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1991 USGA Green Section Education Conference Issue

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Cover Photo:
Joseph C. Troll (right) accepts the 1991 Green Section Award from Raymond B. Anderson, Chairman of the USGA's Green Section Committee.

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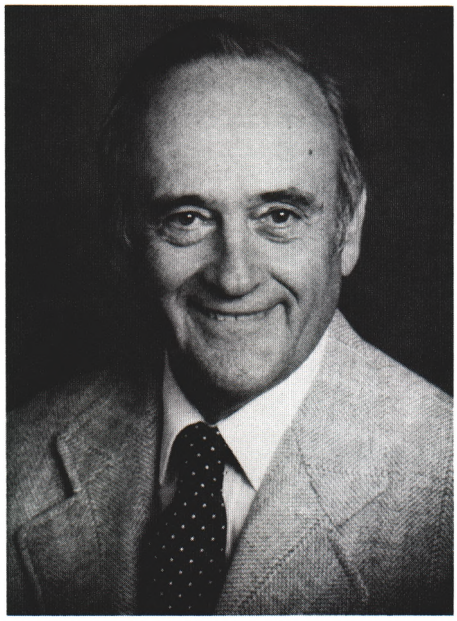
Joseph C. Troll — 1991 USGA Green Section Award Recipient

DR. JOSEPH C. TROLL, renowned educator of golf course superintendents and other turfgrass specialists, has received the 1991 Green Section Award from the United States Golf Association. Raymond B. Anderson, Chairman of the USGA Green Section Committee, presented the award to Dr. Troll on February 13, 1991, in Las Vegas, Nevada. The presentation was made at the banquet of the Golf Course Superintendents Association of America annual conference and show.

"This is a man who worked hard to get an education and then worked harder to educate others," noted Anderson when presenting the award. The turfgrass industries have made substantial improvements as a result of better educated golf course superintendents and turfgrass managers. These results are in no small way due to the dedicated efforts of Joseph Troll.

Dr. Troll received his bachelor's and master's degrees from the University of Rhode Island. In 1965 he received his Ph.D. from the University of Massachusetts, studying the pathogenicity of the nematodes *Pratylenchus penetrans* and *Tylenchorhynchus claytoni* on turfgrasses. Dr. Troll joined the Department of Plant and Soil Sciences at the University of Massachusetts as an instructor in 1957 and was promoted to professor in 1959.

During his University of Massachusetts tenure, Dr. Troll was involved in the education of more than a thousand students who participated in his program. He was responsible for teaching undergraduate and graduate courses, conducting an eight-week winter school for turfgrass managers, and teaching courses in a two-year program at Stockbridge School. He actively participated in the growth and development of his students, and his encouraging guidance influenced many to become outstanding golf course superintendents, educators, and leaders in the turfgrass industry. As one nomination stated, "Dr. Troll uses every opportunity to promote golf, and especially the golf course superintendent. His legacy is the numerous outstanding superintendents he has inspired. He takes pride in keeping up with his graduates and encouraging them as their careers develop."



Dr. Joseph C. Troll

In receiving the award, Dr. Troll said, "One of the most rewarding aspects of my tenure at the University of Massachusetts was my association with the students and watching them succeed at their chosen profession. A good number have invited me to play golf at their courses, but I would be playing until I was 102."

As a researcher and extension specialist, Dr. Troll worked on turfgrass variety and management studies, renovation, nematode studies, and roadside turfgrass research projects. He has published more than 70 scientific journal papers and extension publications during his career. He supervised the construction, establishment, and maintenance of the eight-acre Turfgrass Research Center in South Deerfield, Massachusetts.

Dr. Troll's contributions did not stop at the university. He served as advisor and contributor to various turfgrass magazines. He was a USGA Green Section Committee member, and assisted the Northeastern Region in conducting Turf Advisory Service visits. He also served as a member of the Massachusetts Pesticide Task Force. His expertise was called upon as he served as a supportive investigator and consultant to the Roadside Development Project.

For his many contributions, Dr. Troll has been recognized over the years. In 1983 the Golf Course Superintendents Association of America presented him with their Distinguished Service Award. He was chosen as Outstanding Professor for three years by the Stockbridge School, and he has received honorary memberships in many golf course superintendents associations in the eastern United States.

Dr. Troll retired from the University in 1988, but he remains very active as the secretary-treasurer of the Massachusetts Turf and Lawn Grass Association. He currently is investigating reduced maintenance inputs on cool-season turfgrasses, use of composted sludge, and nitrogen and potassium effects on the quality, growth, and stress tolerance of perennial ryegrass.

The golf industry has benefited greatly by Dr. Troll's dedication and achievements. For his tireless work as a teacher, researcher, and extension specialist, he is a highly deserving recipient of the 1991 Green Section Award.

1991 GREEN SECTION EDUCATION CONFERENCE

Environmental Opportunities in the 1990s

February 12, 1991, Las Vegas, Nevada

Raymond B. Anderson

FOR THE TENTH CONSECUTIVE YEAR the annual Green Section Education Conference was held in conjunction with the Golf Course Superintendents Association of America International Turfgrass Conference and Show. This year more than 1000 people attended the Green Section's program on Tuesday, February 12, at the Las Vegas Convention Center. Raymond B. Anderson, Chairman of the USGA Green Section Committee, introduced the morning's program of 17 speakers who addressed this year's theme, "Environmental Opportunities in the 1990s." With environmental concerns becoming increasingly more of an issue on golf courses, the topics in this year's program were especially timely for many in the audience. Following are the full proceedings.

THE BEST TURF TIPS OF 1990 — PART I

One of the most popular annual features of the Education Conference is the Best Turf Tips. This year, 11 of the Green Section's agronomists reported on some of the helpful ideas and ingenious innovations they came across while visiting golf course superintendents in every part of the country during 1990. We begin with Part I. Parts II and III appear later in this issue.

Take a Hike!

by LARRY W. GILHULY
Director, Western Region, USGA Green Section

THERE IS something very special about a golf course in the early hours of the day. The still of this domain is broken only by the rhythmic sounds of the irrigation system or various wildlife beginning yet another day of activity. It is at this time of the day when the golf course maintenance staff begins the process of daily course preparation: greens to mow, holes to change, tee blocks to move, tees and fairways to mow, and bunkers to rake. These activities prepare the course for the thundering herd of golfers who will require that this process be repeated the next day.

It is also the time of the day when the golf course superintendent has his best opportunity to view the course. All too often, time demands of the job, inclement weather, meetings, and the urge to simply "drive" the golf course, prevent many superintendents from viewing the course on foot. What benefits can be derived from walking the golf course each morning for approximately two hours?

1. Keeping abreast of disease or insect activity or other extraordinary environmental conditions. In some cases, a fast response can make the difference between turf loss and survival.

2. Ensuring desired course playability. Are the bunkers raked properly, the holes located in fair positions, the tee blocks aligned properly, and all areas mowed in front of play?

3. Education of the maintenance staff. As the course is viewed, mistakes can be quickly rectified *in the field.* It is far more effective to discuss the desired changes in the maintenance employee's element, rather than in the superintendent's office.

4. Motivation of the maintenance staff. If the superintendent walks the course every morning, the staff will always be more aware of detail and output.

5. Exercise. A brisk, two-hour walk is great for the body and spirit.

6. Membership accessibility and public relations. Early morning players notice and respond favorably to a superintendent who walks the course. Contact with players offers a method of education that is not available from a moving vehicle or a warm office.

Far too many golf course superintendents rely on vehicular transportation to view the golf course. Many do not see the course on a daily basis for justifiable reasons. If a committed

Problem areas on the golf course can be easily overlooked when viewed only from a golf cart.

decision is made, however, these two hours of every day can be the backbone of the maintenance program.

Mr. Milt Bauman, retired CGCS and 1981 GCSAA Distinguished Service Award recipient, followed this basic principle during his 45 years in the golf course maintenance business. To quote this successful superintendent, "Anyone can think of an excuse not to walk the golf course. The successful superintendent looks not for excuses, but for results!"

Working the Topdressing In and Rolling Greens Revisited

by JOHN H. FOY
Director, Florida State Region, USGA Green Section

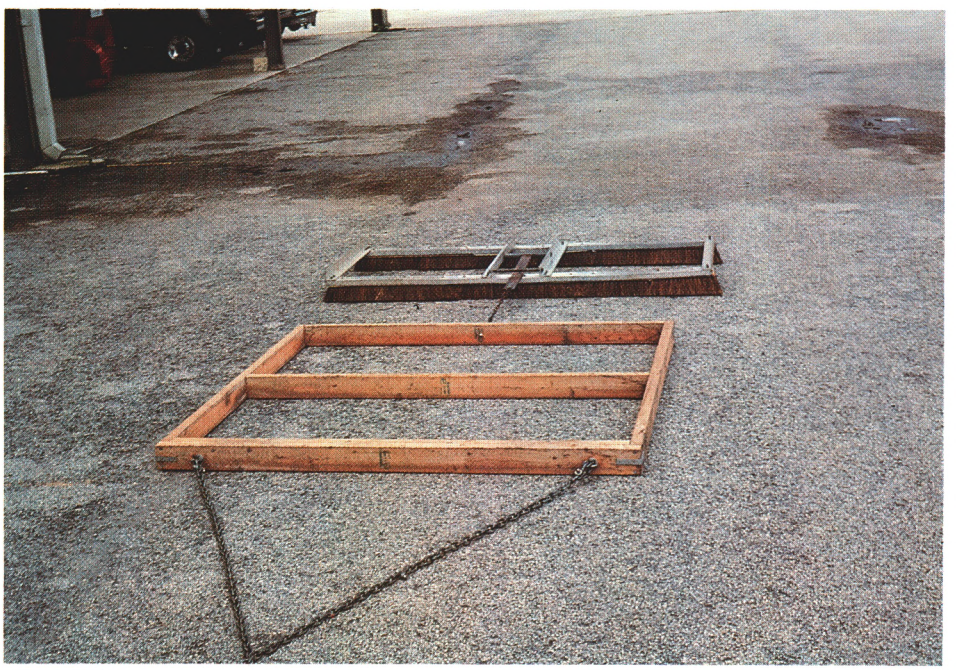
DEEP AERIFICATION of putting greens has become a popular practice during the past several years. The ability of deep aerification equipment to punch through soil layers and improve both water percolation rates and soil oxygen content is an advantage when managing problem greens. Furthermore, when a proper topdressing material is worked into the aerification holes, the physical characteristics of a root zone mix can be gradually modified and improved.

