Two case studies: State BMPs for water conservation on golf courses

GCSAA chapters in Arizona and Georgia have worked successfully with their state governments to define BMPs for water conservation on golf course turf.

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EDITOR'S note:

This is the last in a series of three articles highlighting the importance of best management practices in relation to the golf industry and environmental issues concerning water. The first two articles appeared in the June and July 2005 issues of *GCM*.

In this third article in a series about best management practices (BMPs) for water conservation on golf courses, we present case studies involving the golf industry and the state governments of Arizona and Georgia. The first article in this series discussed the use of BMPs for addressing environmental issues in general (2), and the second presented BMPs strategies specific to water conservation on the golf course (3).

In 2003 and 2004, Robert Carrow, Ph.D., Ron Duncan, Ph.D., and F.C. Waltz, Ph.D., of the University of Georgia developed a program for GCSM to stimulate a BMPs approach for golf courses. The components were an on-line course; the BMPs for Turfgrass Water Conservation Workshop, which included a 107-page workbook (www.georgiaturf.com) and a 90-day listserv period, in which the instructors were available for assistance to participants as they initiated their specific BMPs plans.

Each individual who participated was encouraged to use the information from the program to develop a BMPs document for his or her respective golf course. More important, the participants who were already involved in water-conservation issues and planning in their state or region could use the template information to foster a BMPs approach at the regulatory and turf industry levels within their region.

Photos by David Wienecke

Figure 1. When BMPs for irrigation are practiced, the result is a uniform stress-tolerant turf that provides optimal playing conditions.

David Wienecke in Arizona and Frank Siple and Mark Esoda in Georgia took the BMPs document from the GCSM workshop to their respective state departments of natural resources with the specific purposes of defining BMPs for water conservation on golf courses and requesting that state regulations follow a BMPs approach rather than the more-limiting regulations approach. Positive personal contact (that is, "How can we help you?") by well-informed representatives of the golf course industry coupled with a science-based document that could be used in initial discussions was successful in both states. The two case studies discussed here show the progress that has occurred within each state.

Arizona (David L. Wienecke)

Precision irrigation practices are essential in Arizona and throughout the arid Southwest because water resources are limited. Precipitation cycles range from extreme drought years to periods of reduced drought severity when precipitation increases. These cycles coupled with continual population growth require planned water management to maintain the current quality of life in the region. Water regulators have begun collaborating with researchers and golf courses to

develop water-conservation measures that ensure the minimum amount of irrigation water is used to maintain golf course quality.

Traditional regulatory water-conservation measures are based on restricting irrigated turf acreage and irrigation scheduling, but in Arizona, a BMPs irrigation and conservation approach is being pursued as an alternative. BMPs document water conservation through precision water use by using evapotranspiration rates (that is, ETo) as a reference point for establishing water budgets. BMPs for irrigation also provide a factual and scientific basis for irrigation application and management decisions.

Action taken

In March 2004, the USGA Arizona Regional Conference brought together for the first time representatives from the water regulatory community and users of irrigation water from the golf industry. Speakers from the Tucson and Phoenix management areas of the Arizona Department of Water Resources (ADWR), the Arizona Governor's Drought Task Force, the Cactus and Pine GCSA, the University of Arizona, the Arizona Golf Association, the PGA and the USGA joined to develop consensus and plans for ensuring responsible stewardship of the state's water resources.

State employees involved in public policy and water regulation voiced concerns about the public's false perception of golf courses as major water users (water-use figures from Tucson ADWR: municipal, 48%; agriculture, 30%; mining, 12%; golf, 6%; other industrial, 4%).

