Rural Water Use Efficiency for Irrigation Futures
Progress report 2013–16
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Introduction

Rural water use efficiency programs were first implemented in Queensland in 1999 to assist the irrigation sector to improve the efficiency of on-farm water use and to help transition irrigators through a raft of national and state government water reforms.

Rural Water Use Efficiency for Irrigation Futures (RWUE-IF) is a partnership arrangement between rural irrigation industries and government. The aim is to improve the use and management of on-farm irrigation water 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) who enhance outcomes by improving the technical capacity of service providers to deliver competent services and through the development and uptake of new technologies and practices.
More than

$6m invested over 3 years for 17 projects to improve the use and management of on-farm irrigation water to achieve improved productivity and sustainability of rural industries and achieve natural resource management outcomes.

<table>
<thead>
<tr>
<th>Individual cases of energy savings of up to 70 per cent and water gains of up to 30 per cent</th>
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<tr>
<th>A software application for mobile devices to allow irrigators to access real time climate and irrigation scheduling data</th>
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<th>Benchmarking data for irrigation water use in the dairy, sugar and horticulture industries</th>
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Snapshot of key achievements
## Project list

<table>
<thead>
<tr>
<th>Organisation</th>
<th>Project</th>
<th>Funding $ (2013–2016)</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&lt;br&gt;Tablelands—work with the Northern Gulf NRM group to promote practice change for irrigation system efficiencies in Arriga basin&lt;br&gt;Whitsundays/Proserpine, Mackay/Sarina and Bundaberg/Childers—development of climate and soil/water information systems</td>
<td>$2 158 200</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&lt;br&gt;Callide Valley—maintain/improve productivity through water and nutrient use efficiency and irrigation system change&lt;br&gt;South East Queensland—maintain/improve productivity through water and nutrient use efficiency and irrigation system change</td>
<td>$913 875</td>
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<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>$900 000</td>
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<tr>
<td>Nursery and Garden Industry Queensland</td>
<td>Queensland wide—improve productivity and sustainability through development of whole of farm management plans</td>
<td>$600 000</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>$263 570</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>$231 630</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>$319 000</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>$239 000</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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<tr>
<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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<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>Irrigation Australia Limited</td>
<td>Develop codes of practice and standards 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>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>Queensland Dairyfarmers' Organisation</td>
<td>Establish a demonstration farm in Callide Valley to exhibit management practices in water use efficiency and management of poor quality irrigation water</td>
<td>$93 500</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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Industry adoption projects

**The Queensland Dairyfarmers’ Organisation’s** project engages with dairy and fodder growers in targeted areas including the Callide Valley where irrigators are dealing with reduced water allocations due to the water planning process. Growers are engaged through on-farm technical advice, irrigation system assessments, performance-based financial incentives for changes to irrigation and water reuse systems and demonstration farms.

To date an average reduction of 43 per cent in energy use to pump a ML of water has been achieved.

**Growcom’s** project targets on-farm assessments including pump, irrigation and fertigation system performance evaluations. Through active participation growers have learnt how to undertake various tests on their systems better enabling them to apply changes across the entire production area.

On review of the participating growers Growcom has found:
- Many growers (80-90 per cent) did not manage fertigation application correctly. When tested, Growcom found issues with injection and flush timings. When these issues were addressed, there was an average reduction of 25 per cent in fertiliser used.
- removal of large pumps in exchange for those that better match duty required
- improved pump to system design resulting in an overall reduction in kilowatt consumption
- reduced pump sizing and installed variable speed drive units reducing power consumption by 50 per cent
- installation of solar pumping units to offset pump costs

**The CANEGROWERS’ project** is largely focused in the Lower Burdekin where a number of strategies are being piloted to contribute to lowering the water table and to prevent land salinisation.