In observing deep aerification operations on Florida golf courses for the past several years, a couple of logistical problems have been noted. First, the green surface is often very soft and easily rutted by topdressing application equipment, particularly following deep aerification with a Verti-Drain unit. Making the topdressing applications prior to conducting the deep-tine operation is a simple solution to this problem. It is also apparent that when the surface is topdressed prior to deep aerification, rutting from aerification equipment is minimized.

These concerns are somewhat minor compared to the problems encountered in working large quantities of topdressing sand into the aerification holes. Typically, one cubic yard or more of topdressing material per 1,000 square feet is being applied, and a variety of dragging, brushing, and matting operations are used to work the topdressing into the aerification holes. In one instance, high-pressure water hoses were used to wash the topdressing into the surface. These methods eventually move the material into the aerification holes, but they are time consuming and labor intensive.

My first turf tip for this year involves a better way of working in heavy topdressing applications following deep aerification. At Martin Downs Country Club, near Stuart, Florida, golf course superintendent David Oliver and his staff have been on a deep-aerification program for several years. After trying several different dragging arrangements, it was found that a simple board float made of two-by-fours was a very effective and efficient means of moving a large quantity of topdressing material into the deep-tine aerification holes. The board float is pulled with a utility vehicle and a standard drag brush is attached behind the float. A couple of bags of cement mix mounted on the sides of the float help maintain maximum performance. The next time you want to incorporate a large amount of topdressing into a green, give this setup a try.

At last year's conference, Jim Latham discussed a method of rolling putting greens to temporarily increase their speed and surface firmness. Though I have a few reservations about rolling greens, there has been an increase in the use of this management technique. During my travels in 1990, I observed a couple of different rolling methods. At The Plantation at Ponte Vedra, outside of Jacksonville, Florida, bentgrass greens are being maintained. To help compensate for slower greens speeds when the bentgrass is cut at higher mowing heights during periods of stress, the greens are rolled for special events. Rolling is done with a unit



(Top) Rolling greens temporarily increases speed and surface firmness.

(Above) A board float made with two-by-fours is an effective tool to move large quantities of topdressing material into deep-tine aerification holes.

fabricated by course mechanic David Smith. An angle iron frame holds the roller in place, and a simple hydraulic piston arrangement raises and lowers the transport wheels. The roller drum is actually a giant pulley from a paper production plant that was lathed to produce a smooth surface.

At Grand Cypress, in Orlando, Florida, superintendent Tom Alex has been using a rolling program in his tournament preparation program. Their rolling setup consists of a walk-behind mowing unit that has a wooden box mounted over the front roller. Filling the box approximately two-thirds full with sand adds an extra 20 pounds to the unit. This past fall, when the World Team Championships were held at Grand Cypress, the combination of multiple mowings and rolling of the greens produced speeds in the range of 10½ to 11 feet. This is an excellent speed for championship play, especially on bermudagrass greens. It is important to note, however, that the rolling of greens is not an everyday practice at either of the courses mentioned.

"If They Only Knew . . ."

by DAVID OATIS
Director, Northeastern Region, USGA Green Section

GOOD DRAINAGE has long been identified as an essential element of a reliable putting green turf, and hundreds of programs have been developed over the years for improving the internal drainage characteristics of putting green soils.

Golfers, on the other hand, are often much more interested in the condition of the visible portion of the putting green surface, and don't always understand the ramifications of poor drainage. At times they can be less than sympathetic to the plight of the superintendent. Nonetheless, it is the task of the golf course superintendent to explain these problems in order to gain the support needed to employ whatever solution is dictated by the circumstances. It has been said that "a picture is worth a thousand words," and this is the premise that Mr. Chris Baier, golf course superintendent of The Pines Golf Course in Newport News, Virginia, used to illustrate the problems of maintaining the putting greens on his course to his membership.

The Pines Golf Course is located in a climate that often experiences extended periods of heat and humidity, and this accentuates the problems created by poor drainage. The greens were constructed of native clay soils, and all manner of fill was used during their construction. Old railroad ties and even the rails themselves have been found beneath greens as they have been reconstructed. It is even rumored that a buried piano is the cause of the localized dry spot frequently observed on the sixth green.

The clays found on the golf course are extremely difficult to work with when they become wet and, in some cases, drain lines have had to be excavated by hand when trenching machines proved to be completely ineffective. In fact, a brick factory, operating in the early 1800s and utilizing local clays for its products, was located right next to the golf course property.

The maintenance crew quickly discovered how pliable the material was and, during breaks and at lunch, began molding figures out of it. When left out in the sun to dry, the figures became incredibly hard, and so the idea was born to make tee markers in the same manner. Chris and staff experimented with several shapes before the final design was selected and mass production begun. The process was simple; the shapes were molded, a pin inserted, and they were left in the sun to cure. Finally, the markers were painted and sealed, leaving them impervious to water.

Though the golfers were unimpressed by the design selected, they were quite shocked by their origin, and the message definitely got through. Thanks to this creative and inventive communication aid, Chris Baier now has a Verti-Drain and has completely reconstructed five greens. Two more are to be rebuilt this spring, and the club has been convinced beyond the shadow of a doubt that reconstruction is the only answer to their problem. Chris no longer ponders, "If they only knew . . . ."

Incidentally, the markers, though no longer in use, proved to be extremely durable, though they did become a frequent target of theft.

Gray clay after molding and curing.

The finished product!

Enhancing the Environmental Benefits of Golf Courses

by RICHARD D. KLEIN
President, Community & Environmental Defense Associates

A GOLF COURSE provides many benefits to the environmental quality of streams, lakes, and tidal waters. Today the golf course architect can take advantage of a variety of recently developed tools that have the potential to turn fairways, greens, and tees into clean water generators. Many of these same tools can also be applied to courses constructed decades ago.

The opportunities to enhance the environmental benefits of a golf course lie in five areas: buffers, pesticide and fertilizer use, irrigation, and stormwater runoff from parking lots, rooftops, and other impervious surfaces.

Richard D. Klein

Buffers

In the context of the aquatic environment, a buffer is a dense growth of vegetation established along the periphery of a waterway. Generally, the most effective buffer measures 75 to 150 feet in width and consists of trees and shrubs. Such a buffer provides a number of extremely important benefits:

- Shade-casting vegetation prevents the sun from excessively heating a waterway, benefiting trout and other fish that cannot tolerate warm or hot waters.
- The buffer contributes leaves, twigs, and other plant parts which serve as the basic source of food that supports the ecosystem of small streams.
- Tree trunks and root systems retard floodwaters, protecting downstream structures and slowing channel erosion.
- The buffer may intercept and absorb runoff flowing along the surface, reducing the quantity of pollutants reaching the waterway.

Naturally, a buffer will not resolve all of the potential water quality concerns associated with a golf course. They tend to provide the greatest benefit when applied to small headwater streams, those which are less than 50 feet in width. But even a broad river, lake, or pond will benefit from the presence of a dense shoreline buffer.

Pesticide and Fertilizer Use

Integrated Pest Management (IPM) programs can do much to minimize concerns related to pesticide and fertilizer use. Most golf courses should become clean-water generators through the use of IPM practices such as:

- The selection of drought- and pest-resistant turfgrass varieties.
- Proper irrigation practices.
- Reasonable mowing heights.
- Restricting pesticide use to spot-treatments with products having a low mobility in the soil column, a short half-life, and low toxicity.

If a portion of the fairways, greens, or tees reside upon very sandy soil, or the depth to groundwater or bedrock is less than four feet, then additional precautions may be warranted. Potential concerns associated with pesticide and fertilizer use on such areas can be reduced by:

- Converting the area to rough or some other use, if practical.
- Increasing the organic matter content by mixing peat, sludge, compost, or some other material into the soil surface.
- Filling the area to either increase the clay content of sandy soils or to raise the elevation above the water table and bedrock.
- Lowering the water table through a subsurface drainage system.

If a green or tee is sited on a sandy soil, particularly where the water table lies close to the surface, then consideration should be given to the use of an underdrain and directing the collected groundwater to a peat-sand filter. The peat will absorb much of the pesticide associated with groundwater flowing from beneath the green or tee.

Irrigation

In my home state of Maryland, an 18-hole golf course may use a daily average of 75,000 to 100,000 gallons of irrigation water during the summer. Our state water resources agency assumes that 75% of the water used for irrigation will no longer be available for other uses. Ideally, an irrigation water supply source should be used which will have a minimal impact upon aquatic ecosystems and other users.

If a stream or river serves as the supply source and more than 5% of the low flow is withdrawn for irrigation, then the impact upon fish and other users may be significant. The same would apply if a pond serves as the water supply source and the pond was constructed on a flowing stream.

The use of groundwater as an irrigation supply may be a problem under some circumstances. If the withdrawal of irrigation water lowers the water yield to nearby wells, then other groundwater uses may be harmed. Also, a production well located close to a flowing stream may draw water from the channel and into the ground, thereby lowering stream flow. While some modest effect upon stream flow and other water users may be an acceptable trade-off for the benefits associated with a golf course, the ideal situation is one in which all users enjoy an adequate supply of water.

