How secure is your club's irrigation water supply?

Despite being a crucial component of a golf course's summer toolkit, water, and its availability is still a subject not entirely understood by all secretaries and greenkeepers. Surely water is just water, but like the wrong kind of snow on a rail track, the 'wrong' kind of water can leave some clubs high and dry if their water costs continue to rise. Or worse if the supply is switched off.

What are the different 'kinds' of water that a golf course can use for its irrigation system?

Potable mains water, also known as municipal water, or just plain old tap water is the most obvious source. This water is the chlorinated water we drink and brush our teeth with. As most club houses and greenkeeper's compounds have potable mains, it is generally the easiest and most obvious source of supply. The water companies make their money from selling water so using theirs for your irrigation is good for them. Capital outlay on a tank and ball-cock etc is relatively cheap, but the cost of the actual water itself is relatively expensive.

Costs depend on whether the club has negotiated with their water company to give a 100% rebate on sewerage costs charged on that water which is used to irrigate the course. Ordinarily this might mean having two accounts with two separate water meters. The first account – the 'normal account' - should be for the club house and the greenkeeper's yard; for drinking, washing, toilets etc.. This 'normal account' includes a payment for the water to be taken away via the sewers and subsequently treated. The second account – 'the irrigation account'- does not pay for treatment downstream because all of the water is applied to the golf course and none of it is returned to the drains

The cost of water from the two accounts is about 75p per cubic metre for irrigation and £1.65 per cubic metre for the 'normal' account.

Ordinarily, potable mains water is a very secure form of water. Seasonal costs for an 18-hole greens, tees and approaches irrigation system should range between £6,000 and £12,000 per year. An irrigation system covering fairways will have costs proportionally higher, and as these costs can typically be in excess of £20,000 per year, most fairway systems will have their own abstraction licences and do not use potable mains water.

A club having greens and tees irrigation may not find it worthwhile attempting to reduce their unit water costs by moving away from potable water, but in the South and East of England, drought orders and hose pipe bans may have a major impact. Having no water at all may be the most expensive way of all.

Irrespective of the 'kind' of water used, unit costs of water can be reduced by having a well designed and efficient irrigation system.

Efficient sprinkler irrigation at Royal Liverpool Golf Club

Abstraction licences: The Environment Agency (EA) in England and Wales, and more recently the Scottish Environment Protection Agency (SEPA), issue golf clubs with licences to 'abstract' water from the natural environment. These government bodies have a duty to ensure that water is not taken if its loss will be detrimental to the environment or to another existing user. They must also ensure that the use of the water is 'justifiable'.

There are three common forms of abstraction licence. These are

1. **Summer surface licence** which as its name implies, licences water to be taken from a stream, river or pond etc. in the summer months,
2. **Winter surface licence**, ditto, except the water is taken in the winter
3. **Groundwater licence** which is for water taken from underground porous or fissured rock – aquifers. A seasonal definition is less likely to be made for groundwater licences as the water takes much longer to percolate down to the aquifer than it does to run down the course of a river

Summer surface licences: Water taken from a stream or pond in the summer season is most likely to have an impact on the environment. Bogs, marshes and other wetlands, may not be lowered in the summer, and streams may not be pumped dry. For this reason licences are now rarely granted for summer surface abstractions. Some existing summer licences in 'Special Areas of Conservation' (SAC's) or 'Special Protection Areas' (SPA's) even face partial or full revocation under the European Habitats Directive. Complete revocation of a licence is likely to be extremely rare, but the Environment Agency is attempting to quantify all water and all its uses in every catchment, in their Catchment Abstraction Management Strategies (CAMS), and seasonal 'hands-off' conditions in times of drought may be imposed on any abstraction under Section 57 of the Water Resources Act 1991. Abstraction licensing for golf irrigation is still fairly low in the priority order of water use.

Groundwater licences: Water that is held naturally underground is more secure than summer surface water. There is more of it and its total quantity does not vary as greatly as this water is generally abstracted using a borehole pump and stored temporarily in a tank for night time irrigation.

Compared with continental Europe, Britain is an island with no mountain-range fed deep aquifers. Britain's aquifers are increasingly becoming classed as fully committed or even over-committed in terms of the number of licences already granted to abstract from them. In parts of the country, notable the West and North, new boreholes may be a viable proposition to many golf courses, but this is not the case in most of the South and East.