The Burdekin program is three tiered, and includes:

1. Financial incentives for conjunctive use bores (conjunctive use of surface water and bore water)

2. Financial incentives for efficiency measures, piping, soil moisture equipment, system change, recycle pits through to automation (linked to irrigation system assessments and extension)

3. Information systems for improved irrigation scheduling, which provides local real-time data to growers to make better decisions on irrigation (information systems have been installed in five other peak irrigation areas across the state).

To date nine bores have been installed for conjunctive use in high risk and targeted areas and 1500 megalitres (ML) has been pumped and used conjunctively with surface water.

**Turf Queensland** is working with six case study farms and are demonstrating results across the industry. Two of the farms where projects are complete have measured 30 per cent and 33 per cent water use efficiency gains.

**Nursery and Garden Industry Queensland** is working with irrigators to develop Irrigation Drainage and Energy Management Plans to target farm management in relation to drainage and recycling and minimise off farm movement of water. Initial measured results taken from seven participating production nurseries to date indicate a 10 per cent to 48 per cent improvement in water use efficiency, 33 per cent gain in energy savings and 10 per cent to 0 per cent improvement in crop growth.
The Flower Association of Queensland has produced six case studies to date where reduction in energy use ranges from 27 per cent to 83 per cent. They continue to work with growers in targeted areas to optimise energy use in relation to the pumping of irrigation water.

Irrigation Australia Limited has provided technology training and support to irrigation areas including Great Barrier Reef Catchments through working with a network of local productivity boards and grower associations, irrigation service providers, agronomists and other private consultants providing services to irrigators. They are providing opportunities for industry certification and training for private service providers including irrigation designers, suppliers, and consultants.

This project supports the industry projects by providing technical support and training for industry extension staff and end users. During this reporting period, Irrigation Australia developed Industry ‘Standards and Codes’ for the design and installation of pressurised irrigation systems.

The National Centre for Engineering in Agriculture maintain existing decision support tools, promote their uptake, and provide support for new users and administrative support for existing users. They have developed information and materials demonstrating efficiency gains made through improved irrigation management.

During this reporting period, the RWUE-IF Program funded the development of the Scheduling Irrigation Diary. This web-based tool allows irrigators to record irrigation and rainfall while also calculating daily crop water use and has been developed on a mobile platform to allow irrigators to enter relevant date in the field.
Burdekin dewatering case study

A pilot project in the Burdekin is showing promising early signs indicating that dewatering bores could become an effective weapon in helping combat rising groundwater levels.

Funded by the Rural Water Use Efficiency for Irrigation Futures (RWUE-IF) five dewatering bores have been drilled on farms connected to the Burdekin-Haughton Water Supply Scheme.

The thick clay soil is typically sticky underfoot as Burdekin cane grower, Mark Hatch, examines a recently-planted row of plant cane.

On the neighbouring block, a mix of water from SunWater’s irrigation channel and a recently drilled de-watering bore on the Hatch family farm is pouring from plastic fluming and along the rows, watering an impressive Q183 ratoon crop.

“We’re very different, we’re fully irrigated and rely on the irrigation, if we didn’t irrigate we wouldn’t have cane,” Burdekin Productivity Services extension officer Marian Davis pointed out during an inspection of the dewatering bore on Mark Hatch’s farm.

“But we need to really manage that irrigation so we don’t have bigger problems being created by doing exactly what we need to do to grow our cane.”

“Irrigation management to reduce deep drainage is really important in the Burdekin to keep those ground water levels as low as possible.”

“We’re adding water constantly through irrigation, through channels, the river runs all the time now so there’s a water head in the river and we’ve just changed the hydrology and environment around us and if we keep adding water to the system we’re bound to start increasing the ground water levels as it drains,” Marian said.

Elevation of the water table to the point where it impacts on the root base of crops could directly impact on productivity for a variety of reasons.

“If we get water coming too close to the surface, we can get things like salinization that we’ve seen in other irrigation areas like the Murray–Darling where you actually get salt areas appearing,” Marian said.

