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The plant, called Durango Hills, can process 10 million gallons of effluent a day. Angel Park pays \$2.33 per 1,000 gallons for recycled water. Fresh water costs about \$3.50 per 1,000 gallons, so Angel Park saves significantly. Rohret believes recycled water expenditures will increase later this summer.

When Angel Park converted to effluent water, there were other costs as well, mainly to build or retrofit pump stations because recycled water wears out the irrigation infrastructure more quickly than potable water. The conversion from potable water to effluent water cost about \$1 million, Rohret says.

"We had to reline all our irrigation links with 60 mL PVC liners to prevent leakage into the environment," he says. "We also rebuilt a bunch of our lakes and installed new pump stations."

#### A WATER AGREEMENT

Richard Staughton, CGCS, general manager at Towne Lake Hills Golf Club in Woodstock, Ga., also uses effluent water. Towne Lake Hills was built in 1994 and is part of a housing development that started a couple of years before the course opened. A water treatment plant was part of the development and was online when the course was constructed.

"This has been our only source of irrigation for the course from day one," Staughton says. "The water is a good source. The owners feel good about the business decision that was made 14 years ago to irrigate with reclaimed water, especially with the present and future water crisis in the state."

An agreement was reached between Towne Lake Hills and the county water department, which is the water supplier, allowing the course to determine the amount of water needed. There are no minimums or maximums.

"In a sense, the water itself is free because the course pays monthly for the power required to run the pumps, plus a \$100-per-month maintenance fee for pump repairs," Staughton says. "The average yearly cost is about \$3,000 to use reclaimed water."

#### SALT OF THE EARTH

Although Rohret generally has been happy with the overall quality of the reclaimed water he uses, he's not happy with the salinity levels (about 800 parts per million). Because of those levels, he has to aerify his greens more frequently to improve the health of the turfgrass. Aside from the turf, trees develop an effluent sheen because of the additional bicarbonates in the water.

"This is a white look," he says. "When the water spray hits the trees, it causes the leaves to defoliate in the summer."

Angel Park's Bermudagrass greens are overseeded with *Poa trivialis*, or rough bluegrass, in the winter. But a problem with *Poa trivialis* is that it's sensitive to rapid blight, which can damage greens badly if not caught early. Rohret didn't see this disease until three years after the conversion to recycled water.

"Rapid blight is salt sensitive, so we test salinity levels every week and flush our greens

The average yearly cost to use reclaimed water at Towne Lake Hills in Georgia is about \$3,000. Photo: Towne Lake Hills

once a month to wash away the salt," he says. "We're also noticing higher salt levels in poor drainage areas on our fairways and roughs. Aerifying and flushing is a must."

Since Towne Lake Hills switched to effluent, Staughton has seen salinity levels rise. The sodium levels increase during the summer if there are no flushing rains, so Staughton does sodium and gypsum flushes during the summer as a safeguard.

The Nevada department of natural resources requires Angel Park to post signs around the lakes warning the water is recycled, even though the water used at Angel Park is so clean you could bathe in it or drink it, according to Rohret. The course is also required to post this fact on scorecards.

Towne Lake Hills also communicates to its golfers that the course uses effluent water. It has a sign posted in the golf shop that states reclaimed water is used to irrigate the golf course.

#### ON THE WAY OUT

Tom Verrips, CGCS, at Otter Creek Golf Course in Ankeny, Iowa, has used effluent water to irrigate the course for 20 years, but that's going to change soon. The course is in the midst of a grow-in because the original 18 holes were renovated completely. Verrips can still use the effluent until the grow-in is complete, but after that, he's going to use well water.

"When I arrived, Otter Creek was an 18-hole course with an automatic double-row irrigation system for the fairways, but I couldn't use it because there wasn't enough water," he says. "We looked at drilling wells, but then effluent as a potential water source was brought to the table by a young engineer working for us who spearheaded the project."

The effluent water has been good for the course, Verrips says.

"In 1988, we had a drought, but as a result of our effluent water supply, we were the only public golf course with an irrigation system on its fairways and we were able to stay green," he says. "We went from about

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20,000 rounds a year to 38,000.”

Verrips says the quality of the effluent was always top-notch, so that's not the reason Otter Creek is changing its irrigation source. Rather, the decision is driven by politics and economics. The city of Ankeny decided to change water sources for various reasons.

“We're basically land-locked,” Verrips says. “Recently, another golf course was built south of ours, and they have a holding pond and well. They put in a pump station and have an empty hole for our course to pump into.”