One alternative to tapping a limited water supply may be the use of stormwater runoff. I have seen several proposals which call for the construction of ponds to capture and store surface stormwater runoff for future irrigation use. The ponds should be constructed where runoff can be collected without placing a dam across a stream. Care should also be taken to bypass sufficient floodwater to maintain the health of downstream waterways.

(Above) Vegetation that casts shade on the water prevents the sun from excessively heating a waterway, benefiting aquatic wildlife.

(Left) More golf courses can become clean-water generators by using IPM practices.

Stormwater from Impervious Surfaces

Stormwater may wash a variety of water pollutants from roadways, rooftops, parking lots, and other impervious surfaces. The pollutants include: toxic compounds, nutrients, oxygen-consuming waste, and heat. Many of these pollutants are derived from automobile operation and air pollution.

Stormwater runoff from paved surfaces routinely contains sufficient toxic materials, particularly copper, lead, and zinc, to exceed the levels deemed safe for aquatic life. The nutrients associated with stormwater can stimulate excessive algal growth in ponds, tidal waterways, lakes, and large rivers. As the algae die, they combine with other oxygen-consuming waste to deplete the waterway of this life-giving gas. If you've ever walked barefoot across a parking lot in August, then you can easily imagine just how hot rainwater gets after flowing across the asphalt. This thermal pollution can combine with the other stormwater impacts to degrade the quality of a stream once more than 10% of the drainage area is rendered impervious.

The most effective method for controlling stormwater impacts is to allow runoff from paved surfaces to soak into the earth. This method of control, known as "infiltration," can capture 60% to 90% of the pollutants associated with stormwater and will mitigate the thermal effects as well. But infiltration cannot be practiced on all soils. A peat/sand filter is the next most effective control measure. While other control measures, such as a pond or a wetland, have been applied to stormwater, none can remove sufficient pollution to fully protect aquatic resources.

Further information on these methods to enhance the environmental benefits of golf courses can be obtained by ordering a copy of "Protecting the Aquatic Environment from the Effects of Golf Courses." To order a copy of this 70-page publication, just send a check for $12.00 to: CEDA, P.O. Box 206, Maryland Line, MD 21105. And please give me a call at (301) 329-8194 if I can be of further assistance.

A Case Study of the Atlantic Golf Club

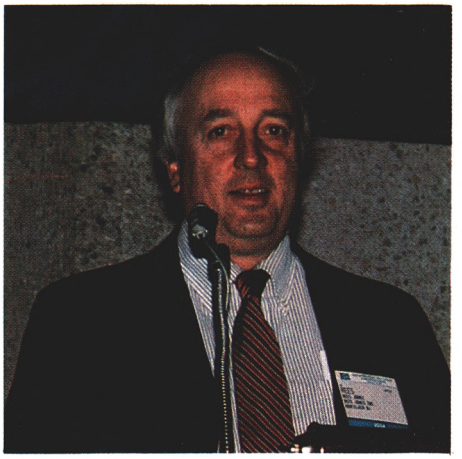
by REES JONES, Golf Course Architect

THE ATLANTIC Golf Course is a classic example of a project that was designed and built as a cooperative venture between local officials, the community, and the developer. Specifically, the project was the result of combined efforts of a sensitive golf course developer, Lowell Schulman, his project manager, Tom Julius of the Legacy Group, golf course superintendent Bob Ranum, and our firm working with the Town of Southampton, New York, and two local environmental groups, the Group for the South Fork and The Nature Conservancy. Rees Jones, Inc., Tom Julius, and Lowell Schulman used cooperation and creativity to ensure the site was designed to be attractive to wildlife while incorporating the requirements of a superb golf course.

To ensure that our environmental homework was done properly, Tom Julius asked local officials and environmental groups for suggestions of issues to be studied and recommendations of consultants to retain. Accordingly, impact reports were prepared on vegetation, ornithology, wildlife, soils, hydrogeology, traffic, archeology, turf management, and herpetology. Studies made regarding birds, wildlife, reptiles, water quality, and wetlands indicated the potential impacts of the golf course and pointed out the steps needed to protect and enhance wildlife habitat, preserve the wetlands, and guarantee good water quality. The studies regarding traffic, drainage, noise, and archeology showed these were areas of little impact and consequently of minimal concern to local officials in the development of the Atlantic Golf Club.

One of the primary goals at the outset was to find methods to convert 204 acres of farm fields to a golf course, while improving the ecology of the site. One clear advantage was our ability to show that maintenance of golf turf requires less fertilization and other chemical applications than required by the farm crops previously grown on the property.

We also knew from previous projects that golf courses can be designed, built,



Rees Jones

and planted to provide better habitats for birds, wildlife, and reptiles. Through the controlled use of fertilizer and other chemicals, we were able to demonstrate that we would enhance groundwater quality as well. Crops previously had been grown right to the edge of the wetlands, but in the golf course design, 100- and 200-foot buffers were established to protect existing wetlands.

Studies indicated there were two New York State endangered species inhabiting the site. One species was the northern harrier hawk, the only hawk which hunts by sound instead of sight. It was also determined that a kettle hole on the property was possibly a hibernation area for the eastern tiger salamander. Steps were taken to protect and ultimately enhance the environment for these two endangered species. For instance, in order to protect the migration movement patterns of the eastern tiger salamander, we avoided working areas of the site during the migrating period of March to May.

To enhance the future needs of the eastern tiger salamander, we worked with a herpetologist to prepare a specific habitat plan for the major kettle hole. A 200-foot buffer was maintained in this area, tree trunks and rocks were installed in the deep grasses, and, as mentioned earlier, a path was kept open and no golf course construction in March, April, or May occurred in the area where the eastern tiger salamander migrates.

SHINNECOCK Hills Golf Club and other maritime grassland areas were investigated to find grasses that would be conducive to golf play and acceptable as native plants to our botanist, Eric Lamont. Seven or eight native, local types of grasses were found that golf shots could be played from. These native grasses have been diminishing in quantity over a period of years because of residential development and farming. Several types of grasses were selected and incorporated into our grassing plan. We located the seeds for the principal grass in Denmark, after checking more than 25 domestic seed sources. Ultimately we collected some of the seed ourselves when we were unable to locate suppliers.

The primary wetland to be protected was the one where the eastern tiger salamander was found. This kettle hole, as well as Shorts Pond, are two of nine kettle holes found on the South Fork of Long Island resulting from the action of a receding glacier. They are geologically significant and prove to be wonderful natural features to incorporate in the golf course design.

In order to protect the wetlands, snow fences were installed adjacent to the wetland itself and also at the 100- and 200-foot buffer areas. Filtration fabric, approved as the standard fabric for erosion control, was installed to supplement the snow fence. For two reasons, we also volunteered to install hay bales next to the filter cloth; it would protect the expensive filter cloth, and it would serve as another method of erosion control for the wetlands. In the kettle hole area the erosion control devices were staggered so that the salamander could continue to move in and out of the wetland during migration. We also left a few openings in the snow fence to allow wildlife to enter for drinking water.

Since this site had been farmed for more than 100 years, native grasses previously existing in many areas had been lost and replaced by non-native

species such as ryegrass. To prepare these areas for the native grasses, sand was incorporated into the topsoil. These grasses were basically "poverty" grasses that grow best in sandy soil and drought conditions. Because maritime grasses survive better with poor soil and little water, they also require less water from the aquifer — another example of incorporating an environmental concern into a golf course design benefit.

In many areas, non-native tree species were removed to encourage the native species to better survive. Choke cherry and maple trees were often removed, leaving the spruces and hemlocks.

Between the 18th tee and 18th fairway a unique black willow grove was found. Black willows usually grow independently, and it was very unusual to find a grove this large. We were encouraged by local officials to clean out the non-indigenous trees to help the more valued native species to survive. In order to control erosion in this area, we agreed to plant three types of sheep fescue (*Festuca ovina*) and other native grasses, such as switch grass and sweet vernal.

EROSION CONTROL was of paramount importance from the outset of this project. A variety of control methods were used, including a cellular paper mesh imbedded with fescue grass. This "netting" product was purchased, with seed already imbedded, from a company in the Midwest. We ultimately were not happy with the seed quality and the resulting turf quality, but the method worked well on severe slopes to stabilize topsoil and prevent erosion. If we were to do it again, we would order seed from our designated supplier, send the seed to the "mesh" company and have them embed the mesh with the selected grass seed varieties. This would give us much better results with this method of erosion control. On Long Island, where there are several sod farms, the cost of sod installed was $.40 to $.45 per square foot. Using the cellular paper mesh method of seeding cost approximately $.20 per square foot. In other slope areas a hydro mulch consisting of wood pulp fiber mixed with seed was used. This method cost approximately $.06 per square foot; however, the method was not as efficient with regard to even seed application.

The most appropriate native maritime grasses for golf were broom-sedge (*Andropogon virginicus*) and common tufted hairgrass (*Deschampsia flexu-*

Photographs by RAMESHWAR DAS

The Atlantic Golf Club site prior to construction in February 1990.

Construction was completed on the Atlantic Golf Club in November 1991.

osa). Other grasses used in the rough areas were: little bluestem (*Schizachyrium scoparium*), big bluestem (*Andropogon gerardi*), Indian grass (*Sorgastrum nutans*), and tall fescue (*Festuca arundinacea*). There were only five other locations on Long Island where these native grasses were still evident. The Group for the South Fork and local officials were pleased that we were willing to try to establish a sixth location. Common hairgrass (*Deschampsia flexuosa*) seed was hand collected from the Nature Conservancy lands in Montauk. We located an area in West Hampton that had another desired native species, *Karex pennsylvanicus*. The landowner was paid approximately $5,000 to allow us to remove an acre of this grass, and it cost between $10,000 and $11,000 to divide the sod and transplant the plugs to the site. These plugs were used for the maritime grassland slope areas. The nearest alternate source of these materials was on Martha's Vineyard, and it would have cost the Atlantic Golf Club approximately $140,000 to buy, transport, and install a comparable number of plugs.

