

AquaSpy is the leader in Demand Based Irrigation Management.

www.aquaspy.com

Water is now an economic resource

- Are water shortages a sign of climate change?
 - Public Reactions
 - Government Reactions
- Water shortages are not confined to just Australia.
- World food shortages



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Water is now an economic resource. From its humble beginnings as a resource in plentiful supply suddenly the general public is seeing water shortages as a sign of the affects of climate change. From one obscure article a month speaking about the drought to certain parts of Australia four or five years ago it has become a daily headline. Likewise the government with its plans on water have raised the profile and the stakes by initiating some major projects to allow irrigation by farmers and environmental flows in the Murray Darling River System. Overseas the situation is similar with water taking centre stage in parts of the USA and also in Asia. Water Restrictions have become a way of life not only in Australia but also in other countries, even the United Kingdom – a country renown for its rain is having restrictions imposed in the South East.

More recently, food shortages and prices have also started to hit the headlines. As with Climate Change and Water; Water is also the link with food shortages..

All around the world, people are tapping into rivers, aquifers and prehistoric water supplies to get water. Water is being over used and as a result, some supplies are drying up. Other supplies are being polluted by the leaching of chemicals into rivers and aquifers. Our pure water sources are gradually getting smaller and yet the proposed solution has been 'de-salination' or 'recycling'

Lake Mead, NV



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Lake Mead servicing Nevada has dropped by more than 100 ft since 2000. It is now over 1,000 feet below its capacity.

Water Use Efficiency

- Doing more with less!
- Manage the resource
- Accurately measures the water needed to:-
 - Maximise crop yield
 - Maximise quality of product
 - Minimise wasted water
 - Reduce pollution by sending nutrients into the Aquifer or River systems
- By-products:
 - Reduce green house gases
 - Help Save the Planet

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Few people speak about Water Use Efficiency and yet if we consider Water an economic resource then efficiency is the key to the future. If we can use less water to create an equal or even better output of food production then why don't we do it? We don't need more water we just need to use it better. Likewise, if we can create a better and more sustainable environment by using water more sensibly then why shouldn't we do that? Using water efficiently and effectively is the key to solving our current water crisis; and by so doing it will also help save the Murray Darling River system by allowing more water for inflows

Governments don't seem to understand or at least listen. They still plough ahead with de-salination and recycling regardless of the costs to the community both in financial terms and environmentally.

Water is Heavy...



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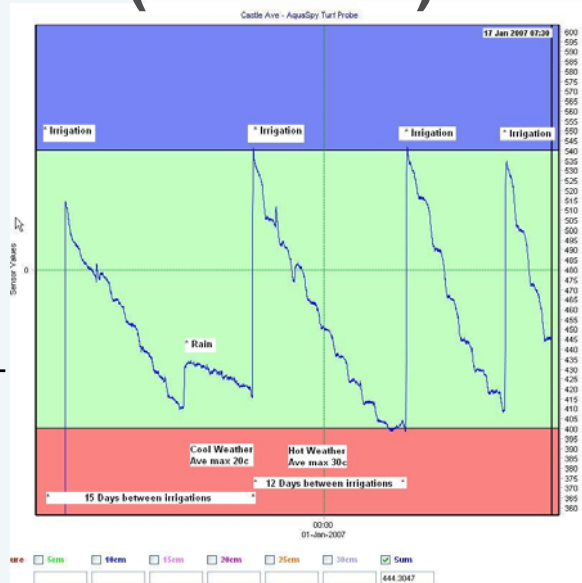
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Water is very heavy, at one tonne for every cubic metre it is expensive to move around. Pumping water from the coast to outback Australia is something that requires a lot of expensive infrastructure and equally a lot of power for pumping. In a conversation I had a few months back in the USA I was told by a Southern California Metropolitan Water Board Senior Manager that it uses 19% of the Southern Californian electricity grid to pump water. So saving water saves power which saves carbon emissions. ...