Highlights of the current status in Arizona golf course irrigation BMPs are listed below:

- Members of the Cactus and Pine GCSA have supported the concept of BMPs development in conjunction with ADWR, USGA and the University of Arizona. In August 2004, Cactus and Pine GCSA approved funding for two research projects by University of Arizona faculty members David Kopec, Ph.D., and Paul Brown, Ph.D., to develop data for a fact-based BMPs document for Arizona. This research will attempt to define several parameters: the physiological differences between adequate and deficit irrigation; the physiological requirements of salt-affected golf course turf under water-conservation irrigation limitations; the influence of topography, soil types, area size and edge effects; and other factors essential to develop accurate models of physiological irrigation requirements for golf course turf.
- University of Arizona research will be used to collect irrigation water-use data for healthy turf and turf subjected to deficit irrigation. A water budget based on ETo (that is, reference evapotranspiration [ETo] with appropriate crop coefficients) will be developed for specific levels of irrigation, ranging from optimal turf irrigation to deficit turf irrigation. This research shows water-conservation procedures must account for adjustments for salt-affected turf irrigation, winter overseeded turf and natural precipitation. (For example, BMPs could assume a distribution uniformity of 80%; 100% of ETo for 10 days during spring transition; 110% ETo in October during overseeding; and site-specific ETo replacement levels for optimal turf during each month through the year; no salt limitations; and 50% of rainfall precipitation for turf use).
- Because the current BMPs distribution uniformity model assumes a distribution uniformity of 80%, increasing uniformity and cultivating enough to maintain adequate porosity are essential for effective water-conservation programs. For example, improving distribution uniformity by 10% can produce a 2.5%- 5% reduction in water use, with corresponding improvements in turf health and play quality.
- Turf edges require more water than plants inside larger turf areas. Research shows that 7%-11 % additional water is needed to maintain the quality of turf edges in the afternoon, whereas 6%-8% additional water is needed in the morning. In small turf areas (less than 60 feet [18.3 meters] from the edge), 5%-10% more water is needed compared to turf in larger areas. These results show how golf course design can affect turf irrigation and water conservation .
- In the current management plan, ADWR has established a 90-acre (36.4-hectare) maximum irrigated turf area for golf courses with 4.6 to 4.9 acre-feet of water applied per irrigated acre (1.40-1.49 hectare-meters/hectare). An additional water allocation of 5%-15% is available to golf courses with salt-affected irrigation water to allow for regular leaching. Research that has been funded recently will try to determine the actual deficit irrigation specifics for golf course turf and the water supplements needed to maintain the health of golf turf affected by salt.
- Water losses must be specified in a comprehensive BMPs plan. Losses identified in golf course irrigation are estimated to be 1 %10% from leaks and 2%-20% from drift and evaporation. Other undefined water

Figure 2. Brown areas on the course are a sign of inadequate spacing or overlapping of irrigation heads, which produce nonuniform turf and also waste water.

losses include: overwatering (that is, mismanagement), and nonuniform irrigation (caused by design, management and maintenance inconsistencies). Additional research is needed to define these losses and determine the exact amount of irrigation water that is applied to turf compared to water delivered to the property for irrigation.

- Some site-specific influences to be included in BMPs are: turf species, root depth, soil moisture and texture, infiltration rates, mowing heights, cultivation procedures and alternative irrigation water reuse (for example, capture of water runoff). The irrigation water source is also a site-specific aspect of the BMPs (for example, well, potable, effluent/reclaimed and irrigation district water, etc.)
- Discussions will continue through 2005 and 2006 while the fourth ADWR irrigation management plan for golf courses is developed (first management plan, 1980-1990; second, 1990-2000; third, 20002010; fourth, 2010-2020; fifth, 20202025.) The years 2005 and 2006 are crucial for discussions between ADWR and water-use stakeholders regarding any changes from the current program performance process. We hope that BMPs will be the basis for this new fourth management plan and that it will use water-budget criteria rather than strict water-use or day restriction criteria.

Current status

Paul Brown and David Kopec of the University of Arizona and Wienecke are developing the outline and content for the Arizona Golf Course Irrigation BMPs document. The BMPs document is based on the original work by Carrow, Duncan and Waltz (1), but the Arizona document will be designed for climates in that state. The BMPs are viewed as an evolving document that will change as research and/or field experience dictate. It is hoped that the BMPs will be a boilerplate for superintendents who are developing site-specific BMPs for their golf course.