A distinct and positive aspect of planting and using native grasses, as well as the fescues, was that these grasses provide a suitable habitat for field mice, snakes, and other small animals which are the natural food supply for the northern harrier hawk. By using native grasses as part of the design, we were able to enhance the existing environment for this endangered species. These grasses also require significantly less water, causing less of an impact on the aquifer.

NATIVE SHRUBS were planted around the kettle hole area and Shorts Pond. We were helped in the selection process by The Nature Conservancy and the Group for the South Fork. These shrubs will provide a wonderful habitat for bird life since most of the shrubs in these out-of-play areas have berries, a food supply for birds. The planting around Shorts Pond was an example of Atlantic Golf Club's effort to work with the Town of Southampton to enhance the wetland habitat for wildlife. It should be mentioned that no heavy machinery was brought into the area, and the shrubs and trees were hand planted.

A golf course can be designed with the environment in mind, to create a better habitat for wildlife. As the golf course designer for the project, we incorporated all the findings of our environmental homework into our design and did several routings to accommodate the findings of these reports. We were fortunate enough to have had a 204-acre parcel to begin with, giving us plenty of room to develop the final 148-acre golf course.

By preserving the wetlands and utilizing a 100-foot buffer around four of them and a 200-foot buffer around the main kettle hole, we were able to utilize natural areas to re-vegetate the site as it may have been in the past. We also used native grasses and shrubs within some areas of the 148-acre golf course when they were compatible with the play of the game.

By utilizing the high ground for golf and enhancing the slopes to the wetlands, we have created a golf course which is truly visually exciting. The course will play differently each day due to the varying conditions of the wind. It is the type of golf course that one can continually enjoy, and it is a true example of a course designed in harmony with nature. It is my sincere hope that this course will become a model for other projects planned for environmentally sensitive sites.

Erosion control methods employed around the wetlands.

The Audubon Cooperative Sanctuary Program for Golf Courses seeks to protect and enhance wildlife habitat, like that seen here at the Shinnecock Hills Golf Club, in Southampton, New York.

THE USGA'S ENVIRONMENTAL PROGRAM

by JAMES T. SNOW
National Director, USGA Green Section

IT'S SURELY NO NEWS that the environment is a hot topic in golf today. Environmental issues are having a dramatic impact on how golf courses are built and how they are operated and maintained. Concerns often center around pesticide, fertilizer, and water use on golf courses, as well as land use policies and the loss of "natural" habitat and open land. In many instances, concern about the effects of golf courses on the environment is used as an excuse to block the development of adjacent properties into housing units or other uses.

The exact nature of the effects of golf course construction and maintenance activities on the environment is not completely known, though many studies are now in progress to investigate this relationship. It is essential to understand the extent to which pesticides and fertilizers affect groundwater and surface water supplies, and their effects on humans, wildlife, and other non-target organisms, so that we can address with scientific facts the concerns about golf courses. Many of the criticisms about golf courses as polluters of the environment probably are not true, but where there is a sound scientific basis for concern, we want to take the appropriate steps to mitigate the problem.

The USGA is approaching the environmental concerns of golf from several angles. Essentially, the program consists of the following components:

1. The USGA/GCSAA Turfgrass Research Program.
2. The Environmental Research Program.
3. The Audubon Cooperative Sanctuary Program for Golf Courses, and associated educational activities.

The USGA/GCSAA Turfgrass Research Program

Since 1921 the USGA Green Section has been involved in turfgrass research. For 30 years the Green Section staff actually conducted research work in cooperation with the United States Department of Agriculture at its Arlington, Virginia, and Beltsville, Maryland, research stations. After 1952, research support was provided by way of grants to many universities throughout the country.

In 1982 the USGA committed substantially more money to turfgrass research and established a special advisory committee to oversee project selection and progress. Through 1991, the Turfgrass Research Committee will have disbursed more than $4.3 million in support of 40 projects at 19 universities.

Among the original goals of the current turfgrass research program was to develop grasses for golf that use significantly less water, are tolerant of pests and environmental stresses, and cost less to maintain. This goal has a decidedly environmental slant, addressing water use and pesticide use issues that are at the forefront of the environmental concerns of private organizations and governmental agencies today.

The turfgrass research program has accomplished much during the past eight years. Among the highlights of interest from an environmental standpoint are the following:

- The development of cultural maintenance practices that increase the ability of turfgrasses to tolerate or resist the effects of stresses such as heat, cold, drought, diseases, and insects.
- The investigation of mechanisms by which turfgrasses endure and resist environmental stresses such as heat, cold, drought, salt, etc., and the use of this information in turfgrass breeding programs.
- The establishment of turfgrass breeding programs that are producing grasses inherently more tolerant and resistant to environmental stresses and pests.

An improved seeded bermudagrass (Nu-Mex Sahara) and an improved buffalograss (NE-609) have already been introduced. During the next few years a host of new grasses, including bentgrasses, bermudagrasses, zoysiagrasses, and buffalograsses, will be generated by the program and will be available for use on golf courses and other turf areas. Various other native grass species also are being improved through breeding efforts and may find their way into golf course management programs. Golf and the environment will both be winners as these new grasses are marketed and used.

A group of researchers observes buffalograss selections from the breeding program of Dr. Terry Riordan at the University of Nebraska. An improved cultivar from this program, NE 84-609, is available on the market this year.

The Environmental Research Program

At its August 1989 meeting, the USGA Executive Committee agreed in principle to fund research relating to the impact of golf course activities on the environment. Subsequently, the USGA Turfgrass Research Committee commissioned a complete literature review of the subject by Spectrum Research Inc., an independent research agency located in Minneapolis, Minnesota. Spectrum completed the study and submitted a 400-page document to the Committee entitled "Environmental Issues Related to Golf Course Construction and Management: A Literature Search and Review." It consisted of information from more than 1000 references from the scientific literature; each had to have a sound scientific basis to be included in the review. Currently, the review is being updated and will be published in book form by the end of 1991 if all goes well.

Based upon the results of the literature review, the Research Committee developed a set of priorities for the environmental research program. It was determined that the following topics were most in need of being addressed:

- The fate of pesticides and nutrients applied to golf courses.
- Alternative methods of pest control.
- The impacts and benefits of golf courses on people, wildlife, and the environment.

At its June 1990 meeting, the USGA Executive Committee allocated $2.8 million for a three-year period to fund research projects related to the priorities set forth by the Research Committee.

From more than 80 pre-proposals, the USGA Environmental Research Committee has thus far agreed to fund 15 projects: eight in the category of pesticide and nutrient fate, six having to do with alternative methods of pest control, and one concerning the benefits of golf courses. Other proposals related to the last category are being requested and will be evaluated and acted upon at the committee's July 1991 meeting.

It is anticipated that this three-year study will produce a much greater understanding of the effects of golf course activities, including pesticide and fertilizer applications, on people, wildlife, and the environment. At the end of the study, it is expected that further research will be required. Areas of study will likely include:

- The development of mathematical models to predict the fate of pesticides and fertilizers applied to various turf/soil systems, based upon the data generated in the initial study.
- The further development of alternative methods of pest control.
- The continuation of breeding programs to produce turfgrasses that use less water and are tolerant or resistant to pests and stresses.
- The development of cultural practices that reduce the dependence of turfgrasses on water and pesticides.
- Other areas where critical unanswered questions remain.

Audubon Cooperative Sanctuary Program for Golf Courses

A new and exciting program being sponsored by the USGA and administered by the Audubon Society of New York State is titled the Audubon Cooperative Sanctuary Program for Golf Courses. It's an attempt to match the interests of environmental groups for conservation programs and the welfare of wildlife with the interests of golf, which include the preservation of water and wildlife resources as well as the playing of the game.

The program's objectives are several:

1. Protect and enhance wildlife habitat on existing and planned golf courses.
2. Enhance the image of golf courses as sanctuaries for wildlife.
3. Encourage golf course superintendents, course officials, and golfers to become more knowledgeable about environmental issues and take an active role in conservation practices on golf courses.

Among the topics to be encompassed by the program are wildlife protection and habitat enhancement, Integrated Pest Management (IPM) practices, and water conservation programs. Courses that participate in the program and follow through with appropriate conservation practices can become certified and will be eligible for regional and national awards. Activities of these courses will be publicized through Audubon and golf-related publications, and press releases will be sent to selected media in the cities where the courses are located. It is hoped that this recognition program will enhance the image of golf courses as good neighbors within their communities.

One of the requisites of becoming certified will be to establish an environmental resource committee at the course and to develop a plan for the various conservation projects to be undertaken. The resource committee consists of several golfers and at least one non-member who has expertise in some facet of the planned program. This person (or people) can come from the ranks of the county extension service, the Soil Conservation Service, the local environmental center, or the local chapter of the Audubon Society or some other environmental organization. The purpose for involving outside people is twofold:

1. To make available to the golf course a person or people who have special expertise that would be of value in following through with planned conservation practices.
2. To establish a dialogue between golf courses and local environmental organizations or agencies. A pro-active relationship between these groups can be nothing but a win/win situation for golf and the environment.

To assist golf courses in becoming certified in the Audubon Cooperative Sanctuary Program, New York Audubon Society and the USGA will combine resources to provide cooperating courses information via:

- Mail and phone correspondence.
- On-site visits by Audubon or USGA personnel.

A method for determining the volatilization loss of pesticides from turf used by Dr. Richard Cooper at the University of Massachusetts.

- Periodicals, bulletins, fact sheets, etc.
- Presentations at meetings and seminars.

It is anticipated that the Golf Course Superintendents Association of America (GCSAA) also will encourage its members to participate in the program through its own certification programs and will provide training and educational opportunities to those participants.

