Alternate water supplies for sports turf irrigation

Throughout my 25 years of irrigation installation, design, and maintenance, I had to learn how to solve the technical, environmental and economic problems that different water supplies presented.

If your facility uses potable water for irrigation, you have likely been asked to reduce your irrigation water use and to continue managing soil moisture levels in the rootzone of your irrigated turf.

The price and regulation of potable water continues to change dramatically, and you may be asked to use a lower quality water supply soon. Alternative irrigation water supplies like ground water, surface water, reclaimed water from a utility, or water from a reverse osmosis (RO) treatment plant may be your next choice.

WATER RIGHTS AND USE REGULATIONS

In Western states with water rights, those laws must be considered first. In many cases, high quality water supplies may be on site and at low cost to access, but regulations prohibit easy access to them. In Utah, the state legislature is considering lifting restrictions on rainwater harvesting for small scale irrigation systems. This regulatory change (Senate Bill 32) would allow the collection of rainwater in a single 2,500-gallon underground tank. Anyone harvesting rainwater would be required to register with the state water districts, provide technical specifications of the harvesting system and report collection volumes. Although a 2,500-gallon tank will not provide adequate water supply for a sport turf system, this legislation represents a shift in the regulation of rainwater harvesting and alternate irrigation options.

Eastern states that previously had few ordinances governing the withdrawal and use of water resources for irrigation have new restrictive laws and regulations.

For example, one north Georgia city shut down all irrigation systems using potable water, including sports turf, during a recent drought. Only irrigation systems using well water or surface water systems were allowed to operate, and only for 1 day a week during the drought. A group of local turf managers spoke up and a new set of water use rules were adopted that recognized the professional turf managers' responsibilities. In the event of another prolonged drought, facilities with sports turf will be allowed to operate their irrigation systems as required to manage quality turf and safe playing conditions on their fields.

WATER QUALITY

When it comes to irrigation water quality, turf managers should consider the presence of suspended particulate matter that might affect the irrigation system equipment, and dissolved salts or elements in the soil that may affect the health of the turfgrass.

To determine water, and the effect it can have on your soils, a laboratory chemical analysis should be performed. These tests can be conducted with relative ease by following sampling methods and using specific collection containers. A basic water or soil analysis report will cost between $100-$200 and will reveal the size and volume, or count, of dissolved and suspended organics and inorganic solids and minerals, and conditions of the sample that are present at the time and location of the sampling.

Basic water tests often include measurements of water pH, Electronic Conductivity (EC), Total Dissolved Solids (TDS), Total Suspended Solids (TSS), salinity hazard, total alkalinity, hardness, metals (aluminum, iron, manganese, copper, zinc), major cations (sodium, calcium, potassium, magnesium), sodium adsorption ratio (SAR), and major anions (fluoride, chloride, bromide, nitrate-N, phosphorus, sulphur). The water lab will ask for the turf type being sampled, and will provide a report outlining the hazard potentials relative to the level of each parameter.

Although an analysis of the above tests would be better explained by a university professor and a chemistry textbook, it is important to understand that these are present in the water and soil and do have an effect on the turf. Turf managers are traditionally most interested in pH and salinity numbers, SAR, TDS and EC as these may eventually result in soil conditions that inhibit nutrient and water uptake. This could potentially lead to plant stress, thinning turf, or susceptibility to pests and diseases.

Organic material content, soil composition, soil compaction, drainage and cultural practices will further determine how a water supply will ultimately affect soil and turf.

GROUND WATER

After potable water, ground water from a well can be the highest quality and the lowest cost of irrigation water supply available to turf managers. Most drinking water supplies come from deep ground water wells, so there is competition for this water supply. Ground water quantity and quality varies at different levels in the soil profile and at different locations on a site.

Well water samples for new wells are obviously hard to acquire. These samples should be taken and paid for by the well installer in the "test well" phase during the drilling of a well. The test well process assures water quality, volume and pressure from a new irrigation well. Purchasing agents or irrigation consultants can assist in developing language for well water drilling specifications.

Depending on the hydrology of a site, an irrigation well could be drawing either shallow or deep. Local well drillers will

Ground water drawn from a new 6-inch shallow well with pressure start pump motor controls and sand filter.

All images by M. Prevost

This is signal start, suction lift pump station pulling surface water from a canal adjacent to new football practice fields.

generally provide excellent advice on the location and depth of a well that will deliver the best water quality at the flow rate and pressure needed. Well drillers are like irrigation installers—each have their own approach to workmanship, materials and equipment for a project. It is recommended to have at least two local well drillers visit the site and review the well application before sending out a request for proposal (RFP) for a new well. This will assist in developing the scope, budget and timeline for the project.

Surficial (shallow) well waters tend to be lower quality as they have less soil structure to act as a filter. Iron staining can occur when the iron (Fe) content is greater than .3mg/L in water, and can be expensive to eliminate. An environmentally effective method to treat iron staining is to discharge the well water into an open surface water body. Oxygen in the water converts (oxidizes) the suspended Fe to a solid and it falls (precipitates) out of suspension in the water. The equipment and power to pump the water out of the treatment lake is an added expense, but the water is cleaner without using any injection equipment or chemicals.