Generally people overwater. With the water shortage creating State Government responses of water restrictions, it was no big surprise that the first tier of restrictions increased the amount of watering done by domestic users. Not unlike other forms of rationing, the first response by the public is to take their share – whether needed or not. As a consequence the first round of water restrictions created an increase in usage and not the desired reduction. Only with tighter and tighter controls imposed on the public over a relatively short time did the governments create the water reductions it wanted. Not surprisingly to us, water restrictions rapidly moved up through the various levels till eventually nobody could use it.

Water Restrictions (Domestic)

- On the right is a soil moisture profile before and after restrictions. In reality watering was needed initially after 15 days.
- However with higher temperatures, watering was needed more often (probably 9-10 days). Water restrictions however forced him to irrigate every 7 days.



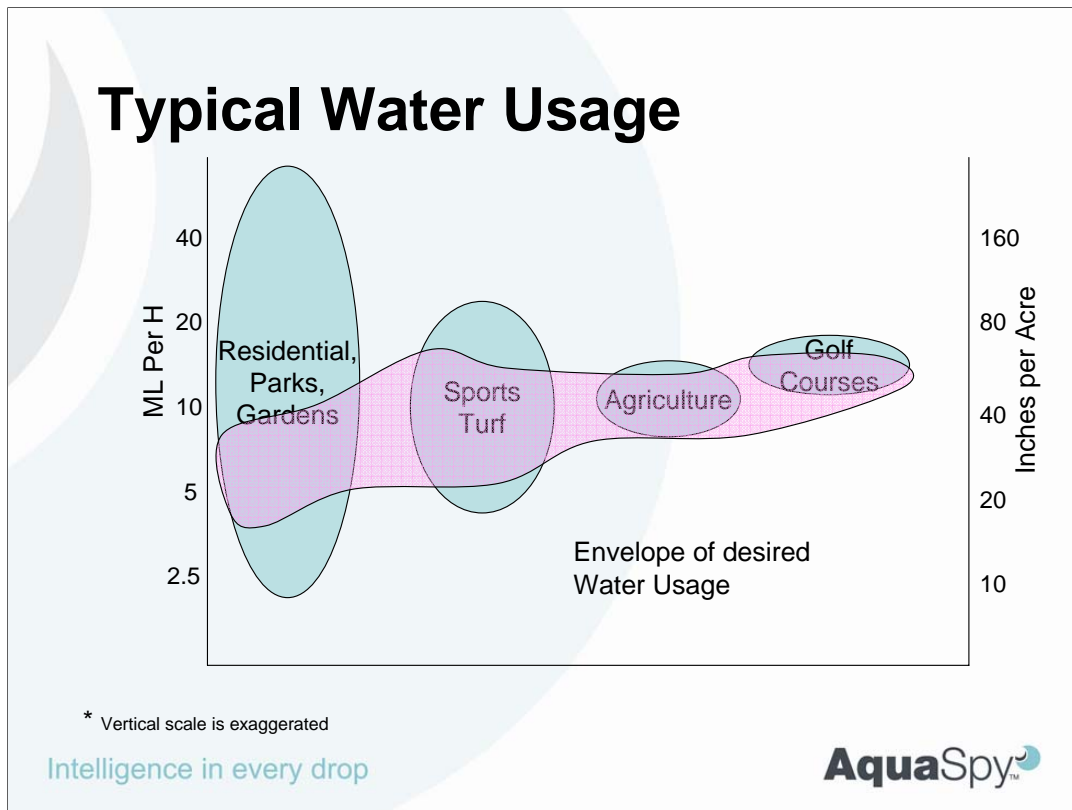
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Last year we approached the then Minister Malcolm Turnbull with our findings regarding the increase in water usage caused by water restrictions and showed him some evidence. We showed that the standard approach for water restrictions just made matters worse and that we needed improved education in the community to resolve the water problems for future generations. In this picture, given to the Minister ...

Sadly, this initiative was missed by the Minister.

This spurred us to take a fresh look at our business and where we wanted to go in the future which I shall now turn my attention to.