Drilling for water at Newark Golf Club

Winter Surface Water: Unlike relatively arid regions where irrigation is an absolute must for golf courses and crops alike, Green and Pleasant Britain has an abundance of aquatic environments. Though these environments must be carefully protected in the summer, in the winter there is often a surplus of water running down to the sea. This winter surplus, which is not needed by the environment or by other abstractors, can be harvested by a golf course and stored for use in the summer. As the storage of 'winter water' is a relatively new phenomenon, occurring in the last 15 years or so, winter abstractions are well researched prior to the licences being granted. This makes them the most environmentally friendly form of abstraction, and this kind of abstraction is actively encouraged by the government through the Environment Agency and SEPA.

In comparison with potable mains water, and as a general overhead, the price of water taken directly from the environment under an abstraction licence is cheap. Water abstracted under licence for an18-hole greens, tees and approaches irrigation system will cost much less than a thousand pounds a year. Water abstracted in the winter and stored in a reservoir is ten times cheaper than summer-abstracted water. A 15,000m^3 reservoir (3.3m gallons) can be filled annually for a few hundreds of pounds.

The major benefit of winter surface water, over and above the fact that it is cheap, is that once it is stored, it belongs to the club and may not be subject to any drought orders etc..

How does a club apply for a licence?

The eco-unfriendly summer surface licence is to the winter surface licence what the Hummer H1 is to the Toyota Prius. Though groundwater licences may be granted in some parts of Britain, summer surface licences will invariably not be encouraged and are environmentally frowned upon. Winter licences provide the best option for a club looking for a more secure, reliable, and less costly form of water.

When applying for an abstraction licence, the club must demonstrate that the water is readily available and that the amount applied for is actually needed. A 9-hole club on the west coast of Britain will not be granted ten million gallons (c. 45,500m^3) for greens and tees irrigation! A greens and tees system may require 12,000m^3 per year, and a fairway system may require 25,000 - 30,000m^3 per year. However, due to the vagaries of the interpretation of the law, in the area covered by the Southern Region of the Environment Agency, the irrigation of fairways is not classified as a 'justifiable' use of water and golf club's may be limited to 18,000m^3/year irrespective of actual irrigation requirement and water availability.

For a groundwater licence, demonstrating that water is available for a new borehole abstraction will involve carrying out a specifically designed pump test to check that the lowering of the water table is minimal, and that it has no effect on nearby water features and other boreholes. Water features, here means marshes, streams, dew ponds, lakes etc, not Charlie Dimmock's pebble fountains!

If the proposal is to abstract water from a stream in the winter, the applicant must show that there is sufficient water flowing down the stream in the average winter. Existing abstractions on the river and the needs of the environment are taken into account. The environment has priority followed by other abstractors on a first come first served basis. More water is required environmentally by a river in the winter than in the summer. This is because greater flows are needed to clean gravels of silt for fish spawning sites, to move these silts down to the feeding grounds of waders, and to move nitrate build-ups out of estuary habitats.

Monitoring a stream often involves installing a flow-gauging weir together with automated logging equipment. If the precise flows over a complete winter season are measured, approaches can be made to the Environment Agency to take either a very small proportion of normal flows (termed base flow), or to take large percentages of flows at time of flood (storm-flow). Each application is different and depends on the characteristics of the catchment and the quantity of water required.

Flow monitoring weir at Elton Furze Golf Club

Once sufficient data has been collected and the indications are good that a licence may be granted, an application is made. This is a carefully proscribed legal process involving the presentation of all the data in a defined format. All the application forms and appendices etc. that contain the information for the application must also be made available for public inspection at a point within five miles of the proposed abstraction point for a specified period of time dependent on the advertisement of the public notice.

Hydrograph of stream flow at Sleaford Golf Club

Mistakes are rarely made in the abstraction licensing process, especially if a reputable and experienced agent is engaged, but typical costs for a new application fee and for the advertising are in the region of £1,200.00.

An abstraction licence can take some time to be granted or declined. Prior to any monitoring equipment installed in a stream, Land Drainage Consent must be obtained to ensure that a structure does not present a flood hazard. This normally takes around six weeks. During this time a water features survey is often carried out to identify sites that may be affected by the proposed abstraction. There is normally also a period of a few months where views are solicited from English Nature and the local wildlife trusts for their perspective. Following monitoring for the required time period and the collation of all the data and a final decision made as to the proposed abstraction, the licence is applied for and all application forms and documents remain on public inspection for one month. Thereafter the Environment Agency have 90 days to 'determine' the licence. However, this 90 days is a standard period which is often extended many times. To gain a licence from the time of first proposal is normally at least 12 – 18 months, though some licences have taken over five years to be granted.

In Scotland, under the new Water Environment (Controlled Activities) (Scotland) Regulations 2005 – the CAR Regs – , the process of assessing whether there is sufficient water must end in the same result, but costs are different. An application for a 'complex' licence requiring in excess of 150m^3 in any one day will be £2,944, whereas an application for less than 150m^3 will cost £542.00. Annual charges are likely to be in the region of hundreds of pounds a year rather than thousands for the average abstraction.

