IRRIGATION TECHNOLOGY: URBAN

AUTOMATION PROVES WATER SAVINGS

After flooding rains in the new year in southern Queensland, it seems hard to believe that since 2005 a key concern of Ipswich City Council, 50 km west of Brisbane, has been to reduce water consumption on its playing fields while keeping them fit for playing.

The council has a big area of green space to manage – 500 parks and 33 ha of irrigated sports fields.

Until 2005, how much water was used for irrigating these sports fields wasn't a significant issue.

"Where irrigation systems were installed, they were used to present a quality turf playing surface, and their management was at the discretion of the field supervisor in line with other agronomic management decisions such as fertiliser and aeration," explained Geoff Faulkner, irrigation advisor to Ipswich City Council.

As the drought started to bite in 2005 and the regulation of town water use in south-east Queensland was introduced by the state government, the council knew they had to improve irrigation management of their playing fields. Lifting water restrictions to Level 6 in September 2007 underlined this.

As a result, the council took a number of steps to minimise water use while keeping fields "fit for play", i.e. safe and useable including for sports events.

Ipswich City Council automated irrigation systems on its playing fields in a strategy to minimise water use.

Trial compares irrigation efficiencies

Geoff explained that the council decided to compare soil moisture monitoring with a volumetric allocation system based on historic daily rainfall used by the Queensland Water Commission (QWC) as a way of determining when and how much to irrigate.

"We collected soil moisture data using a manual gauge and related the result to level of stress in the turf," he said. "While the soil moisture probe gave us the soil moisture, it was apparent that the available soil moisture varied according to soil type. We decided that, in the absence of enough data across soil types, we would use a reading of 15% as the trigger to start irrigating based on our collected data."

To determine how much to irrigate the council developed a turf irrigation calculator, which the QWC then adapted for is volumetric allocation method.

While this was effective, it was also manually intensive. It also meant that council staff had to understand soil profile features and be able to interpret the data. The next step was to automate the process.

An advantage of automated systems is that management can be done from a central location, saving on time and effort. In this photo a member of council staff is adjusting an irrigation schedule.

Automation provides solution

Ipswich Council contracted the job of automation to MAIT Industries, which installed permanent in-ground sensors into six preliminary sites in March 2008.

"The data we captured initially was soil moisture at root zone and at 30 cm, temperature at root zone and flow," said Geoff. "We now capture soil moisture, soil temperature and electrical conductivity at increments to 40 cm as well as flow and rainfall."

With the centrally controlled irrigation system, staff found they could fine tune scheduling based on the physical data without the need to drive out to the field to manually set the programming. This was a great time saver.

The web-based system only allows irrigation when soil moisture reaches a predetermined, low set point. Each set point is specific to a playing area and is calculated using a variety of elements, such as soil type. A rain switch is also integrated into the system so that when it rains, irrigation is stopped.

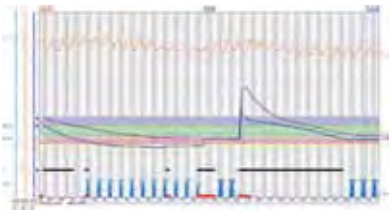

Figure 1. Data of a typical cycle for a field showing soil moisture decreasing (blue line) and the system enabling irrigation (black line) when the low set point is reached. Irrigation (blue bars) and rain (red tag) then puts the soil moisture above the high set point and irrigation is again disabled and so on. Note that rain at the end of the irrigation cycle sent soil moisture to field capacity.

And what happened to water consumption?

From Figure 2, which uses 2005 as a base line, consumption started to decrease from 2007 although this did coincide with an increase in rainfall. This shows the responsiveness of using soil moisture rather than an arbitrary allocation value based on a predicted rainfall pattern.

While Geoff isn't sure that field managers would have used less water than that allocated with the allocation method, he says that human nature being what it is suggests the allocation would have been used no matter what!

He is certain, however, that had rainfall been lower, council would have used more water, as is illustrated in Figure 3.

