CORNELL UNIVERSITY TURFGRASS TIMES

CUTT

Summer 2001 • Volume 12 • Number 2

The Challenge Of Poor Irrigation Water

The recurrent droughts experienced through the US each year have given the turf industry pause. Watershed commissions that cross state lines, water management districts that determine water needs, and municipal water suppliers continue to question the use of potable water for recreational (read nonessential) use.

The Northeast Climate Center reported that the month of April in the Northeast United States was the driest in recorded history. The Southeast United States is in the throes of the most significant drought in the last 100 years. The Florida golf turf industry may soon be facing phased-in restrictions that will allow watering of fairways once per week, and greens and tees twice per week.

The energy debate that is currently raging across the United States—and focused in California—pales in comparison to the volatility and politics of water. "Water rights stir deep emotions in the Western states," says Bill Bradley, former Senator from New Jersey and member of the Senate Energy and Natural Resource Committee, in his 1996 memoir *Time Present, Time Past* (Knopf Publishing, NY). "Disputes over water in Western history have affected sovereignty and influenced borders," Bradley alludes, "where many say whiskey is for drinking, water is for fighting."

With less than 1% of the world's water available for human consumption and 80% of the fresh water consumed for agriculture, concern is growing over water used for maintaining greenspace, such as golf courses. Jim Watson, Ph.D., in the opening chapter of the 1994 text *Wastewater Reuse for Golf Course Irrigation* (Lewis Publishers, MI), proposes six areas the will increase water availability. Along with conservation and development of plants that use less water, Watson suggests that the use of wastewater and desalinization of seawater offer two important options. As salt water intrusion into Long Island wells increases, desalinization may soon be required.

Wastewater

With population growth and the demand for potable water expected to increase, the turfgrass industry can no longer take a passive

continued on page 4

This Times

CUTT, "CORNELL UNIVERSITY TURFGRASS TIMES" is published four times per year by the Turfgrass Science Program at Cornell University, Ithaca, New York 14853. Address correspondence to: CORNELL UNIVERSITY TURFGRASS TIMES, 20 Plant Science Building, Cornell University, Ithaca, NY 14853; phone: (607) 255-1629; email: fsr3@cornell.edu.

Editor: Frank Rossi

Design & Production: Ghostwriters, inc., Ithaca, NY

Cornell University is an equal opportunity, affirmative action educator and employer.

Poor Irrigation Water

continued from page 1

approach to water use issues. The Western US receives only one third of the nation's rainfall, yet uses 80-85 percent of the nation's fresh water.

A 1999 survey conducted by the National Golf Foundation reported that 34% of golf courses in the Southwest US use effluent water (recycled, non-potable, wastewater, reclaimed). Nationally about 13% of all courses use effluent. Where irrigation water costs can range from $100,000 to $1,000,000, effluent is a viable option. Still, should every course use effluent? Is all effluent created equal? Does effluent create other challenges?

Effluent wastewater can be delivered following primary, secondary or tertiary treatment at a wastewater treatment facility. Primary treatment mechanically removes the majority of the solid waste with screens, grinders and settling tanks. While primary treatment involves mechanical removal of solids, secondary treatment engages biological processes to remove the majority of the remaining solids. Secondary treatment may also involve chlorinating prior to discharge. Water for turf and landscape uses must have at least experienced secondary treatment.

Several processes may follow secondary treatment, including using chemicals to flocculate remaining solids followed by more sediment removal, and various methods of filtration. A reverse osmosis process or chlorinating that can occur prior to release produces highly purified water. In the end, the water will likely contain a variety of nutrients (from the waste), metals (from the flocculation) and salts (from the purification) that will require careful management to minimize their impact on turf quality.

Interestingly, golf courses often involved with real estate development are constructing their own wastewater or desalinization treatment facilities. Several Audubon International Signature Properties are leading the way with small facilities that utilize ultra filtration and biological reactors to treat wastewater before reusing it back on the course. Jupiter Island Country Club in Florida recently installed its own reverse osmosis facility to desalinize salty ground water. Estimates are that the $500,000 price tag can be recovered in a few years based on the increasing cost and restrictions placed on irrigation water is south Florida.

Be Aware

Dan Quast, the former golf course superintendent at Medinah Country Club outside Chicago, IL, discussed his preparation and challenges from the 1999 PGA Championship at the New England Turfgrass Conference. The summer of 1999 will be remembered for its drought; Dan will remember it because of his high salt content irrigation water. Dan indicated that salt levels increased 5 to 10 fold during the summer months. He then asked how many superintendents regularly monitor their irrigation water quality. Less than 10 hands were raised in a room of 500 attendees!

Golf course superintendents who manage with effluent water cannot afford such ignorance. Effluent water quality can be variable and will always have a variety of "contaminants" that will require specific management practices.

Professors Bob Carrow and Ronny Duncan from the University of Georgia authored *Salt Affected Turfgrass Sites* (Lewis Publishing, MI) in an effort to bring together the best thinking on managing turfgrass with poor quality water. The title of the Carrow and Duncan book clearly identifies the major challenge with effluent irrigation water—high salt content—but it is not the only issue.