“I hate to lose the reliability of the effluent because I knew what it was,” he adds. “I always thought it was progressive to use effluent water, but it became a political and economic issue.”

#### ON THE WAY IN

The public, 36-hole River Ridge Golf Club in Oxnard, Calif., isn't irrigating with effluent

water now, but it's in the process of switching from well water to recycled water by 2010.

“The city has got the infrastructure set with the exception of the piping out to the golf course,” says Kyle Kanny, superintendent at River Ridge. “The city recently changed all its mainline water distribution piping and left the old pipes for effluent distribution.”

Kanny is excited about the transition.

“I can't wait for it to happen because the water quality I currently get out of the deep well isn't that good for growing grass, though it's fine for consumption,” he says.

“Our bicarbonate and sodium levels are high for grass, and the combination of those two items is a superintendent's nightmare.”

Oxnard is building a reverse osmosis plant that will clean the water used to irrigate River Ridge.

“During reverse osmosis, effluent water is

forced through a filter to remove impurities,” he says. “I'll be able to dictate the chemistry of the water. The water quality I'll wind up with will be far superior to what I'm using now.”

Kanny pays for the use of his irrigation water now, but when he uses the effluent water, it won't cost him a cent.

“That's the agreement with the city,” he says. “We get the free effluent in exchange for our water rights. It's such a win-win.”

Kanny believes all golf courses will have to use effluent water eventually because water is a dwindling resource.

“Good planning can make the switch to effluent such a positive experience for generations to come,” he says. “You're taking dirty water, cleaning it and then putting it back into the aquifers. Meanwhile, you're growing great grass, and you're not using any potable water.” **GCI**



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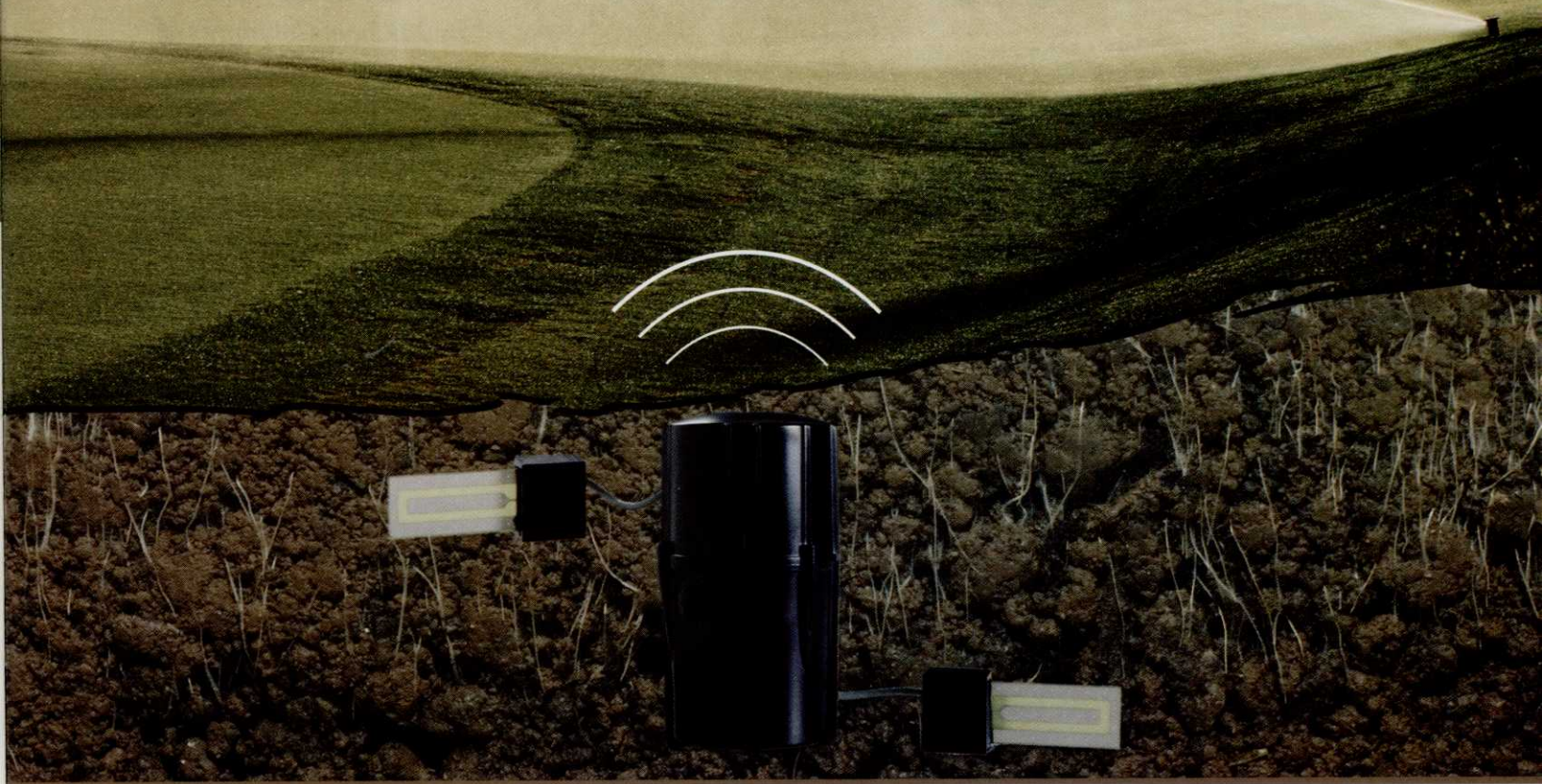
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Amendments contribute to water efficiency when they fit course conditions