For the six months of the trial (December 2007 to May 2008), an average of 390 kL/ha was used over 11.33 ha compared with the allocation of 1430 kL/ha average for the same fields (see Figure 3). This is a water saving of about 11.8 ML for the six months, which equates to a cost saving of about $20,640 or $1822/ha. Actual water costs using smart irrigation were $7725 while the QWC volume allocation method would have cost $28,364.

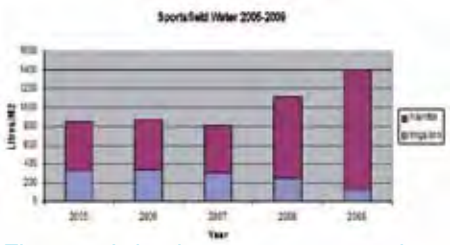

Figure 2. Irrigation water consumption decreased from 2007.

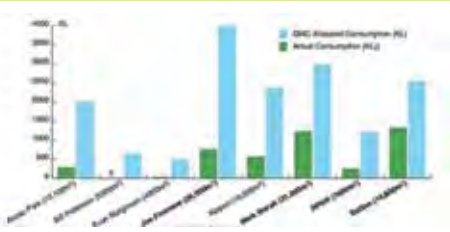

Figure 3. Actual water consumption compared to QWC volumetric allocations, December 2007 – May 2008 (Sites in bold had the MAIT system installed).

The predicted return on investment was also very clear – capital expenditure was about $40,000, giving a payback period of one year.

Of course, there are other benefits. Monitoring soil moisture results in consistent, good quality active playing surfaces, reduced labour and water costs, and accountability to ratepayers and club members.

Geoff said that while the drought may have put the spotlight on water consumption and use patterns, he is confident that Ipswich City Council has learnt to use water efficiently and for a defined outcome.

"While we can expect water restrictions will be a permanent feature, we now have the capacity to know field conditions and when to intervene with irrigation. We can fine tune the applications as required without going to each field. We have the flexibility of adapting systems for both long term and short term needs," he said.

"We can demonstrate stewardship to the wider community that we are using water wisely and save money at the same time."

Note. This article was adapted by Anne Currey from information supplied by Ipswich City Council and MAIT Industries

THREE-MONTH WATER FORECASTS TO HELP WATER PLANNERS

If you go to the Bureau of Meteorology's website and click on the new seasonal streamflow forecasts page, you will see a picture of inflows into the south-east Murray-Darling catchment that last year we would have thought almost impossible. Unlike the same period last year – January to March – the website is forecasting that higher than average flows are likely.

This new Seasonal Streamflow Forecast Service, developed by CSIRO and the Bureau of Meteorology, will help water managers and planners estimate how much water is expected to flow into specific rivers and catchments up to three months ahead.

The forecasts, released in December last year, will help with decision making around seasonal water allocation outlooks, reservoir operations, environmental flow management and water markets. They are issued monthly on the bureau's website.

According to Dr Rob Vertessy, Bureau of Meteorology Deputy Director (Climate and Water), water managers and users now have access to reliable and robust forecasts of seasonal streamflows.

"Although there is a lot of water in some areas of Australia at the moment, water availability will continue to vary in the future as demand continues to grow and climate inevitably varies. This poses major challenges for water resource management so the need to accurately monitor, assess and forecast the availability of water resources is more vital than ever," Rob said.

CSIRO provided the research and development that underpins the forecast service, which the bureau has developed for thirteen river sites and eight storages in the south-east Murray-Darling Basin. The service will gradually expand to other locations in Australia over the next two years.

The launch of the forecast service follows a 12-month experimental phase in which the Bureau and CSIRO consulted closely with water organisations.

These forecasts use a sophisticated statistical modelling approach, called Bayesian joint probability (BJP), to provide information on likely water inflows into major river and storage systems for the three months ahead.

The Bureau of Meteorology's new seasonal streamflow forecasts service is designed to help water managers and planners by providing forecasts of inflows into river systems.

The BJP approach forecasts the likelihood of streamflows exceeding various volumes. The forecasts are based on how current catchment conditions and current climate patterns (such as El Nino cycles) influence future catchment runoff.

Forecasts are verified against observed streamflows. The experimental phase showed that the forecasts produced by the BJP approach are reliable and robust.

The forecasts are on the bureau's website at http://www.bom.gov.au/water/ssf/