THE EFFECT OF WATER QUALITY ON IRRIGATION COMPONENTS

Most groundskeepers will tell you that one inch of rain does more good for turf than one inch of irrigation. This appears true despite talk about air pollution and acid rain. How does rainfall differ from groundwater, or, in an increasing number of instances, reclaimed water?

Water quality is a growing concern in many parts of the country. Not only does it affect the condition of turf under your care, it can also increase the amount of maintenance required for irrigation system components.

There just isn't enough potable water to serve everyone's needs. Irrigation, especially for golf courses, parks, and other large areas, depends increasingly upon reclaimed or "dirty" water. While this water is not toxic to plants, it may contain chemicals, organic material, or particles that can foul or slowly degrade rubber or metal components of irrigation systems.

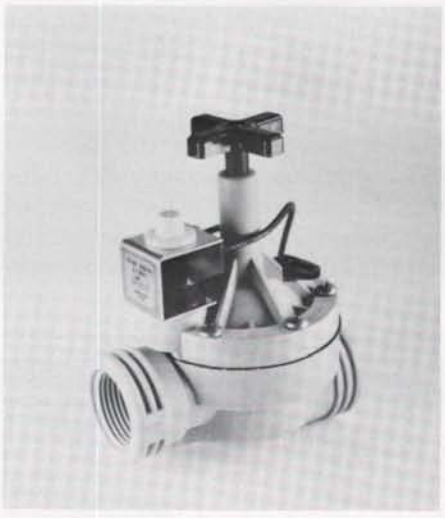
Whether water is obtained from treatment plants, wells, rivers, or lakes, superintendents and groundskeepers need to be aware of what is in water delivered by irrigation systems. Many problems can be solved by filtration at the pump station. Others may require greater diligence on the part of irrigation specialists to maintain proper operation of valves and sprinkler heads.

"Today the golf course superintendent has to be more than an expert on turf management," claims Efraim Donitz, president of Aqua Programs International, Inc. of North Hollywood, CA. "He has to know about water and its impact on turf and other plants. Every large turf facility should have its water tested at least once a year and, in some cases, four times during the season. Once you identify contaminants, there are ways to overcome them or learn to live with them."

Protecting pump stations against dirty water was discussed in the November 1990 issue of Golf & sportsTURF. This article will focus on valves, heads, and, to a limited extent, pipe.

There are two basic types of potentially dirty water used for irrigation, reclaimed and unprocessed well or surface water. Manufacturers point out that even potable water may contain particles or chemicals that can affect irrigation system components over a period of time. Products injected into irrigation systems, such as fertilizers, can also react with metal or rubber parts.

As potable water supplies are stretched to their limits, municipal water districts are encouraging or requiring large turf facilities to switch to reclaimed water. Arizona, California, Florida, and Texas have initiated separate delivery systems for water processed by treatment plants. To distinguish between potable and reclaimed water, the irrigation industry has adopted the use of purple or brown pipes, valves, and sprinkler head caps as an indicator of reclaimed water carriers. The color is a warning to those who might consider using the water for drinking purposes.



Color-coded plastic valve for reclaimed water by Imperial Underground Sprinkler Co.

"The best way to protect irrigation valves and heads is at the source," advises John Williams of Toro Irrigation. "That is why we pursued aeration. By managing irrigation reservoirs to control algae and improve aerobic decomposition of organic matter at the source, you reduce contamination problems.

"Filtration is critical if you have standard electric valves," Williams adds. "If debris gets into the top chamber of the valve, it can disrupt operation. Some electric valves are designed with small screens that filter the water entering the bonnet. Our pressure-regulating electric valve has a different type of metering which is more tolerable of dirty water."

Williams recommends hydraulically-controlled valves for serious water problems. "The water operating the valve is from a clean, pressurized source," he says. "The chance of fouling is greatly reduced."

Early hydraulic controls were not flawless. Larry Thomas, irrigation supervisor at the University of California, Irvine, has been switching from hydraulic to electric valves over the past five years. The university has been using reclaimed water for 15 years. "Something in the water was causing a metal disk in the hydraulic controller to break down," he reveals. "It would actually crumble in your hand when you touched it. We think the culprit was chlorine reacting with the metal." Today, the disk has been replaced with plastic pilot valves to correct the problem.

Both plastic and brass valves are included among the thousands of valves on the UC campus. "We use standard electric valves from Rain Bird and Hardie," Thomas states. "The water we get from the Irvine Ranch Water District is clean. It just contains a lot of chlorine. The chlorine seems to cut the life of diaphragms in half. Instead of getting ten or more years from these parts, we receive about five years."

Thomas' crew of three has become skilled at replacing the diaphragms. "It's just something you plan for and watch closely," he states. "We make sure all valves are conveniently located for servicing. Some of the valves on the baseball and other athletic fields are buried, so we'll check them every year or two. If there is a problem, we'll change out the valve to a dirty-water type with a reinforced diaphragm."

Other precautions taken by Thomas include using Toro stream rotors for the campus and Hunter gear-drive heads with drain check valves for the athletic fields and inner park. "The buckets on our old heads used to fill up with water," he reveals. "We

try to avoid any standing water or drift since it is reclaimed water. Now, we are 90-percent electric valves and have installed a Rain Bird MaxiCom central for tight control of our irrigation program."

Thomas has not experienced any problems with the water reacting with the brass or plastic bodies of the valves. Brass is an alloy of copper and zinc. Sulfur in water can leach the zinc out of the brass. Acidic water has been reported to react with some brass or metal components. Plastic is considered chemically inert and is sometimes favored in areas with high concentrations of sulfur in water. Some early plastic valves, however, were subject to breakdown by chlorine.

