

**RURAL  
WATER USE  
EFFICIENCY**

**IRRIGATION  
FUTURES**

Improving irrigation management  
for a profitable and sustainable future



## Small investment large benefits—a case study

Mad About Plants is located approximately 15 minutes south of Cairns, and is the largest wholesale nursery in north Queensland. They have supplied a wide range of native and exotic shrubs, trees, palms, ground covers, and ornamentals to the landscape, retail and tropical plantation industries for 25 years.

The 6.45 hectare site is irrigated using two bores, and has a water licence for 25 ML per year dating back to 1983. Concrete collection drains direct runoff water to an onsite dam, but being in the wet tropics, water use and water recycling was a minor concern. However, due to several years of winter droughts and nursery expansion, water use had increased considerably to an average of 96 mega-litres per year.

In 2012 the Department of Natural Resources and Mines (DNRM) installed water meters onto both bores, and in July 2016 implemented the Wet Tropics Resource Operations Plan (WTROP), which required Mad About Plants to adhere to its license allocation or incur a significant fine.

Concerns over the high water use and increasing operating costs lead the nursery owner to ask how water use and operating costs could be reduced. As part of the Rural Water Use Efficiency Irrigation Futures (RWUE-IF) project, an Irrigation, Drainage &

*“At this stage our power and water saving expectations have been exceeded, especially given it was a relatively simple, cost effective upgrade to an aging bore.”*





Energy Management Plan (IDEMP) assessment was made, and an action plan developed.

The assessment identified the two Grundfos SP 46-6 bore pumps, which were run at a constant speed, had a greater output capacity than the irrigation system required, and a bypass system was used to reduce the operating pressure to match the irrigation system specifications. Up to 2608 litres per day was siphoned off and disposed of into the catchment dam. This was water that had consumed pumping energy but was lost to the nursery.



The irrigation uniformity varied on each production area, with Coefficients of Uniformity (CU) ranging from 64% to 74% and Scheduling Coefficients (SC) of 2.2 to 5.3. Industry Best Management Practice parameters are >85% CU and <1.5 SC. Sprinkler spacing also varied across production areas, with spacing ranging from 3m by 3m, up to 10m by 12m. Although there were separate production areas for different plant species, placement of plants was determined by available space. This meant that seedlings were placed next to mature plants, and all growth stages received the same amount of irrigation each day. No adjustments were made for actual plant water requirements. A timed irrigation schedule was set according to the sprinkler capacity, flow rate, and the managers' experience, with run times ranging from 5 minutes to 17 minutes three times per day in summer and reduced by 30% to 50% in winter.

As a result of the IDEMP several upgrades were recommended, including -

- Installing a variable frequency drive (VFD) control unit to adjust pump operation to match irrigation operating specifications,
- Installing more efficient sprinklers to improve irrigation uniformity,
- Reducing the size of irrigation zones to provide more flexibility in irrigation scheduling,
- Grouping plants with similar irrigation requirements to refine irrigation scheduling to suit plant water use,
- Install new pipes and wiring from the bores to the solenoids,
- Install a new irrigation control system including flow and rain sensors,
- Capture runoff water and install a water recycling system to reduce the reliance on bore water. This option was considered to be impractical to implement due to constraints on the land area available.



In May 2017 a Variable Frequency Drive (VFD) pump controller was installed on the main bore pump, which led to an immediate decrease in water and energy use. Total cost of investment was \$3826.16 including the installation. A month later several growing areas were upgraded to more efficient sprinklers that required a lower operating pressure. The upgrades were conducted with little interruption to the nursery operation, and did not incur any staff labour costs.



The installation of the VFD pump controller has increased pumping efficiency, reduced water use, and decreased energy use. It provides a more accurate and consistent irrigation operating pressure irrespective of how many irrigation zones are active. It changes the pump speed to suit the irrigation system requirements, negating the need for the bypass system. This, combined with the changes to irrigation layouts and management practices has resulted in the following water and energy savings.

Prior to the installation of the VFD pump controller, water use ranged from approximately 53 to 96 ML per year or 8 to 15 ML/ha/annum, with up to 2608 litres per day or 0.9 ML per year being lost via the bypass system. After the installation of the VFD and irrigation system upgrades, water use dropped to approximately 19 ML per year, saving 34 ML or 65% of water use. More accurate control of the irrigation operating pressure has reduced pump energy use by 15 kilo-watt hours per day, resulting in a reduction to the quarterly power bill by an average \$368.00.

Table 1: Water and energy use yearly averages for before and after VFD upgrade\*.

	Average water use (ML/Yr)	Average ML/ha/Yr	Average energy use (kWh/day)	Average energy cost (\$/quarter)
Before upgrade	53	15	27	\$692.30
After upgrade	19	3	12	\$324.30
Savings	34 (65%)	12	15	\$368.00 (53%)

\* Values calculated on potential yearly averages from data provided by the nursery and does not account for seasonal variation.

Operating the old sprinkler system with the new VFD pump controller provided a pump energy use saving of approximately 14%. Further energy savings were achieved with the installation of more efficient irrigation layouts, resulting in a final pump energy saving of approximately 42%. However, the upgrade has provided greater cost savings than recorded



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during the irrigation system assessments. Whole of nursery electricity costs have fallen by approximately 53% per quarter. This may be attributed to extra pumping costs incurred with blown irrigation pipes. Furthermore, the irrigation schedule has been changed to suit the improved irrigation efficiencies, with daily irrigation run-times being reduced from 210 minutes to 130 minutes (38% reduction).

If no other upgrades are made, the savings attained in energy costs alone by installing the VFD will provide an unadjusted saving of \$14,720 over ten years, and will pay back the investment in 2.6 years. Over this period, using a discounted rate of 7%, the initial investment of \$3862 will return \$7236 over the life of the investment in today's dollars.

**This means that even with an increase in electricity costs over the next ten years, the initial investment of \$3826 provides an increased value to the business of \$7236 in today's dollars.**

Due to the improvements achieved with this small low-cost upgrade, further upgrades are planned that will reduce water use and increase production efficiency further. Fine tuning of the VFD controller pressure settings to ensure smooth start up and slow down will help to reduce operating stress on an aging irrigation system, while providing more accurate and consistent flow rates. More accuracy in irrigation application rates allows for ongoing refinement to the irrigation schedule to suit plant water requirements.

Upgrades to the system are ongoing, and the nursery is in the process of reducing irrigation zone sizes and consolidating plants of similar water requirements into separate irrigation blocks, so irrigation scheduling can be adjusted for plant water use. The installation of an electronic weather station and a more advanced irrigation controller to assist in the management of the irrigation system is being implemented. In addition to improving efficiencies of the system, a further water allocation was sought and granted to provide greater water security for the business.

For more information contact NGIQ on Ph. 07 3277 7900

*“The upgrade has also helped give us the confidence to further invest in up to date technology like a WiFi enabled, weather sensitive irrigation control system.”*



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