USGA Staff Additions

The USGA has committed itself to the Green Section's environmental program by adding several professional positions to the Green Section staff. A research director, a technical writer and an environmental specialist were hired in 1990 and will enhance the environmental program by providing:

- Coordination and oversight of research projects.
- Preparation of annual research reports, environment-oriented bulletins, newsletters, fact sheets, articles, videotapes, and other publications for interested parties.
- On-site visits to interested courses, architects, developers, and builders.
- Presentations on environmental themes at golf and turfgrass meetings, conferences, and seminars.
- Training for the Green Section's 15 regional agronomists, thereby expanding the reach of the program.

Opening Communication Channels

The Green Section has opened a dialogue with ten national environmental organizations, a dozen prominent foundations active in environmental issues, and regulatory agencies such as the EPA. They have been informed of the USGA's research program and other activities and about golf's commitments to the environment through the Audubon program and other endeavors. As information on the effects of golf course activities on the environment is generated by the research program, these organizations and selected media will be kept abreast of the findings.

Criticisms of golf courses are often based on a lack of knowledge, a problem that can at least be partly overcome by maintaining good communications channels. By communicating and interacting with environmental organizations and agencies, we hope to improve people's perceptions about the positive role golf courses can play in the environment.

CANADA GEESE: *Waterfowl or Just Plain Fowl?*

by GEORGE THOMPSON, CGCS
Country Club of North Carolina

WHAT IS happening to that truly wild bird that used to migrate thousands of miles? That bird, of which hundreds of stories have been written, has challenged generations of hunters and now challenges the golf course superintendent.

Canada geese nest in the most remote waste areas of the Hudson Bay in northern Canada. In early fall, after the young geese can fly, they begin their southern migration to places like the Delmarva Peninsula on the eastern shore of the Chesapeake Bay. They fly in large V formations at altitudes up to 29,000 feet. With favorable winds, they can cover 1,000 miles in a few nights. The old ganders have navigated the flyway many times, and they know the safe lakes and rivers to which their ancestors have returned for 5,000 years.

George Thompson

The Indians thought of the Canada goose as their protection from hunger and their sentinels in the night. Their coming and going marked the passage of time, and the Indian medicine men prayed for their safe return each year. Golfers and superintendents do not have the same reverence for geese. There are still thousands of wild migrat-

A goose roundup was used at the Country Club of North Carolina to transport the geese to another area.

ing geese in the various flyways, but more are becoming non-migratory each year.

When a few geese arrived at The Country Club of North Carolina in Pinehurst eight years ago, members thought the wild geese were nice and started to feed them corn. Geese are prolific, and we soon had an over-population problem. After they nested, it was virtually impossible to get them to leave. They frequented certain areas of the golf course and left their deposits on greens, tees, and fairways every evening. The greens had to be scraped prior to mowing in the mornings.

If you have ever played golf through their excrement (droppings), or chased them off the fairway in order to make a second shot, then you realize what a problem they can be. A golf course environment has plenty of fresh water for drinking, roosting areas, verdant grasses to graze on, and no natural enemies. Once established, they are extremely difficult to drive off.

The Country Club of North Carolina has more than 100 acres of water. Eighteen of the 36 holes have water hazards, including a 30-acre lake and a 60-acre lake. Some half-hearted attempts were made to drive away a resident flock of geese, but a persistent effort was not made and the flock grew from 26 birds in 1986 to 89 birds in 1990. We had permits to shake the eggs or freeze them during nesting seasons; otherwise, we would have had 150 to 200 local birds.

By 1990 the members had had enough, and the animal damage control specialists from the U.S. Department of Agriculture were contacted. The U.S. Department of Agriculture had requests for geese in another state 700 miles away, and we cooperated and rounded up our flock in late June while they were flightless. The Department of Agriculture was paid $1,110 for the removal of 89 nuisance geese, or $12.47 each. The members thought this was a bargain and were happy we didn't kill them during the special non-migratory nuisance goose season in early September. These birds have never returned.

One country club decided to shoot some of their birds during the local season, and they made headlines in the media. Some of the letters to the editors included quotes of "mindless and wanton slaughter of innocent Canada geese," "the murder of only a few geese in order to reduce soiling of their precious golf course is totally inhumane and is revolting to the sensibilities of decent people," and "the reasons given for their slaughter are self-serving rationalizations to justify a disgusting action." Even though the club dealt with the birds legally during the hunting season with the necessary permits, waterfowl stamps, and licenses, they were criticized for their actions.

GOLF COURSES with large lakes naturally have the greatest problem with geese, but there are numerous methods of discouraging them and

It's Saturday morning on the golf course . . . the gang's all here!

Dogs can be trained to chase geese from golf course waterways.

driving the birds away. Prevention is the best method and, like other golf course programs, it is important to be diligent.

Pyrotechnics work well if used immediately when geese try to land on lakes or ponds. An efficient system is to have someone assigned to monitor the golf course on a daily basis. There are a number of scare-away pyrotechnics such as Bird Bangers, Screamer Siren Projectiles, Bird Banger Rockers, and Shell Crackers shot from a 12-gauge shotgun. The simplest device is a single-shot pistol launcher similar to a starter's pistol. In most cases the screamers will do the job; however, if the geese refuse to leave, stalk the birds in the early morning or evening and shoot Shell Crackers or Bird Bangers over their heads. When they feel threatened for their safety, they will leave.

A few words of caution if you intend to use pyrotechnics. Check with local authorities regarding noise ordinances. If there are homes on the golf course, warn the owners of your intentions. Bird Bangers are loud, and firing one in someone's backyard at 6 a.m. will draw some wild reactions from neighbors as well as geese. The U.S. Department of Agriculture, Animal Damage Control, can provide names of companies dealing in pyrotechnics and useful information pertaining to goose control. To obtain the address of the Animal Damage Control office in your state, call (301) 436-8281.

Styrofoam swan families have been used successfully in keeping geese from landing on water areas of the golf course. The styrofoam swans should be placed in family groups, one per surface area. In large bodies of water, place the swan families in areas highly visible to airborne geese.

Another technique is to string a single strand of wire along the lake shoreline. This wire should be approximately six inches above the waterline. Our geese would land in the water and then swim to shore to walk out on the fairway to feed. The wire was enough of a deterrent to force them out of this area into another location of the course where we could keep better track of them.

Some golf course superintendents use dogs to chase or stalk the birds, keeping them in the water. Geese are primarily grazers and if they can't get to the turf to feed, they will go elsewhere. The dog should not be left out on the course alone. To help keep the dog's interest level high, it is important not to make it a game; treat it as seriously as a job, make it part of a daily routine, and let the dog work under your care and supervision.

The Canada goose has become a tremendous problem on golf courses, and there are no easy solutions. When using deterrents, be persistent and do not let the geese become established on your property.

In the future, repellents may be available. The USDA Bird Repellent Laboratory, in Sandusky, Ohio, is working on a repellent made from the essence of grapes. This is a food-grade powder dye which is mixed with water and sprayed along the water's edge. Only time will tell if repellents will be a successful and cost-effective method of controlling geese on golf courses.

THE BEST TURF TIPS OF 1990 — PART II

Winter Water Wagons Minimize Dakota Desiccation

by JAMES M. LATHAM
Director, Great Lakes Region, USGA Green Section

WINTERKILL is an annual specter that haunts golf course superintendents throughout the northern two-thirds of the continental United States. One form of winterkill is desiccation, something like the freeze-drying of plant tissue which accompanies the extremely cold, dry, windy weather common to the Great Plains and fringe areas. Elevated greens, tees, and mounds are especially hard hit since snow cover is often swept away by the wind.

Several methods of turf protection are used with varying degrees of success. Among them are putting brush or tree branches on exposed areas to hold snow, surrounding greens and tees with snow fences, topdressing heavily, covering with some type of fabric or plastic sheets, applying a layer of hydromulch fiber, or winter irrigation.

The latter method has been perfected to the nth degree by golf course superintendent Cal Polsean at Westward Ho Country Club, in Sioux Falls, South Dakota. Mr. Polsean is a second-generation Dakota superintendent who is all too familiar with the windy, almost snowless winters, with deep cold interspersed with periodic mild spells. He considers a Winter Water Wagon an essential part of his equipment inventory. In fact, he has three. Two are old 1,000-gallon tankers, one of which is a gravity-flow rig used for irrigating new trees and shrubs. The other is fitted with pumps, hoses, and sprinklers.

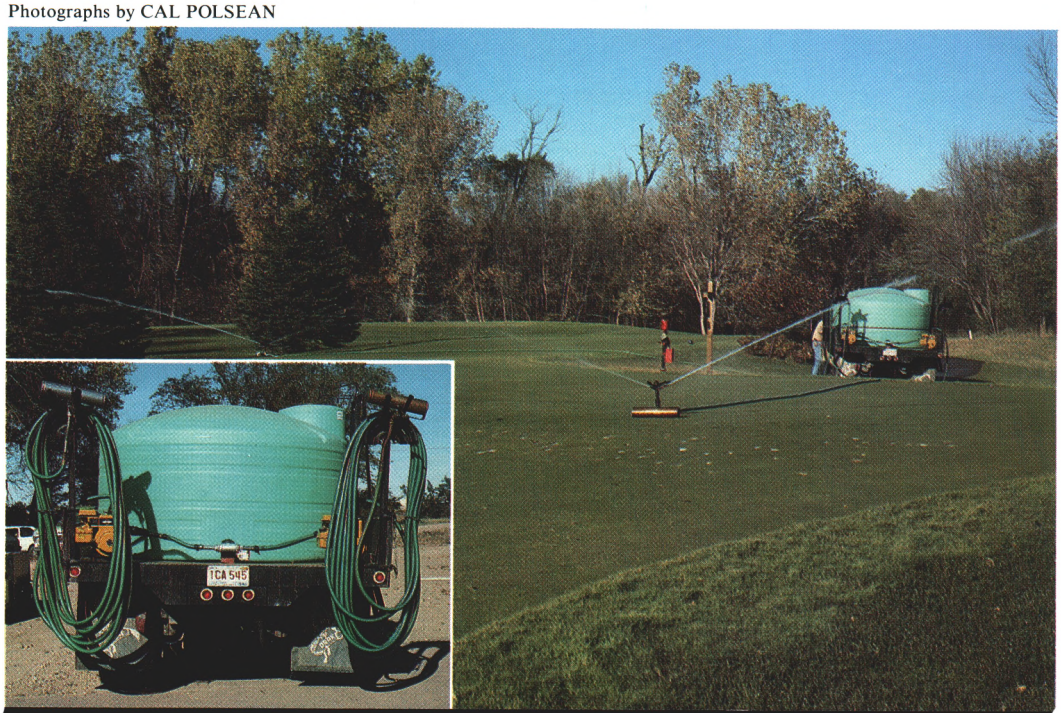
The newest setup is a 1,250-gallon fiberglass tank carried in the bed of the club's dump truck. Water is applied to the turf by two five-horsepower pumps, one-inch diameter hoses, and roller-base sprinklers. The pump stands and hose racks were built from scrap metal by the staff and are fastened to the truck with only two pins. The pumps are bolted to the stands prior to installation. Using a three-inch hose, one of the irrigation pumps can fill the tank in only two minutes.