# Water Precisely

By Michael Coleman

**Y**ou've been in the industry a while, and you're ready to take your turfgrass management program to the next level. You need tools that will reduce your maintenance time and make your course look better using less water. The right surfactants and wetting agents can reduce watering and boost turf health.

Determining the best combination of surfactants, wetting agents and other inputs for a course depends on local conditions. Superintendents might have fairways that stay too wet on top, even with less watering, or localized dry spots that always need hand-watering. It's possible to solve these issues, but superintendents should rely on their experience and experiment before investing too heavily in certain products.

## MOVING WATER

Rich Cope, golf course superintendent at the University of Texas Golf Club in Austin, planned his surfactant program while he was growing in the course. With five years under his belt at the club, Cope has used various products, depending on what he needs to accomplish on the course. On the TifEagle greens, he uses Wet-Sol.

"It helps penetration a great deal and aids tremendously in capillary movement of the water," he says.

Course conditions tend to guide his wetting agent usage, especially when he detects dry spots. On the other hand, too much precipitation during the winter calls for another tool he likes to use.

"During wet season, when I need to move water through the green, I use Surfside," he says. "It's good at moving water vertically."

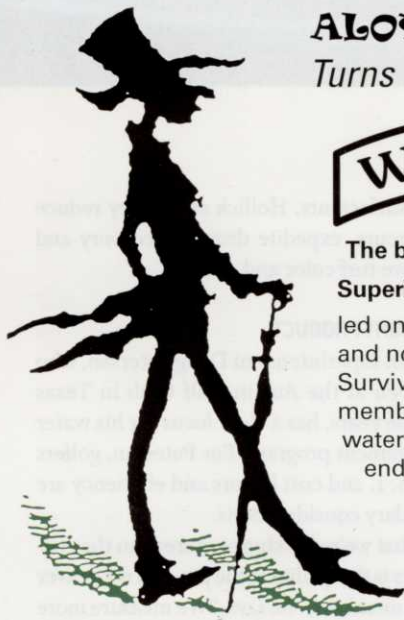
When selecting a surfactant that will help use water more efficiently, specific properties of a course are some of the biggest factors involved. Selecting the right product can be complex, involving a lot of variables.

Kelly Durfee Cardoza, founder of Avalon Consulting in Taunton, Mass., helps superintendents determine how to use water more efficiently while keeping courses healthy. Avalon specializes in water management practices and helps superintendents reduce the amount of water they use throughout the year.

"I have clients who've said to me, 'I'm consistently too wet on the top, no matter what we do,'" Cardoza says. "They've switched from one product to another before they find the right solution for their situation."

Variables such as course traffic, turf age and condition, soil type and thatch point to the best option.

