UISGE BEATHA - THE WATER OF LIFE

By Adrian D Mortram

For many of us a wee dram is a pleasure, to be taken with a little water, no doubt. But for our grass plants water is an essential ingredient in maintaining the quality of the playing surfaces required for our sport. With the notable changes in our weather patterns, the summers of 2003 and 2006 being two of the hottest on record, and legislation in the form of the Water Bill now on the statute books it seems sensible indeed to look at water accountability and consider such topics as:

- Water conservation measures
- Accurate recording of water usage
- The use of modern technology, and
- Water resourcing

A recent report 1 investigated the science behind climate change on water usage. It concluded that both domestic and industrial water use would rise by 2-3% by the year 2020; whereas agricultural use, which includes sportsturf and golf courses, was predicted to rise by 2-3% per annum due primarily to a longer growing season. In addition this growth in water usage was to be regional specific with the South East and Thames to be the most affected.

A second report 2 although world wide and not specific to agriculture / horticulture was alarmist predicting that:

- In many countries throughout the world there is at present a severe water shortage yet leaders refuse to acknowledge the problem
- There will be a cut of up to one third of the average persons water supply in the next 50 years
- The water crisis will affect between 2-7 billion people world-wide

The fact that this report is alarmist will provoke Western Governments into action and the action will be extended to the easiest targets, you the end user. In response to previous reports the British Government has introduced the 'Water Bill', much of which revolves around 'sustainability' and 'taking water responsibly'.

The principal areas within the new Water Bill which concern spray irrigation users for sportsturf and golf courses are summarised below. Although most of these are of relevance to England and Wales only, who are governed by the Environmental Agency (EA), it is important that the Scottish Environmental Protection Agency (SEPA) are monitoring the situation carefully with future legislation in Scotland for water resources now a reality.

- Removal of abstraction licensing exemptions currently given on grounds of use,
- Establishing a threshold of 20m3 per day, above which an abstractor needs a license,
- Time limiting of all new and existing abstraction licenses for a duration in the order of 15 years, whereas in the past licenses were granted in perpetuity,
- Streamlining the license application,

modification and transfer system and allow trading of water rights between parties,
- Placing water companies under an enforceable duty to further water conservation,
- Giving the Environmental Agency powers to revoke an existing abstraction license without compensation if it has not been used for four years,

And most importantly:
- Giving the Environmental Agency powers to require abstractors (i.e. yourselves) to enter into water management arrangements and to use water in an efficient and effective manner

So, how will this affect the end user? Well, there is a pressing need for us all to become more 'accountable' and to demonstrate that we are using available water resources efficiently. This initially involves having a good working knowledge of soil water relations and the inter-relationship between simple soil science and plant botany. An understanding of the relationship between gravitational water and field capacity. An awareness of the value of infiltration and percolation rates, and an accurate assessment of water availability within the root zone. These features alone can ensure good conservation practices and prevent water wastage by reducing over application, surface run-off, and inadvertent losses through the drainage water. Equally it is essential to know how much water is being applied through supplementary irrigation, not in 'so many minutes per station' but in millimetres per hour, as this can then be compared favourably or otherwise with the surface infiltration rate to maximise water use efficiency.

A working knowledge and understanding of the above will assist in the ability to manage available sources of water better, and more precisely to 'calculate' rather than 'guess' the potential irrigation demands of the turf. A water balance sheet 3 may further help in this provision. This involves not only monitoring the condition of the turf on a daily basis through such cultural skills as the observation of foot printing and the relative dryness of the core when changing holes, but also balancing the water input (profits) to water loss from the turf. Water input is by natural precipitation, which is free, and by irrigation. Water loss from the turf is by transpiration through the leaves and evaporation from the soil combining to give evapo-transpiration (E/T). Figures, albeit average figures are available for E/T via the Met Office (MORECS data), and rainfall can easily be measured by a weather station rain gauge. All that remains to produce a simple 'profit and loss' account (water balance sheet), indicating not only the need for irrigation but the amounts required is the ability to maintain daily records and be aware of the precipitation rates from the irrigation sprinklers. Also working with the concept of an allowable water depletion, that is to say not returning the soil to field capacity, a buffer can exist to allow for dew or unexpected rainfall. By constantly returning the root zone to field capacity, or above, wastage of water can occur, the soil structure can be impaired, surface rooting will be encouraged and nutrients may be lost via gravitational water through drainage.