The sprinkling operation applies 1/10 inch of water in the 20 minutes required to empty the tank. A rain gauge is used when greater accuracy is needed. It is obvious, too, that the truck cabs are fitted with effective heaters. These folks are as intelligent as they are hardy.

Watering begins soon after the irrigation system is drained in mid-October and continues until it is recharged in mid-April. Greens and tees receive weekly waterings until snow covers the turf, provided the air temperature is above freezing. Thereafter, exposed turf areas are watered as needed, with the same temperature restriction. Experience has shown that these light applications of water adequately replace enough of the water lost by evaporation, sublimation of ice, and plant use to prevent desiccation. Long, open winters require lots of watering. A few years ago, the Westward Ho winter watering program required over 400 man-hours. Mr. Polsean figures that he gets no reduction in the effectiveness of snowmold prevention fungicides until about an inch of water is applied and, of course, the slow water application rate avoids runoff problems.

The success of winter watering is evident every spring. The elevated greens on this rather open golf course have not experienced any major desiccation loss in years. The same is true for the tees and other areas on the course which receive this "off-season" watering. With two pumpers and a gravity-flow tanker at work during the winter, one winterkill problem has been eliminated, and Westward Ho golfers find excellent, green greens every spring.

Photographs by CAL POLSEAN



(Left) Irrigation with two sprinklers empties the tank in about 20 minutes, applying about 1/10 inch of water. Water wagons are the sole source of supplemental water after the irrigation system is drained in mid-October until the first snow cover (early December in 1990).

(Bottom left) A winter water wagon is used during cold, windy, South Dakota winters for irrigating exposed turf to prevent desiccation. Water is applied to greens, tees, and other critical areas whenever the air temperature is above the freezing point.

PAST AND PRESENT

by JIM SKORULSKI
Agronomist, Northeastern Region, USGA Green Section

HOW OLD is your Sand Pro? Perhaps six, eight, or even ten years old? What's that? You say it has seen better days and owes the club nothing. Furthermore, the Green Committee now prefers to have the bunkers raked by hand. Maybe the old machine can be traded or sold to another golf course. More than likely it will be parked deep within the garage and serve as a future source for parts. How sad it is to see the dependable old mule unceremoniously cast aside after many trying seasons at the "beach." Other golf course equipment items meet a similar fate as innovations and changing management trends continue in our industry.

Perhaps not all is lost for the Sand Pro, however, as its fate may have been altered forever as a result of an innovative idea from Superintendent Bob Alonzi, at the Winged Foot Golf Club in Mamaroneck, New York. Mr. Alonzi realized that the machine's wide wheel base, low center of gravity, and excellent maneuverability make it ideal for use as a boom sprayer on relatively steep bunker banks and other areas that are less accessible to conventional spray booms. With several modifications he was able to develop a prototype spray rig which has proved successful in initial trials.

The modifications involved the use of a simple spray kit developed originally for All Terrain Vehicles (ATVs). The kit includes a 10-gallon polyethylene tank, 12-volt electric pump, hoses, and a 36-inch boom equipped with three nozzles. Alonzi and his mechanic decided to mount the boom directly to an existing plow blade attachment off the front frame. The plastic tank and pump were attached directly behind the seat. The operator controls the pump with a toggle switch mounted on the dash. A rubber skirt has since been mounted on the prototype model to protect the applicator from spray drift. The skirt attaches to the front frame, between the boom and applicator. The boom can also be attached to the Sand Pro's rear frame to reduce spray contact with the applicator and prevent possible tracking. Alonzi and his spray technicians prefer the front mounting for visibility and control purposes and have not reported adverse drift or tracking problems.

The pump generates between 15 and 40 psi to provide approximately 2 to 2.2 gpm. Unfortunately, there is no agitator provided with the small spray kits, so chemical selection is limited to emulsifiable concentrates, liquid concentrates, and soluble powders. Alonzi has found that an additional 12-volt marine battery should be used during applications to avoid excessive drainage of the primary battery. The supplemental battery provides adequate voltage to operate the pump for 6 to 8 hours before recharging is required.

Calibration is handled as with any boom sprayer. The speed of the Sand Pro can be held constant with an accelerator lock. Run the Sand Pro over a set, measured distance, and time the run to calculate speed. Once a constant speed is determined, pump pressure and nozzles can be adjusted accordingly to obtain desired application rates. The machine provides a uniform and consistent spray pattern.

The Winged Foot crew uses the machine regularly to apply broadleaf and preemergent herbicides to bunker banks and around sensitive trees and border plantings. A significant savings in time has been realized with the modified sprayer. The compact sprayer might also offer a precise means for applying growth regulators to reduce mowing frequency and slow Bermudagrass encroachment into sand bunkers.

The modifications can be completed using one of the kits for approximately $400, a small cost considering the added versatility it provides to a pest management program.

So the next time a shop "cleanup" is scheduled and that old Sand Pro is discovered beneath the case of marking paint, consider resurrecting it into a new, useful equipment item. The favorable results may entice the imagination, spawning additional innovations with old equipment everywhere.

The prototype model in action around one of the many famed Winged Foot sand bunkers.

Practice stops here. A wind screen barrier protects tee areas before championships and still allows for easy removal for mowing.

Protecting Pumps and Tees

by TIM MORAGHAN
Agronomist for Championships, USGA Green Section

DESPITE all her splendor, Mother Nature has her fickle side, and this characteristic is very evident during the winter throughout our southern states. One moment we are enjoying pleasant temperatures and warm sunshine, and overnight it can all change to a freezing, unfeeling arctic blast. This fierce change in conditions can wreak havoc on many golf course operations, particularly the irrigation system and its pump station, where a sudden freeze can prove very costly.

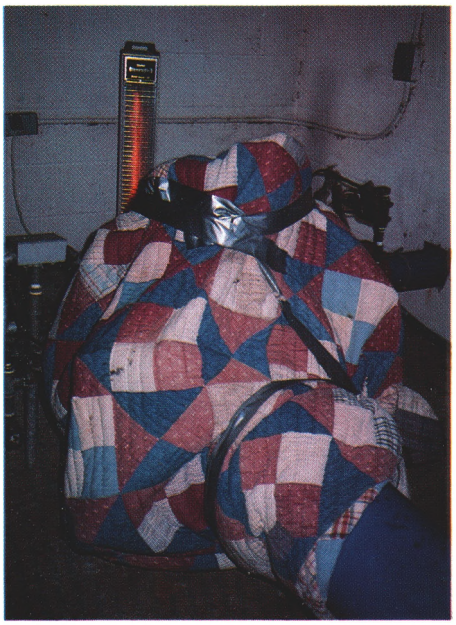
An unprotected pressurized irrigation system that is exposed to a sudden freeze can experience damage in various forms, such as blown-out pressure tanks, fractured Clayton valves, and broken pressure switches. Enclosed pump stations with heaters have a distinct advantage under these conditions. Pumping systems that are not protected, remain pressurized, and receive occasional use, are at a major disadvantage.

Freeze damage to unprotected elements of the pumping system can cost thousands of dollars to repair. There are several precautions, however, that can be taken in the case of a power failure. One alternative is to go to a local department store and purchase two inexpensive electric blankets and extension cords. When the weatherman forecasts a sudden overnight freeze, take the electric blankets and drape them over the Clayton valve and the pressure switch boxes. Use duct tape to secure them and put the heat setting on low for the night.

Another possibility, especially in the case of a power failure, is to add anti-freeze to the Clayton valve and pressure tank to prevent ice formation, swelling, and rupturing of equipment. The process for adding anti-freeze is simple. Remove the plug from the top of the

Clayton valve, force air into the valve to push at least half a gallon of water back out of the valve, and then add the anti-freeze to replace the water.

IN PREPARING for a championship, important and often overlooked portions of the golf course that require protection are the par-3 and par-4 tees where players may elect to use an iron club. Due to heavy play from the regular membership before the event and excessive divoting from players' extra practice swings during practice rounds just before the event begins, these tee areas may become severely worn before the actual competition starts. It is the policy of the USGA to request that areas on the tees chosen for our championships be protected for up to 30 days in advance of the start of play. In the past, protection of these areas consisted of the use of "chicken wire" placed across the surface of the tee. However, chicken wire is rather bulky and is somewhat uncooperative when it comes to removing and replacing it for the sake of mowing the turf. Also, if the mower operator does not happen to have a pair of work gloves, stray pieces of wire can cause deep scratches as he wrestles with it. For some, the tendency is to abandon the wire and leave the tee unprotected.



Cover up your irrigation pump to insulate and protect it from a sudden freeze.