Georgia (Mark Esoda and Frank Siple)

In May 2004, the Georgia GCSA and the Georgia Department of Natural Resources Environmental Protection Division entered into a Memorandum of Agreement. As a result, the state is working with the Georgia GCSA so that 75% of member golf courses will be using water-conservation BMPs within three years. In 2007, the two groups will evaluate the program, determine how water-use efficiency has been affected and consider the next steps toward improving the efficiency of water use on Georgia golf courses.

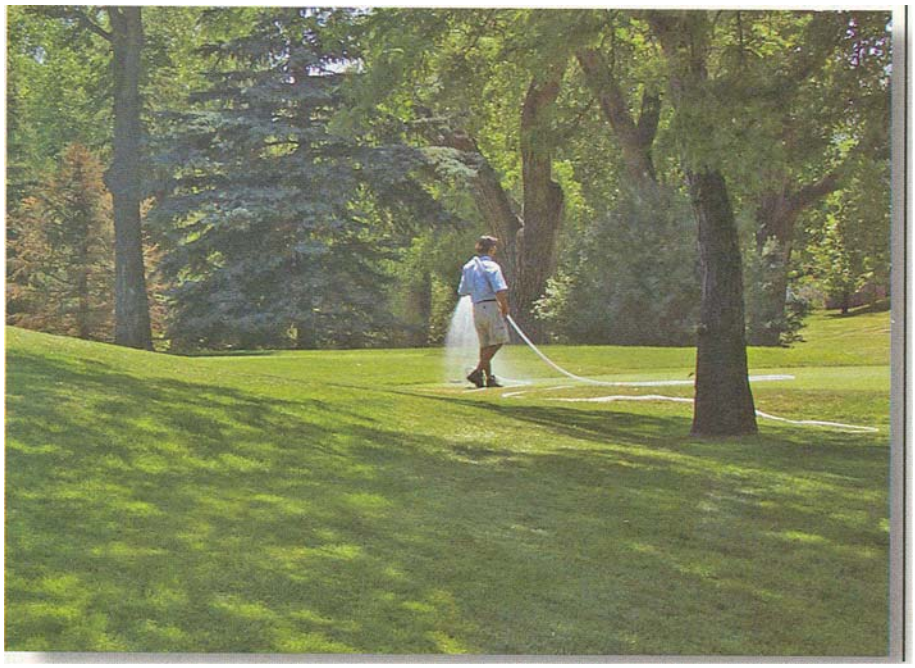

Figure 3. Hand watering, an essential part of BMPs, conserves water because the water is applied far more accurately than it can be delivered by any irrigation system.

Based on the BMPs workshop (1), Esoda, Siple and others from the Georgia GCSA developed the following draft outline of state water conservation plans for golf courses.

Site assessment

2. Area - acreage of components such as green, fairway, tee, landscape, rough, natural native vegetation, etc.
3. Plants - includes basic characteristics such as drought tolerance, cool-season, warm-season, native species and height of cut
4. General factors affecting water use - mature trees, natural areas, elevation and soils
5. Irrigation audit - overall condition, controls, design characteristics, drip systems, metering, evaluating overall distribution efficiency

Determine overall water needs

1. Metering
2. Record keeping and accounting
3. Water testing
4. Reservoirs/ponds
5. Determine future needs
6. Consideration for alternative water sources

BMPs and current water conservation measures

1. Current irrigation controls and hard costs (parts, power)
2. Staffing in irrigation control and irrigation maintenance
3. Scouting - costs
4. Hand watering - hours and costs
5. Night watering capability
6. Rain, leak, etc. loss controls and costs
7. Traffic controls and costs
8. Metering - installation and ongoing calibration and replacement
9. Management for water conservation
   a. Height of cut
   b. Soil cultivation to promote root depth e. Evapotranspiration utilization
   d. Selection of landscape plants
   e. Natural vegetation areas
   f. Fertilization
   g. Pest management - early morning or late evening applications to reduce water loss; consideration of Integrated Pest Management protocols
   h. Wetting agents usage
   i. Record keeping and costs
10. Possible irrigation methods (plant-based, soil-based, budget approach, deficit, atmosphere based)

