustainability through development of whole-of-farm management plans.</td>
<td>$800,000</td>
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<tr>
<td>Turf Queensland</td>
<td>Southern and Northern Queensland: implement irrigation technology advancements and benchmarking to underpin farm productivity improvements.</td>
<td>$365,342</td>
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<tr>
<td>Flower Association Queensland</td>
<td>Sunshine Coast and North Queensland: demonstrate water use efficiency through implementation of efficient irrigation hardware and practices.</td>
<td>$313,000</td>
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<tr>
<td>Irrigation Australia Ltd.</td>
<td>Up-skill the irrigation supply sector and private service providers and provide technical support to industry programs.</td>
<td>$552,842</td>
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<tr>
<td>National Centre for Engineering in Agriculture</td>
<td>Host and maintain software and engage with irrigators through industry programs to facilitate the uptake of new technologies.</td>
<td>$473,610</td>
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<tr>
<td>Growcom</td>
<td>Target improving on-farm management decision making using precision agriculture techniques.</td>
<td>$80,000</td>
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<td>Growcom</td>
<td>Develop best management practices for on-farm sediment control that will complement their current farm management system modules relating to water efficiency, nutrient management and water quality.</td>
<td>$80,000</td>
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<td>Irrigation Australia Limited</td>
<td>Develop codes of practice for rural irrigation systems to guide and assist irrigation designers, consultants, suppliers contractors and ultimately irrigators to achieve best practice.</td>
<td>$75,000</td>
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<tr>
<td>Irrigation Australia Limited</td>
<td>Fast-track the uptake of certification to improve the skills of workers in Queensland’s irrigation service sector such as consultants and suppliers.</td>
<td>$41,600</td>
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<tr>
<td>Queensland Dairyfarmers' Organisation</td>
<td>Investigate the feasibly of using current alternative energy technologies for irrigation systems.</td>
<td>$20,000</td>
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<tr>
<td>National Centre for Engineering in Agriculture</td>
<td>Develop mobile interface for Scheduling Irrigation Diary and benchmark system capacity.</td>
<td>$89,190</td>
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<tr>
<td>National Centre for Engineering in Agriculture</td>
<td>Develop a water management decision support tool on PC and mobile platforms.</td>
<td>$59,210</td>
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