One solution is to obtain two metal stakes, at least four feet in length, and some tennis court windscreen material. Attach the windscreen to the stakes with clips or tie-wraps, using enough material to stretch across the width of each designated championship tee. Use the location of the tee sign as the furthest point forward of the areas to be saved. The height of the windscreen provides a large enough barrier to prevent players from hitting behind the tee sign. More importantly, it is far easier for the mower operator to remove and replace a single stake and a more cooperative piece of screen. Given the increase in the use of walking mowers to cut tees, this procedure saves time and headaches. The only equipment to be added is a small hammer carried by the operator to pound the stake back into the ground. With the vertical windscreen barrier in place, the tee surface is exposed to air and light, is not damaged or discolored from a thicker covering, and is much easier to treat with applications of fertilizer and pesticides.

Save Water — Automatically!

by JAMES F. MOORE
Director, Mid-Continent Region, USGA Green Section

EVERY superintendent who manages an automatic irrigation system is painfully familiar with the innumerable trips back to the course to shut off sprinklers when rain comes. Despite the inconvenience and interruption to one's family life, there are many good reasons to make such a trip. Too much water interferes with play and may even make it necessary to close the course. Key maintenance practices, such as mowing and fertilization, have to be delayed if the course is saturated. Disease incidence increases and a lack of oxygen in the soil makes for spindly turf. Finally, now more than ever, we are all aware that water is a resource that grows more precious with each passing day. This awareness is heightened when water must be purchased at a premium price.

Cottonwood Creek Golf Course in Waco, Texas, must pay such a premium. According to superintendent Tim Upmore, water must be purchased at the rate of .0067 cents per gallon. What at first may seem a nominal amount grows quickly into a major expense given that as much as 250,000 gallons of water may be used nightly. This equates to approximately $1,675.00 per night for water. For Tim, trips back to the course in the middle of the night were not optional.

Tim has combined two good ideas to spend more time in bed at night and to save water.

The first is an inexpensive yet effective rain cutoff switch. This switch is wired into the central controller in the cancel circuit. Whenever a set amount of rain accumulates in the rain switch, an ongoing irrigation cycle is canceled. The switch is easily installed and costs less than $30. Since Tim's 1,000 gpm pump station pumps about $6 worth of water each minute, it takes about five minutes for this switch to pay for itself.

The second device is "homemade" — a little more complicated and expensive, but also more versatile. This idea was first detailed by Thomas R. Streiff, CGCS in *Golf Course Management* magazine (April 1984). An electronic switching device is sold that allows remote control of lights and appliances

in your home. The unit's operation is simple. The main control unit is plugged into a 110-volt outlet and hooked into the telephone line. After the tenth ring, the main control unit answers the phone. A remote control device is then used to enter a code specific to one of 16 appliance modules. This causes the main control unit to send a coded signal through the house wiring and activate the selected appliance module. Whatever is plugged into that appliance module can then be turned on or off.

By using an appliance module to activate a relay, different voltage circuits can be controlled without any direct connection to the 110-volt circuit. When the appliance module is activated, the relay opens or closes, breaking or completing the secondary circuit.

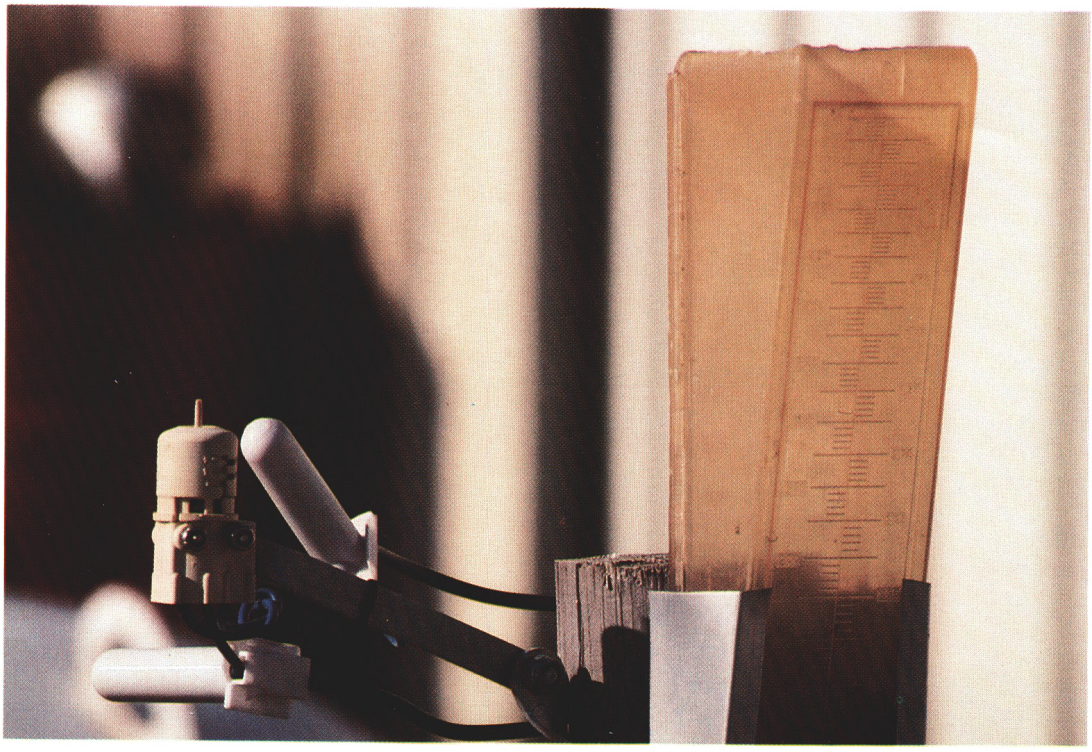
Examples of use include the following:

1. A relay is wired into the signal wire going from the central controller to the satellites. When the relay is activated (by remotely triggering the appropriate appliance module), the signal wire is "broken" and an irrigation cycle cannot be started.

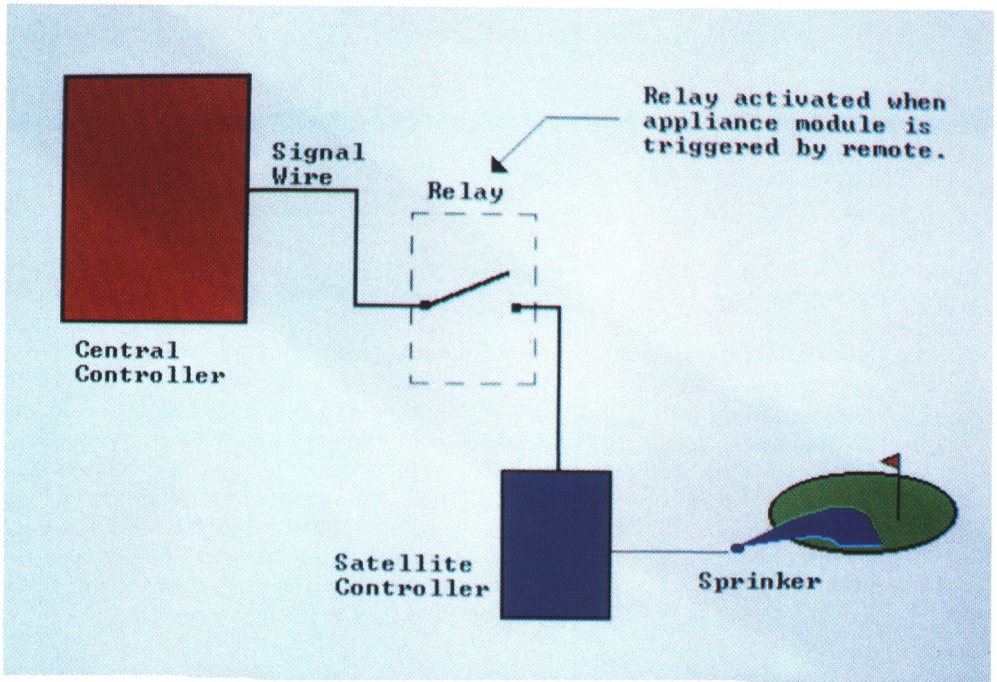
2. Conversely, another relay can be placed between the necessary voltage to start an irrigation cycle and the satellites. This relay can also be remotely activated to begin a cycle.

3. Yet another relay could be wired into the syringe circuit to allow the remote starting of a syringe cycle. This could be particularly handy on frosty mornings.

The unit pictured can control up to 16 different appliance modules. Therefore, up to 16 different switches can be opened or closed. With a little imagination, you can start an irrigation cycle, cancel it later because of rain, start a syringe the next morning to melt the frost, and turn on the shop coffee pot — all without leaving your home.



A "Miniclik" rain cutoff switch is an inexpensive yet effective way to cancel an ongoing irrigation cycle.



Graphic representation of the remote control system.

STEWARDS OF THE LAND: AN OPPORTUNITY

by GERALD FAUBEL, CGCS
Saginaw Country Club, Saginaw, Michigan

THE PRESENT TIME offers great challenges for golf course management. These challenges also represent opportunities for golf course superintendents to demonstrate their professionalism — perhaps more so than any other time in history. Superintendents must take advantage of educational opportunities and research information, and try to gain experience to meet today's challenges.

So, what are these challenges?

The sometimes negative public perception of golf courses and the need to maintain the integrity of these green spaces combine to create a challenge that the golf industry must continue to face head-on. We are on the brink of a new understanding, one that is based on scientific research of golf course uses and benefits and the ecosystems they provide. It is part of the superintendent's responsibility to help spread the word.