Gauging structure for automated logging of stream flow

Where monitoring is not needed, if for instance the club is lucky enough that there is an automated monitoring station on the stream already, owned either by the Environment Agency itself, or other body, the timing may be less. Applying for a borehole is a similar process, except that there is not normally the seasonal element to the monitoring. But the consent to drill and test a borehole will still take at least four weeks to be processed by the Environment Agency prior to a test pump being authorized.

Good coverage on gear drive sprinklers

Other water supplies

In many parts of the world it is illegal to irrigate using potable mains water, and many municipal buildings are constructed with dual-plumbing systems so that non-potable water can be used to flush toilets with etc.. It certainly makes no sense to have all the energy and chemical inputs to water - to make it suitable for human consumption - and then to flush a toilet with it or to spray it onto a golf tee.

Grey-water is water that is has been used for washing clothes etc. and for showering and bathing. It is not toilet waste. It contains low levels of pathogens and low levels of nitrogen relative to raw sewerage water. It is possible to use this kind of water for irrigation but it requires a large capital outlay at the time of constructing the clubhouse to provide separate drains for wash water and for toilet water. Often the toilet waste needs the volume of the wash water to transport it to the water company's treatment plant in an unconcentrated state. In the UK it is generally not feasible to use this water for irrigation as the small volume of water generated does not justify the cost of the filters and pumps necessary.

Treated Effluent Water (T.E.W.) is a source usually from sewerage treatment plants. All sources of water should be investigated by a club but storing such re-cycled water can create its own problems. Water which is left to stand can often develop odours, scum, and worse. Odours are most likely to be detected on atomisation at the sprinkler head! An additional problem with treated water is that treatment systems are designed for particular quantities of water with known types and quantities of contaminants. Additional concentrations of treatable contaminants, or contaminants for which the system has not been designed can have serious repercussions. For this reason, treated water from neighbouring third parties must be constantly monitored.

If there is a stream nearby into which a treatment works may be discharging good quality Treated Effluent Water, it is likely that the stream has sufficient flow in the winter already for a winter abstraction. Abstracting water from the stream or taking the effluent before it enters the stream will make no nett difference to the flow downstream. If the water quality is not good enough to go into the river, it is not good enough to use for irrigation without additional treatment.

Rainwater harvesting, along with drainage interception, can provide a useful source of irrigation water for the club. Taking water off roofs and car parks, if included within a building's or car park's design can be a very effective method of collecting storm water for storage. Oil interceptors may be necessary but these may be required already as part of groundwater protection. The water must be collected in chambers however, and pumped to a storage area. This can be expensive. To estimate the volume of water that can be collected from a car park or roof, the area in square metres must be multiplied by the annual depth of rainfall in the area, and an allowance for losses, evaporation etc. (the drainage coefficient) be made. In most of Britain, an average sized golf club car park is likely to yield less than 2000m^3 per year. However, often, in the negotiation with the Environment Agency for a new

abstraction licence, a club will have to show that it is making the best use of all its existing available sources of water, before any new ones will be considered. For this reason such rainwater harvesting exercises, though expensive, can also help to provide the political leverage for further quantities to be found elsewhere.

In law, any water that falls on the course and does not enter the natural water course can be saved for use on the course. This water must be collected within the drainage system and transferred to a place where it can be stored. If the water enters a drainage ditch or stream it is 'lost' to the club and 'belongs' to the environment. For this reason at a club with low water resources, any new drainage system must be designed in such a way as to take the drainage outfalls to common pumping chambers from where the water can be transferred to more permanent storage. There are some grey areas however. If an existing downstream habitat has been supplied with drainage water from a twenty year old tile drain system, the Environment Agency are likely to take a dim view if all of this water is now intercepted. Issues such as these need addressing on a site to site basis.

Collecting chamber being assembled for 'harvested' water to be pumped to a reservoir

Summary

The most secure 'kind' of water for a golf course is that which it has 100% control over. Potable water is both expensive and may become more so. In times of low rainfall, drought orders or hose pipe bans may be imposed though the fines for flouting the orders seem to be minimal. Summer surface water, the oldest and original form of abstraction, is the least secure form of environmental water and, as pressure from environmentalists increases, is likely to become extremely limited in the coming years.

The cheapest water is that which is free – drainage and rainwater water, but the quantities may not be sufficient for the course without massive capital outlay over and above that necessary to construct the reservoir necessary to store the seasons' accumulations. Combining this water with a well researched long-term winter surface abstraction licence will offer the best prospect for both the club and the environment.

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13,500m^3 reservoir for greens tees and approaches at Spalding Golf Club

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