11. Goal setting regarding water use efficiency
12. Education - List benefits of golf courses and turf areas; publish water conservation plans; engage stakeholders (members, patrons, neighbors, general public) with the benefits of water conservation

With adoption of the above Memorandum of Agreement, the Georgia Depantment of Natural Resources Board approved the Rule for Outdoor Water Use as pan of the State Drought Management Plan. This rule includes mandatory restrictions on water use for me golf industry. lt is important to note that the original rule restricted irrigation on golf courses even during nondrought periods for three days per week and during ser hours. The only exemption was for "misting of greens." After a proactive effort by the golf industry, golf courses have been permitted to use a BMPs approach to manage and conserve water during nondrought periods and level-one drought. The department of natural resources has also granted some exemptions to the golf industry.

In three years, the Georgia GCSA must demonstrate that at least 75% of member golf courses use BMPs for water conservation. After this has been verified, the Georgia GCSA will have the opportunity to review the Rule for Outdoor Water Use with the Georgia Department of Natural Resources, which may then make changes giving golf more flexibility to manage water.

The following basic rules govern outdoor water use for golf courses.

- Nondrought periods: Use BMPs.
- Level-one drought: Use BMPs.

Figure 4. Members of the Georgia GCSA met with various state officials in their efforts to include best management practices for water conservation on golf courses in the state's water regulations. Gil Landry, Ph.D., University of Georgia (far left); Gov. Sonny Perdue (center); Tenia Workman, executive director of the Georgia GCSA (immediately right of Perdue), author Mark Esoda, CGCS, (far right) and members of the Georgia Turfgrass Association.

- Level-two drought: Greens and tees use BMPs. The rest of the course can water between midnight and 10 a.m. on Mondays, Wednesdays and Saturdays.
- Level-three drought: Greens and tees use BMPs. The rest of the course can water between midnight and 10 a.m. on Saturdays.
- Level-four drought: Greens use BMPs.

Golf courses have received the following exemptions from the Rule for Outdoor Water Use.

- Courses on reuse systems approved by the Environmental Protection Division
- Ware ring-in pesticides and fertilizer
- Thirty-day exemption for new installation of landscape and plant material
- irrigation installation and repair
- Construction sires

Other activities essential to daily business

These rules are the minimum standard, and local municipalities and providers may institute more-restrictive rules. Esoda and Siple would like to thank the Georgia GCSA and the Allied Golf Group for working coward the successful mediation of this rule.

Concluding comments

A positive and proactive approach to water conservation on golf courses is essential for the golf industry within each state. The best approach is one used for other environmental issues, BMPs. The following elements are key to fostering the BMPs approach at the regulatory level.

- Define what is meant by BMPs for water conservation on golf courses for the understanding of golf course superintendents as well as for that of regulatory agencies, environmental groups, the general public and golf club personnel.
- Actively strive to gain acceptance for this approach in ordinances, regulations and public policy.
- Adopt and implement a BMPs approach on our golf courses, nor just as a general concept bur as a daily operating policy.

Literature cited

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2. Carrow, R.N., R.R. Duncan and D. Wienecke. 2005a. BMPs: Critical for the turfgrass industry. *Golf Course Management 73(6):81-84.*
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THE RESEARCH says . . .

- **Using the tools** provided in GCSAA's programs, three GCSAA members approached the departments of natural resources of their respective states about developing BMPs for water conservation on golf courses.
- **In Arizona, cooperation** among representatives of the state government, the golf industry and the academic community has yielded a water management plan that includes BMPs for water conservation on golf courses.
- **The Georgia GCSA** has a Memorandum of Agreement with the Georgia Department of Natural Resources that 75% of the GGCSA member golf courses will be using water-conservation BMPs by 2007. Once this has been verified, the golf industry and the state will reopen discussions about the rules governing outdoor use of water.
- **Using BMPs for** water conservation on golf courses opens the door for discussions between the golf industry and state regulators because it reflects the turf industry's commitment to science-based conservation measures.

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