When planning the location of an irrigation water well, provide sufficient vehicular access for the drilling rig. If a large diameter or deep well is needed, the driller will need a wider lay back area for a larger rig's operation. Also, consider the proximity to your existing electrical service as the electrical service can sometimes cost as much as the well equipment. Three phase electric power is required for 10 hp pump motors or larger, so well projects should begin with plans to extend electrical power to a proposed well location.

SURFACE WATER

Surface water supplies maybe your lowest quality water and the lowest cost water supply. Bacteria, algae and aquatics live at different temperatures and light levels in surface water; therefore, it is important to test water quality by taking surface water samples from the same depth that the intake line will be set in the proposed pump station. The highest water quality can be achieved by setting the lake pump intake line at the point in the lake where microbial activity is lowest. Typically, this tends to be 2-3 inches from the lake top, or bottom, depending on the pumping volume, water turbidity (clarity) and lake bottom material.

In arid regions, chlorides are found in rainwater runoff waters. Using surface water in these areas for irrigation requires a leaching cycle which is 30-50% longer than normal station run times. Leaching cycles will help move salt buildup out of rootzones of a well drained turf in the absence of an equivalent rainfall event. The frequency of the leaching

cycle you select is dependent on the concentration of chlorides in the water or soil profile.

Large suspended items like plastic, trash, plants and fish in surface waters can be remediated with an intake line screen. A simple intake screen for a small pumping applications (less than 300 gpm) uses a PVC pipe, correctly sized for the pump flow rate. Holes are cut into it the pipe with a hole saw, the intake is wrapped with 316 grade stainless steel #2 mesh or #4 mesh wire screen, and secured with stainless steel worm gear clamps. The screen is removable, and can be cleaned according to the lake water quality and how the pump station operation is managed. In any application, the intake screen is an important part of the pumping system and is to be included with the maintenance of the pump equipment.

Pump intake lines, discharge lines and power connections should be installed and maintained in the first year warranty by the pump equipment provider. If improperly installed, these lines can damage a pump and diminish pump performance and efficiency. There are many configurations of pumps and filters for surface water applications. As with well motors, bringing electrical power to a lake pump station can be expensive.

RECLAIMED WATER

Reclaimed water is the most technically, environmentally and economically feasible option to reduce potable irrigation water use. Those who have a reliable reclaimed irrigation water source available are fortunate in today's times of limited water sources. The large purple pipes going in the ground on new roadway projects represents the availability of reclaimed water, and it is both a positive nod to the irrigation industry, and a sustainable solution to managing irrigation water supplies.

Because reclaimed water is not used for fire protection or human consumption like potable water, it can have an occasional service interruption, or a minor water quality problem like small debris or odors. Pathogens in the water that are harmful to humans are rarely a problem. There are strict heath department regulations, daily monitoring requirements and treatment plant testing to prevent human health risks.

In some instances, the reclaimed water demand exceeds the availability. Subsequently, subscribers experience a periodic decrease in water pressure, and a booster pump is required to sustain higher water pressures required for sports turf size rotor heads and nozzles.

Higher salt levels have also been observed in reclaimed water. This saline level may decrease ryegrass seed germination rates, requiring higher seeding rates and increasing the need for reseeding. Suspended clays in some reclaimed water can build up over time in the soil layer and inhibit infiltration rates, requiring some type of aerification to remediate the problem.

Some county health inspectors will not allow quick coupler valves on reclaimed water irrigation systems because people are more likely to drink from a hose connected to a quick coupler. On these systems, quick couplers should be serviced from a potable water supply. Outdoor dining and bathing facilities usually have a 50-100- foot set back distance from the wetted area of a reclaimed irrigation system. And, of course, purple colored (Pantone #512) pipe, sprinkler caps, nozzles, and valve boxes are required, as well as signage requirements for public health and safety regulations associated with reclaimed water.

Public health codes require the use of purple color pipe (Pantone 512) to distinguish reclaimed water lines from other supply lines.

REVERSE OSMOSIS WATER

In the reverse osmosis (RO) process, high pressure pumps push low quality (usually salty) water through permeable membranes in cylinders and a pure water supply results. A concentrated salty waste byproduct water has to be discharged and diluted in a larger water body, and a permit is required for this process. RO water is of very high quality and has the highest cost, short of having water purchased and trucked in daily.

On the Monterey Peninsula, the local water purveyor reported their cost was $250 per acre foot to pump fresh water from the Carmel River; however they are being required by the State Water Resources Control Board to pare back withdrawals from the river by over fifty percent. The water company now estimates it will cost $2,500 per acre foot to use an alternate RO water supply.

Reverse osmosis systems produce clean water through permeable membranes in a bank of cylinders.

Micronutrients are eliminated from irrigation water through the RO process, and turf may be subject to a wide range of nutrient deficiencies if irrigated exclusively with this water supply. In the Caribbean, due to scarcity and expense of fresh water, RO water is often blended with lower quality makeup water supplies for irrigation use. RO water is used when all other water supplies are not available, and the economics of the equipment and electric power consumption can be justified.

Each water supply has a technical, environmental or economic advantage over an alternative water supply. It is important for turf managers to understand the impact that any water supply may have on their fields, and to establish early strategies to protect both soil conditions and turf quality. In this time of economic struggles, turf managers have a difficult, yet worthwhile, task: to identify the best alternate water supply, which is easiest to access, has the least cost, and is the most environmentally useful.

My favorite water supply is water conservation. Think about it. Each gallon not used today, is an amount that stays in the system. Today's conservation is tomorrow's water supply. ■

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