Modern technology can also play its part in improving our water use efficiency. Good area specific irrigation design with careful selection of sprinklers and their spacing to maximise distribution uniformity and scheduling coefficients, computerised irrigation control, variable frequency drive pumping systems and on-site weather stations can all help to build up a picture of irrigation water usage and a maintain a credible 'water audit'.

From an irrigation design point of view the objectives of an efficient irrigation system are to apply water:

- To the areas requiring irrigation uniformly
- At the optimum precipitation rate to allow penetration into the rootzone minimising run-off
- In quantities necessary to maintain soil moisture at the required level
- At the optimum time during the day or night

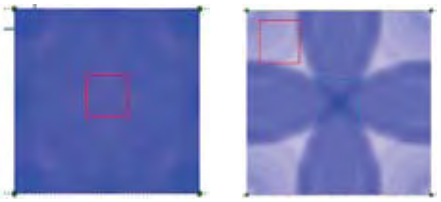
When backed up by digital aerial photography and GPS mapping to highlight the 'precise' areas considered necessary for irrigation, and meteorological data, this enables water to be applied effectively with a constant consideration for conservation.

Computerised irrigation control brings many advantages to irrigation which when combined with accurate evapo-transpiration and rainfall data obtained from a weather station provides the user with the ability once again to 'calculate' rather than 'guess' irrigation requirements, all of which will be essential in the future. Computerised controllers also use sophisticated 'hydraulic management' to minimise hydraulic stress within the system, reducing bursts and saving water. This will be particularly noticeable if your pump station uses variable frequency control whereby the pump flow matches the demands of the system. This saves electrical energy, further reduces hydraulic shock and provides better controllability by delivering only the amount of water required by the system at a particular moment in time.

An on site weather station to record meteorological data such as temperature, humidity, wind speed, solar radiation and of most importance to irrigation, rainfall and evapo-transpiration can help with our water use efficiency. Applying only that water which the soil-plant environment requires can save between 10-15% of water within a cycle, which for those of you who rely on mains potable water can result in a significant saving throughout a season.

It may also be prudent at the current time to look at water resourcing. One thing is for certain; water will become more expensive in the future. Check abstraction licences and monitor current daily and monthly usage, 2003 was a good year to start, as water usage was above average, however, now is never too late. The last time we had a summer even remotely similar to 2003 was eight years previously so statistics would show we are due a prolonged dry summer soon! If your water is mains only then research potential alternatives. If your predominant water is ground water check your license agreements and ensure you know when it is due for renewal otherwise your license to abstract could be lost. In either case it may be necessary to consider the construction of some from of water storage facility, and both time and planning will be on your side if you start now. There has recently been a number of articles on the use of 'grey water' or 'waste water'4. This has to be a potential water source for the future especially where a golf club has a leisure facility attached. 'Waste water' has both advantages and disadvantages and maybe used to supplement other forms of irrigation water.

So where does the Water Bill leave us? I believe as the industry uses only 0.1% of all available water in the UK that if we show accountability by demonstrating a working knowledge of soil water relations, have a written water policy, maintain accurate usage records, have well designed, maintained and efficient irrigation system and effectively demonstrate conservation techniques with the aid of modern technology, we should be in a strong position to meet the demands of the future.



(Above left) Excellent Sprinkler Densogram showing scheduling coefficient of 1.1 and distribution uniformity of 94%.
(Above right) Poor Sprinkler Densogram showing scheduling coefficient of 1.5 and distribution uniformity of 68%.

References -

1 DOWNING, T.E; et al. (2003). CCDeW Climate Change and Demand for Water, Research Report, Stockholm Environmental Institute Oxford Office, Oxford.

2.UNESCO. (2003). World Water Crisis Worsening, AgraNet.

3 MORTRAM, A; HUME R. (1999). How Much to Apply and When. STRI International Turfgrass Bulletin, Issue 204. p. 14.

4 MORTRAM, A. (2003). The Effects of Irrigating Turfgrass with Wastewater. STRI International Turfgrass Bulletin, Issue 219. January, p. 30-32.

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