At the University of Texas Golf Club, superintendent Rich Cope spends about \$14,000 a year on two wetting agents but in return reduces water usage about 30 percent. Photo: Texas Golf Club



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- 1980** "...During 1980, I treated one green with SURFSIDE 37. We syringed the treated green a couple of times during the season, the rest of the greens required over 50 days of syringing... that one SURFSIDE 37 green was incredible! During 1981, we treated all the greens, and only had to syringe a handful of times - maybe a dozen times all summer - and most of that was on the high spots. **80% to 85% reduction** in syringing during the past ten years has meant **major water and labor savings...**"
- 1983** "...We use city water - we're on a meter. Based on comparable figures for 1980, **we reduced water use by 20% in 1983...**"
- 1985** "...This year we would water Friday night, and then wouldn't water again until Sunday night. We **used 30% less water...** didn't syringe once this year...just didn't need it! When we first went on water restrictions, **SURFSIDE 37 kept our fairways alive** during that long July/August stretch. **You can use it anytime...it doesn't matter how hot it is.** We held our worst fairway with a total of 5 gals. per acre..."
- 1988** "... With SURFSIDE and our hand-watering program, we only **water greens two times a week.** We required **50% to 70% less water** on greens than when I arrived two and a half years ago. We spike and top dress the greens every two weeks, and apply SURFSIDE 37 following these cultural procedures. We also Hydroject ten of our twenty greens each week from April until September. We use the SURFSIDE PELLETS on the hose via the Hydroject. This works great in getting the product into the root zone. SURFSIDE 37 is a vital part of our turf management program..."
- 1993** "...I **saved more than 90% of my syringe labor budget.** Afternoon watering was basically eliminated. During the summer of 1993 we syringed less than ten times in the afternoons. During the summer of 1994 we only had to syringe two afternoons. SURFSIDE 37 has **helped eliminate hard to wet areas;** by treating the entire green complex, water movement through the soil has been improved. This has **decreased the need for daily irrigation,** and **nearly eliminates the need to syringe during the day.** **We have saved our operation over \$7,000 per year in labor costs** during the summers of 1993 and 1994..."

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## A DIFFERENT MIX

Greg Hollick knows from experience different soil conditions require a different mix of surfactants and wetting agents. Hollick, director of golf course operations at Ballymeade Country Club and The Golf Club at Cape Cod, both in Falmouth, Mass., has two distinct agronomic challenges. Ballymeade is an older course with fairways that are capped with a loam material. Cape Cod, a Rees Jones Design, opened in 2007 with sand-based tees and greens. The course has native soils on the fairways, and Hollick has no issue with excess water.

"It's almost like one large USGA green," he says. "It moves through pretty quick."

Hollick's experience working for the PGA at the TPC of Jasna Polana in Princeton, N.J., and the TPC of Boston during its grow-in proved valuable when he moved into the lead superintendent role at Ballymeade and

started planning for the new course at Cape Cod. The first-hand knowledge helped him when he selected surfactants and wetting agents, which he considers just a few of the tools a superintendent needs to grow in a healthy course.

Hollick uses Cascade on the greens and tees and Dispatch on the fairways at The Golf Club at Cape Cod. At Ballymeade, Hollick uses Rely on the fairways and tees and Revolution on the greens. He spends about \$9,000 on wetting agents each year at Ballymeade and \$12,000 a year at Cape Cod.

"You see immediate results where your water is penetrating and moving down through the profile," he says. "If you have a hydrophobic situation on your greens or your tees after you apply it, you can see the following morning that there's definitely dew removal there. It doesn't bead up on the surface."

Better penetration isn't the only bonus

from surfactants, Hollick says. They reduce man-hours, expedite drought recovery and improve turf color and quality.

## THE RIGHT PRODUCT

Veteran superintendent Doug Petersan, who has been at the Austin Golf Club in Texas for nine years, has a clear focus for his water management program. For Petersan, golfers are No. 1, and cost factors and efficiency are secondary considerations.

"What we're looking at more than the economics is the quality of the product we deliver to our members," he says. "We measure more from the quality of the surfaces we're providing than the cost."

Petersan has used various products at several courses throughout the years, and some work better than others.

"I don't want any product that's going to keep the top inch or two very wet," he says.

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"I have a soil sampler, and I pull cores out of greens every day."

Cope brought another product, Hydratain, into his arsenal during the past two years, after experimenting with it.

"I was probably the first guy to use it on a golf course in Texas," he says.

Cope spot treated dry areas to test the product. Because of hot conditions and a tendency for limestone to heat up quickly below the surface, there's often water vapor trapped in the soil unavailable to the plants. Cope likes the way Hydratain causes condensation of water molecules in the ground, making more water available to the TifSport turf. Areas where he used the product recovered, looked better and stayed green, which was a big factor in his decision.