"There is a great misconception that brass doesn't work well in aggressive water," says Kurt Thompson of Buckner in Fresno, CA. "High quality brass is sufficiently resistant to corrosion in most irrigation conditions. You also have to remember that there are metal components in plastic valves. If water is highly acidic, you don't solve the problem just by using plastic valves."

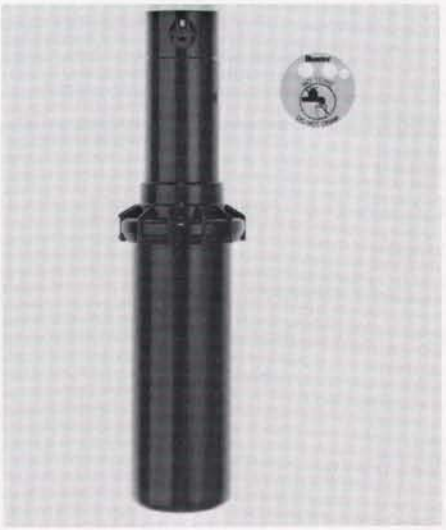
"The main thing to look for in valves is a design that keeps the top chamber clean in dirty water situations," says Bob Caviar, president of Imperial Underground Sprinkler Co. in Lenexa, KS. "Not all valves have the same design. Sand is not round. It can get lodged between sleeves and metering pins. Filters are important, but they have to be located so that water flow keeps them clean. Sizing of the screens is also important."

The design of the valve is important in dirty water situations, states John Thompson, Rain Bird's chief engineer for valves. "If a valve fails, you want it to fail closed. For example, if a diaphragm gets a hole in it or an electrical line is cut, the valve should close. The diaphragms on our pressure-regulating and contamination-proof valves are rubber vulcanized to nylon cloth. These valves also contain filters. Some are self-cleaning and others need to be cleaned manually. The irrigation specialist should know where the screens are located so he can service them."

One drawback to hydraulic control is that valves fail in the open position. "If a tube is cut by rodents or someone digging, these valves are open," remarks Jay Inglis, technical information manager for Hunter Industries in San Marcos, CA. "But they are better suited to dirty water situations, especially with valve-in-head sprinklers."

Even though electric valves fail in the closed position, they can remain open if the inlet on the valve bonnet is plugged with debris, explains William Speelman with Toro Irrigation. "The choice between electric and hydraulic valves is determined by the quality of the water and the region of the country you're talking about. Hydraulic valves are very popular in Florida and Texas because of the danger of damage to electrical systems by lightning. Out West, electric valves are most common because of ground varmints damaging hydraulic lines.

"If the turf manager selects electric and the quality of the water is poor, filtration is a must," Speelman adds. "You have to check to make sure the water will match your system. Reclaimed water varies significantly. Some is crystal clear and some is loaded with suspended organic matter. Changing from potable water to reclaimed water is not a simple matter."



Hunter Industries makes color-coded warning caps for its sprinklers to indicate reclaimed water.

Conversion also necessitates a look at sprinkler heads. Unfiltered water may contain enough suspended organic matter to plug filters or nozzles. It may also carry abrasive particles that hasten the wear of soft metal components.

Manufacturers of most gear-drive heads use Delprin plastic for nozzles and certain other parts because it resists abrasion from water-borne sand better than brass, says Inglis. A second option is stainless steel.

Algae is another threat to heads. Agricultural sprinklers in dirty water situations tend to be impact heads with large nozzles. The rotation mechanism is fairly simple, operating pressure is high, and the volume of water delivered is large. Some of this thinking has carried over into golf and park uses.

The other approach to protecting sprinklers from dirty water is the closed-case rotor, where the drive mechanism is separated from the main flow of water through the head. These heads have the flexibility of operating at lower pressure and flow rates.

"People are becoming very aware of energy costs related to pumping," Speelman reveals. "They are matching precipitation rates more closely to the infiltration rate of the soil. Lower pressure and flow save money, and in some cases, water. The amount of control desired by turf managers depends upon the amount of water required from their irrigation systems. A system in the Northeast may provide only 30 percent of the total amount of water needed by the turf. In Palm Springs, it may provide up to 98 percent of the total! As that percentage increases, so does the importance of head spacing, precipitation rate, and pressure."

One particularly life-shortening factor for valves, heads, and pipe is chlorine in reclaimed water. "There is no upper limit on the amount of chlorine used by treatment plants," remarks Rain Bird's Thompson. "One area may have one hundred times the amount of chlorine as another. We are always looking for materials with better resistance to chlorine."

"Eventually chlorine *and* bromine will be banned," says Donitz. "Some other type of biological process will take their place. Until then, we are dealing with a chemical that breaks down partly into hydrochloric acid. Sulfur is also present in a number of corrosive forms. These chemicals are in our water and in our irrigation systems. We need to be aware of their impact on irrigation hardware."

Nitrates are another group of chemicals which may be in irrigation water. They are intentionally injected into systems during fertigation. They are also common in reclaimed water and in lakes that receive runoff from fertilized watersheds.

So you can see that we are not talking about rainwater. Irrigation systems are exposed to an assortment of chemicals, organic materials, and abrasive particles. In all but extreme cases, our water delivery systems for turf and plants perform reliably. Even then, the most they require is more intensive maintenance of replaceable parts.

By learning about water and adjusting irrigation maintenance levels, reclaimed water can continue to keep millions of acres of golf and sports turf green, healthy, and in play.