The March/April issue of the USGA Green Section Record included an article by Mike Huck, a USGA agronomist in the Southwest Region with Carrow and Duncan, on effluent water. The article outlines the major agronomic and environmental issues and suggests that the first step to using effluent water is to establish a regular monitoring program. In fact, even if your effluent provider offers periodic lab results on the water, Huck et al indicate that this will often not be sufficient for assessing irrigation water quality. A reputable agricultural soil and water lab is preferred. (See the article on page 2 about Cornell's Horticulture Elemental/Nutrient Analytical Laboratory.)

Salty Turf

In a presentation at the 2001 USGA Florida Regional Conference, Bob Carrow stated that "the three most important aspects of managing high salt content irrigation water are leaching, leaching, leaching." This is not simply a matter of copious amounts of water that keep salts

Nationally about 13% of all courses use effluent. Where irrigation water costs can range from $100,000 to $1,000,000, effluent is a viable option.

Dan indicated that salt levels increased 5 to 10 fold during the summer months. He then asked how many superintendents regularly monitor their irrigation water quality. Less than 10 hands were raised in a room of 500 attendees!

In a presentation at the 2001 USGA Florida Regional Conference, Bob Carrow stated that "the three most important aspects of managing high salt content irrigation water are leaching, leaching, leaching."

moving downward; the superintendent must know the type of salt that must be leached, rainfall amounts, turf species tolerance range, and time of year.

Sodium salt can have a direct influence on plant growth in a manner similar to how dog urine burns leaf tissue (although dog urine is a different salt). However, while the direct burn from high salt content irrigation water is rare, high sodium content soils often produce plants that have restricted rooting and develop drought stress symptoms. Depending on the water source and rainfall pattern, the long-term effects of sodium on soils is well documented. As sodium content increases in the soil, the vital process of aggregation is disrupted.

Sodium molecules absorb large amounts of water and swell. The swelling prohibits finer silt and clay particles from making larger aggregates that offer a variety of pore spaces for water and nutrients. In other words, as described by Nick Christians in his 1998 book, *Fundamentals of Turfgrass Management* (Ann Arbor Press, MI), soils with high sodium content have the appearance and behavior of fine talcum powder. This slows the infiltration of water and renders the soil unsuitable for plant growth.

As suggested above, moving the sodium downward via leaching is the key. However, the leaching water should include a soluble calcium (Ca) source. The Ca literally pushes the sodium off the soil particles and leaves it vulnerable to leaching. Of course, the Ca content takes on more importance if the leaching water is already high in sodium.

Salt Management

There are a variety of other water quality issues that are addressed in the USGA Wastewater text, the new Duncan and Carrow text, and several articles in the Green Section Record in 2000-2001. These issues include heavy metal toxicity, other nutrients, total suspended solids, and low pH. All of these factors will require specific management practices in an effort to minimize the impact on turf quality.

The first step, as previously stated, is a regular water quality monitoring program. The next aspect of leaching is critical for long term turf performance. Additionally, core aeration creates channels for water to infiltrate when leaching. Also, less destructive techniques such as high pressure water injection, slicing, spiking, etc. can be implemented. Finally, one must recognize the species tolerance of poor quality water and realize that a biological system cannot just shift to poor quality irrigation water use without a noticeable reduction in quality. Specifically, cool season grasses are significantly less tolerant of high salt content and will decline rapidly, especially in warm summer months.

Regulatory as well as "hidden" costs can consume any savings realized from utilizing less expensive wastewater. Significant costs can be incurred for contamination protection devices and employee training as well as to meet specifications for wastewater storage. Other management costs could include water amendments that will need to be injected into the irrigation system as well as the deterioration of equipment regularly exposed to high salt content water. There can be revenue impacts such as having to close a course during the day to irrigate overseeded turf.

A 2003 Anniversary

The 1993 Golf Course Wastewater Symposium was an important contributor to raising awareness nationally on what was up until then viewed as a regional concern. Twenty two states had golf courses using wastewater irrigation, with over 70% of them coming from the Southwest and Florida. What will those numbers look like in 2003, the 10 year anniversary of the Symposium? How about general poor water quality experienced by people such as Dan Quast in IL?

Most superintendents, especially in areas with adequate rainfall, take their high quality irrigation water for granted. If the population continues to grow, the leadership effort by the turf industry in using effluent could be viewed as facilitating "smart growth." In other words, communities will need golf courses as outlets for society's waste, whether it is water or compost.

Frank S. Rossi

Soils with high sodium content have the appearance and behavior of fine talcum powder. This slows the infiltration of water and renders the soil unsuitable for plant growth.

Other water quality issues include heavy metal toxicity, other nutrients, total suspended solids, and low pH. All of these factors will require specific management practices in an effort to minimize the impact on turf quality.

Specifically, cool season grasses are significantly less tolerant of high salt content and will decline rapidly, especially in warm summer months.