Before we continue I thought it worth while to show this slide. The scale is logarithmic but gives an indication of the water used by different groups. It is diagrammatic only and is not based on anything more than some of our internal research and internet based searches.

Not surprisingly Agriculture is one of the most efficient with Golf although using proportionally more also well ahead of other groups. These are typically the water professionals.

It is really the residential and the turf markets that are the worst. They range dramatically with most users over watering and some under watering and killing off areas of land.

Automatic Watering Systems

- Time
 - Standard approach used in domestic timers
- Volume
 - Measure water flow and therefore volume
 - Applied as mm or inches of water
 - Can be used directly with ET data for control
- Demand
 - Ask the plant what it needs
 - Direct feedback from the source to determine requirements.

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There are many truisms about management and the key ones in our case would be 'You can't control what you don't measure'. How can we expect to control our water usage without having an understanding of how much we are using and how much we need?

We are all aware of Time based irrigation methods. Most of our home automatic watering systems use time as means to allow watering. Likewise, water restrictions were really Time restrictions and had nothing to do with water – that is why they didn't work. By restricting time you are not restricting water, but just the window where watering is allowed.

A better method would have been Volume. Volume methods are less plentiful in the domestic sector since they require an understanding of the water flow from an irrigation source. Volume methods typically work by ascertaining how many Kilo Litres are applied to an area of land. Most growers will know how much that equates to in terms of millimetres of water or acre-inch. And by understanding the crop and the weather patterns they develop an irrigation schedule. Volume based methods of irrigation work well with Evaporative Transpiration models which allow an estimate to be made on how much water needs to be applied based on crop types, soil types, topology and weather patterns.

These methods are in-direct methods of control.

But what about asking the Plant what it needs? This is Demand based irrigation. It allows the plant to ask for water and the grower to decide how much and when. Sometimes it is not in the interests to give a plant water because you may want to exercise the roots a bit more; or reduce the water content in the fruit to develop other features; or because you know that a rain front is going to pass by in a few hours time.

Now I want to turn to the main topic of this presentation – Demand based Irrigation and first I will need to briefly describe the tools we used in our studies.

Sensing and Control Products



AquaSpy Turf Probe
6 soil moisture sensors every 5 cm.



AquaBlu – Single Soil Moisture
sensor with a regulator

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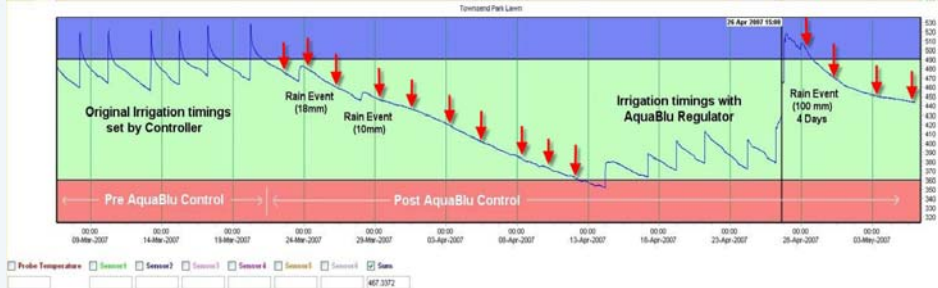
The AquaSpy Turf Probe is a capacitance based sealed probe containing 6 soil moisture sensors spaced at 5cm with a temperature sensor at the 20cm level. This is inserted into turf and buried just below the ground. The cable is then connected to a Data Collection point, which can be radio enabled.

The AquaBlu Controller is used to switch off Automatic Irrigation Systems.

Residential - Adelaide



AquaBlu Soil Moisture Controllers were fitted to automatic watering systems using underground drip. This demonstrated that the organisation had been substantially over watering by as much as 73%. The AquaBlu curtailed this over watering.