“Also, it impacts on farming activity, if you’ve got water close to the surface it means it gets harder to work the ground because it’s wet.”

“Your yield will drop and it’ll be very hard to farm here because it’s heavy clay soil and at the best of times it’s wet and if the water table is high you wouldn’t be able to work your ground.”

The bore was installed in August 2014 and has been one of the better performing of the new de-watering bores in the district.

In addition to the de-watering bore, three observation bores have been drilled in close proximity to the main bore on the Hatch farm; one just a few metres away and two others at distances of 50 and 100 metres.

Piezometer readings are regularly taken from the observation bores to measure the distance from the surface to the water level. This provides accurate data that helps determine what impact the de-watering is having on drawdown of the aquifer. The results can be displayed graphically on a computer screen at the Burdekin Productivity Services office.

It’s too early to be drawing any firm conclusions, but the de-watering bore on Mark’s farm appears to have had some impact on the groundwater level.

“We can see when Mark starts watering, the depth in that first bore drops quite dramatically and then when he stops watering that recovers,” Marian said.

“I guess the pleasing thing that we’ve seen over time since last year, it’s dropped about 10 centimetres from when we started.”

Results from the remaining de-watering bores have been mixed, but Marian Davis remains confident that de-watering bores will be one viable strategy in addressing the considerable challenge of rising groundwater levels in the Burdekin.

Additional dewatering bores are set to be constructed in the Haughton district through 2015, with the Rural Water Use Efficiency for Irrigation Futures-funded project set to continue until 2017.
Growcom case study

Water and energy efficiency improved with correct impeller sizing

As a key component of Growcom’s Rural Water Use Efficiency Irrigation Futures (RWUE-IF) program for horticulture, Growcom Land and Water Field Officer, Kathleen Heuvel conducted a Hort360 irrigation module risk assessment with a citrus grower in the Biloela region. Evaluation of the Hort360 report identified opportunities to improve irrigation uniformity and pump efficiency. Initial findings indicated:

- elevation from pump to irrigation block resulted in notable pressure head loss with 295 kPa measured at the pump and 183 kPa at the filters
- the pump was operating at 8.44 kWh/ML/m well above the industry target of 5 kWh/ML/m
- an incorrect impeller diameter (159 mm) was reducing head capacity
- sprinkler were operating at 20 per cent below the target operating standard of 95 per cent
- pressure measured in several laterals was 110 kPa to 40 kPa below the recommended level
- sprinkler flow measured at 54 l/h to 16 l/h below designed flow rate requirement.

Inefficiencies such as these will result in:

- poor uniformity
- reduced capacity to manage the farming system
- poor return on investment
- reduce crop yield and quality.

On this advice the citrus grower fitted a 182 mm impeller. RWUE-IF conducted a follow-up pump assessment. The follow-up assessment has shown significant improvements to both water and energy efficiency.

“The larger impeller diameter allowed the pump to meet both target pressure and flow rate while operating between 60–70 per cent efficiency,” Ms Heuvel said.

Following installation of the larger impeller, the pump operating cost had reduced to 6.6 kWh/ML/m, close to the industry target. The pump now delivered over 6 L/s and the pressure in the field is 150 kPa, allowing the sprinklers to perform as designed across the irrigation block.

“Improvements to the pump as a result of the original assessment, have made pumping more efficient, increased uniformity and application rates, and taken pressure off the irrigations schedule,” she said.

RWUE-IF is currently being delivered in the Burnett and will be delivered in the Lockyer in 2017. Horticultural growers are invited to take part.

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<th>Table 1: Efficiency gains</th>
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<tr>
<td>Assessment one</td>
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<tr>
<td>Impeller diameter</td>
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<td>Pump efficiency (target 5 kWh/ML/m)</td>
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<td>Flow rate</td>
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<td>Sprinklers within designed operating pressure range</td>
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<td>Irrigation uniformity</td>
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