If an area is hydrophobic, a wetting agent is needed to help the product penetrate the profile. While Cope estimates he spends about

\$14,000 a year on Hydratain and Wet-Sol, he estimates his reduction in water usage at about 30 percent. Studies covering a variety of products have shown a 30-percent reduction in water usage is realistic in many situations.

However, just because one product works well on the front nine of a course doesn't mean it will work as well on the back nine.

"Even in the same small general area, it's a function of your soil conditions, how much play you get and how your irrigation system operates," Cardoza says.

**OTHER INFLUENCES**

Soil variations, which include the presence of fungicides, also can have an influence on these products. Dara Park, Ph.D., a researcher at Clemson University, initiated a study with Bruce Martin, Ph.D., investigating the effect of surfactants and fungicide combinations on Champion ultradwarf Bermudagrass and



Superintendents can use devices to measure volumetric water content at different soil depths. Photo: Dara Park, Ph.D.

localized dry spot.

"Past research demonstrates that certain combinations of surfactants and fungicides tend to increase disease control to a greater

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extent than if the fungicide was applied alone," Park says. "During those experiments, it was observed that there was also an influence on quality and LDS."

A new study Park started this year examines how different surfactant chemistries influence soil moisture within the soil profile along a depth gradient. This will help superintendents combine the proper surfactant with their course's soil conditions.

"Making sure you get the most from a surfactant depends on identifying the proper surfactant chemistry for the situation," Park says. "This process is important because there are different surfactant chemistries for different purposes. To identify which surfactant to use, the superintendent must fully evaluate the situation."

After looking at the options, it helps to run a test on a small area to see what works best. Suggestions from colleagues can be helpful,

but superintendents shouldn't always take into account the differences in specific turf conditions between courses. Proper identification of combinations which increase quality and reduce localized dry spot can help reduce time, labor and chemical costs.

## PART OF THE BIGGER PICTURE

The ideal situation is to get turf to the right height and eliminate the need to mow, Cope says. He uses the plant growth regulator Primo Maxx on the greens only to help reduce mowing time during the week. Another noticeable benefit is less water loss from transpiration and evaporation. Plus, deeper rooting puts more moisture within reach.

Plant growth regulators aren't universally popular, though. For instance, Petersan purposely avoids the need for plant growth regulators by limiting the amount of fertilizer he uses.

No product is a replacement for a well-devised maintenance program. Surfactants, wetting agents and plant growth regulators are part of a larger program that includes tracking evaporation, using weather stations and generally following good agronomic practices.

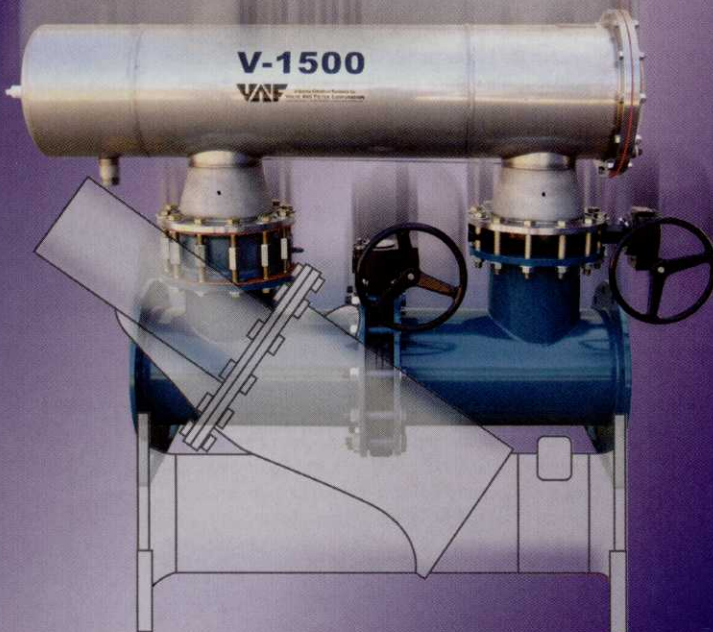
Whatever the product, proper focus needs to be placed on the use of these aids.

"They can be helpful, but they can also cause you problems under certain environmental conditions," Hollick says. "If you have a wet year, obviously you're not going to be putting a wetting agent down that will last you 90 days."

With all the other factors to consider when maintaining healthy turf, superintendents can't just throw any surfactant or wetting agent out there and hope it works well.

"It's another tool for the superintendent's belt," Hollick says. "You have to customize it to your golf course." **GCI**

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