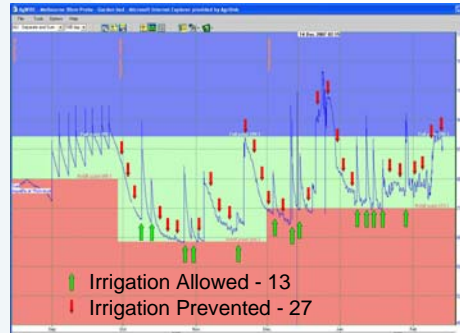
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Adelaide Townsend House. 2 Hectare site using a combination of underground drip and sprinklers on potable supply and bore water. The trial covered parts of the garden bed and also a turf area. AquaBlu regulators were connected to automatic watering systems and we also monitored the soil moisture using AquaSpy Turf probes. The turf probe takes a soil moisture reading every 5cm through the profile. We measured soil moisture at six points through the profile to a depth of 30cm. We then observed the 'sum' graph which is an analogue of the soil moisture capacitance over the 30cm profile. It demonstrated quite clearly that significant over watering had been done. Over the period of the trial, over 70% of all timed irrigations were switched off because the turf didn't need any more water. In the Garden areas the situation was much worse. With nearly \$100,000 spent every year on water and water delivery, \$70,000 could be saved at an outlay of around \$12,000

Urban Landscape - Melbourne

- Over a 5 month period, 40 irrigations programmed by irrigation timer:-
 - 13 irrigations were allowed
 - 27 irrigations were prevented
 - About 60% water was saved



- An **AquaBlu** was installed in a landscaped garden bed at a warehouse situated in an industrial park in Melbourne,
- The garden bed was installed with drippers in August 2007 to comply with the water restrictions in place at the time and programmed to irrigate 2 times a week.
- A 30cm (12in) **AquaSpy Turf probe** was installed in the same garden bed to monitor the **AquaBlu**.

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Melbourne Rain Bird Site. Small area only but helped demonstrate the function of the AquaBlu switching off a Rain Bird domestic controller. A very similar outcome was noted as Townsend House

Similar trials, pilot projects and commercial projects are being undertaken across Australia and the USA using a combination of AquaBlu's and Turf Probes. These include:-

School playing fields

Council playing fields

University Sites

Botanical Gardens

Nature Strips

WOCIM — Whole Of Community Water Management

Tiered model for Demand based irrigation

Tier 1 – Sensor layer

Tier 2 – Analysis Layer

Tier 3 – Control Layer

Tier 4 – Accounting Layer

Tier 5 – Carbon and Water Trading Layer

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When we met with Malcolm Turnbull last year we didn't get the result we were hoping for. However it started us on a journey which we called WOCIM – Whole of Community Irrigation Management. This is only a working name but one which covers an interesting prospect for the future of irrigation. The WOCIM concept has been patented but is going through some refinements therefore there are certain features that I am unable to speak about at this time.

WOCIM is a tiered model of Monitoring and Demand based irrigation control. 'Community' can be any cluster of assets which are under the control of the WOCIM. As such 'Community' could be a school, golf course, resort, village, town, city, farm or even dispersed assets managed by a company such as a hotel chain

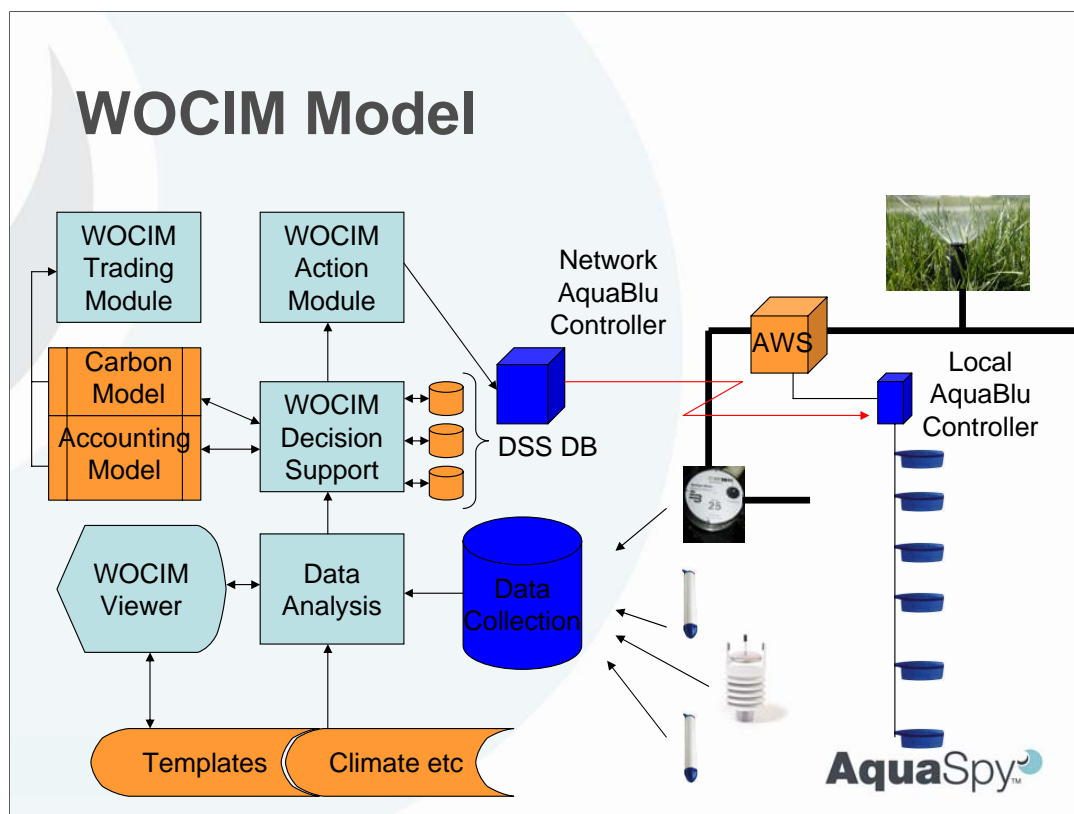
Tier 1 – Sensor Layer.

Tier 2 – Analysis Layer.

Tier 3 – Control Layer.

Tier 4 – Accounting Layer.

Tier 5 – Carbon and Water Trading Layer.



Tier 1 – Sensor Layer. This covers the monitoring of all appropriate sensors and meters within the community.

Tier 2 – Analysis Layer. This is the layer that considers the data from the various sensors and meters with climatological, forecast data and irrigation templates. It determines expected usage by zones as well as identify possible leaks within the network.

Tier 3 – Control Layer. This is the feedback loop that creates the control to irrigation systems across the community subject to the inputs and the analysis.

Tier 4 – Accounting Layer. Accounting is used for real-time management and cost control. Can be used to have off-peak periods or adjust costs to meet the demand or regulations.

Tier 5 – Carbon and Water Trading Layer. This provides the WOCIM Community manager the ability to determine the level of carbon he is able to trade using his WOCIM strategy. For those able to trade water it also provides the mechanism to do that to a neighbouring community.

Summary Benefits

- Minimise water use
- Minimise power (pump) use
- Minimises cost of fertilizer
- Optimises quality (and yields)
- Reduces run-off and pollution

WOCIM used across Australia could:-

- Save every year the equivalent of all the water used by Queensland and South Australia
- Double the environmental flows into the Murray
- Increase food production by as much as 30% (if used across agriculture)

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WOCIM will benefit a community by minimising water usage without impacting the aesthetics of the community. In the case of a farm it will provide a mechanism for automation and optimisation of yield or quality of products. In this way the grower can be assured of the best possible crops and higher output which can be achieved through the watering profile.

The WOCIM concept is the next generation of water use management and if used throughout Australia would result in substantial water savings.

Roughly the entire water supply of Queensland and South Australia (>3,600 GL/year) could be saved every year. This could double the environmental flows along the Murray Darling.

On a global scale, such an approach would revolutionise crop production and efficiency as well as make the planet a better place to live. WOCIM if extended across the world would provide 30% or more food without using one teaspoon of more water than we use today.

Food for thought!



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