The concern for our environment is a legitimate one. Golf course superintendents have responded to the challenges set forth by public concern and environmental regulations. The environmental agenda will continue to create new challenges that will demand action by the golf industry. These challenges will give superintendents the opportunity to maintain a position of leadership in environmental awareness and protection. We must demonstrate our skills in golf course management, especially in the areas of environmental protection and regulatory compliance. It is important, as stewards of the land, to be leaders in the environmental arena. We must be proactive; taking a reactionary stance in regard to environmental regulations is not really an option anymore. Any incident of noncompliance can and will be magnified under close public and media scrutiny. This is something that our industry cannot afford.

Gerald Faubel

Documenting successes in golf course management and sharing these experiences with fellow superintendents is a practice that benefits the profession as a whole. We must actively involve people in our business who do not attend local and national turfgrass meetings. Volunteering to write articles for publications and offering to give presentations at state or local chapter meetings is becoming a professional responsibility.

Demonstrating professionalism can occur at several levels. Furthering your education and becoming a certified golf course superintendent, for instance, gives a superintendent credibility that is recognized throughout the golf industry. A superintendent reaffirms his or her dedication to the profession by fulfilling the continuing education requirements set forth by GCSAA.

Other activities that enhance superintendents' professional standing include community service, participation in associations and charitable organizations, and participation in local government.

Research and Technology Transfer

Developments in research and technology provide new tools to assist superintendents in effectively managing their courses. The USGA Turfgrass and Environmental Research Committee, for instance, is helping to find new ways to solve old problems. Turfgrass programs at institutions of higher learning continue to expand their research activities and provide critical information to our profession.

On the other hand, the effective dissemination of this information is just as important as the research itself. GCSAA has been a leader in the technical transfer of research and technology through its education activities and publications. GCSAA and other associations must continually seek new educational opportunities and improve existing methods of information exchange. Superintendents must have access to this information to maintain the environmental integrity of their courses.

GCSAA is currently developing an Environmental Management Program (EMP) to assist superintendents in the environmental education process. This is a unique opportunity to become recognized leaders in the application of proven, environmentally sound management practices. The EMP consists of six distinct areas of specialization: underground storage tanks; integrated plant management; employee safety and right-to-know; water quality and application; golf course development; and storage, disposal, and recycling. GCSAA has developed these areas of specialization to meet the demand for up-to-date training on environmentally

safe practices. At least 14 new seminars are being established to serve the EMP program.

As superintendents add to their skills, they also add to their earning potential. Those who have exceptional skills will be in demand and thus command a higher salary.

Use the Latest Technology Available

Diagnostic kits for the timing of pesticide applications, weather stations and computer models for irrigation decisions, and antibody tests for residue levels are technological advancements that give superintendents the scientific information they need to make responsible decisions.

Any reductions in pesticide and water use resulting from new technology should be documented. EPA is very interested in gathering information concerning pesticide application reductions. By documenting reductions in pesticide and water use on established courses, we may be able to assist the acceptance of course developments in the future. However, the documentation of this information must be started now in order to pave the way for tomorrow's golf courses.

Public Perception and Public Relations

Scientific information and technological advances are important tools in developing club member awareness and changing the public's perception about the utility of golf courses. There is a new understanding about the uses and benefits of these green spaces. Golf courses are assets to the community, and that message must be communicated to the public.

GCSAA is developing public information tools such as the GreenTips fact sheets and the video "Links with Nature" to assist superintendents in pointing out the positive benefits and golf course impacts on the environment and the surrounding community. These can be used by the club to inform members and the media and address questions that may arise concerning golf course operations.

Sharing your management experiences with others is another way to demonstrate professionalism.

The ecological benefits and non-golf uses that courses provide need to be continually highlighted in order to get the message across. This can partially be accomplished by developing contacts with your local media. Golf courses and turfgrass provide the following environmental benefits:

- Produce oxygen.
- Remove pollutants from the air.
- Cool the atmosphere (act as a heat sink).
- Absorb sound and glare.
- Prevent erosion.
- Filter natural and synthetic contaminants from rainfall and irrigation.
- Provide crucial "greenspace" in urban settings.

These green spaces also provide the following ecological and community assets. Golf courses are:

- Key sanctuary for birds and other wildlife.
- Disposal and treatment sites for effluent wastewater.
- Attractive and environmentally sound "covers" for landfills and other ecologically damaged locations.
- Sites for non-golf recreational activities, such as jogging, walking, bird watching, cross-country skiing, and fishing.
- Businesses that provide hundreds of thousands of skilled and semi-skilled jobs.
- Places for social interaction and community events.
- Community improvements that add value to land, thus increasing local tax bases.

The habitation of wildlife on courses is a subject of considerable public and media interest. If there are special instances of wildlife habitation on your course, take some pictures and contact your local media.

USGA and GCSAA are currently working cooperatively with the Audubon Society of New York in promoting their Audubon Cooperative Sanctuary for Golf Courses program. This voluntary program is an attempt to organize a nationwide network of privately owned and managed wildlife areas. The superintendent will receive informational publications and technical guidance for habitat enhancement as part of the program. Those who have taken an active role in this program will be recognized through regional and national awards programs.

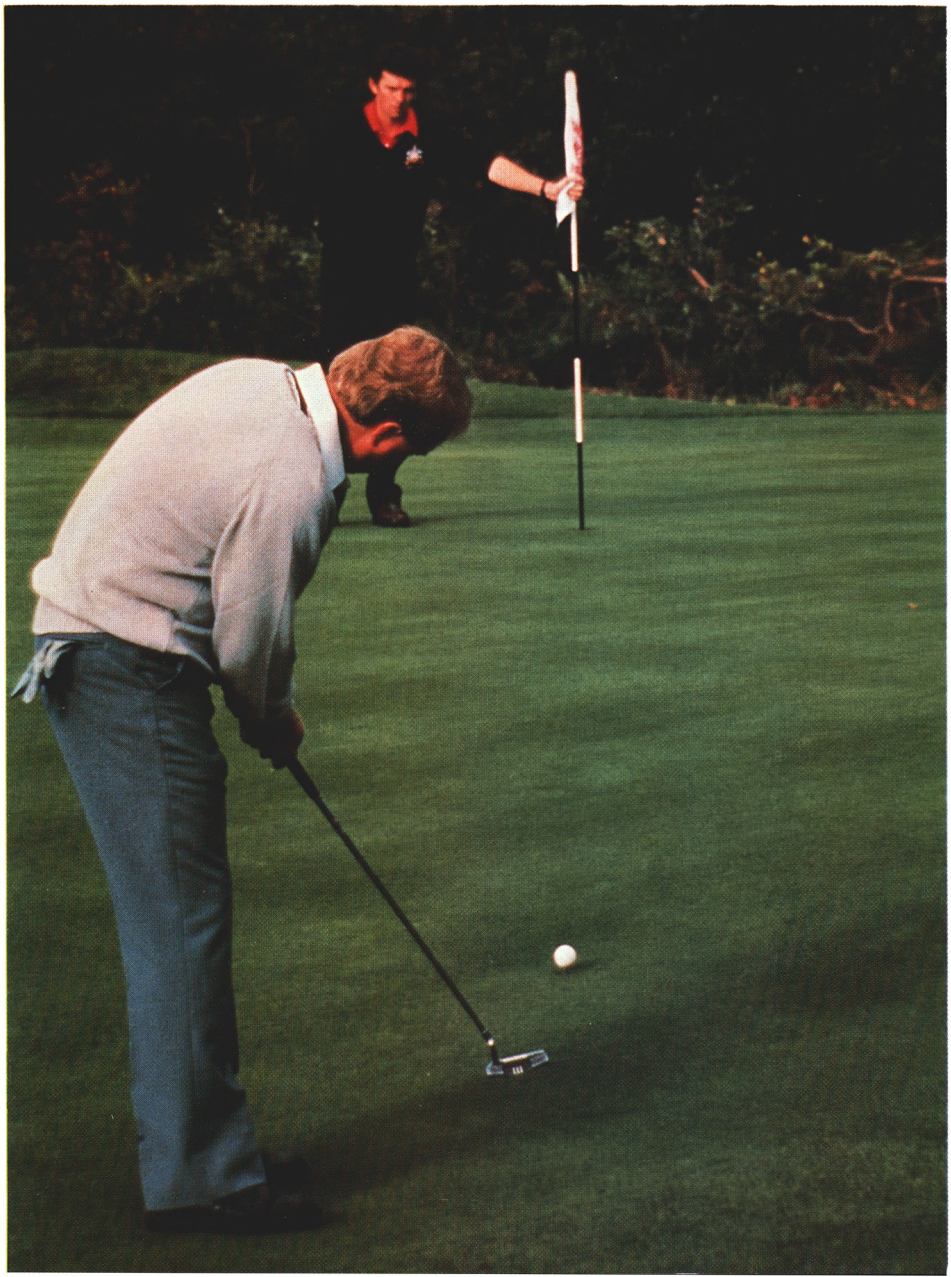
Those already involved in the game of golf are aware that the green spaces for which superintendents are responsible are more than a place to play a round of golf. It must be part of our mission to educate those outside of golf on the value of these green spaces and to reposition golf courses as public and community assets.

You, along with other allied association members, have the responsibility of fulfilling this need for a new understanding of the uses, the environmental benefits, and the community assets that golf courses provide. As superintendents, however, you must bear a greater part of the burden because of the technical expertise that you possess.

Environmental challenges are increasing in frequency, and it is essential that superintendents be knowledgeable in these areas. The USGA and the GCSAA are responding with the development of environmental programs. Superintendents must respond and continue to satisfy their need for environmental and regulatory knowledge through continuing educational opportunities.

Today it is not good enough simply to be an expert or specialist in the areas of turf and ornamental management and other management responsibilities. Superintendents must educate and position themselves as environmental specialists as well, to enhance their professional leadership position as stewards of the land.

It is important, as a steward of the land, to become a leader in environmental issues.



The Story of Shadow Creek

by STEVE WYNN
Chairman of the Board, The Mirage Hotel

THE WORK on this golf course started as a dream many years ago for me. Many personal ideas and goals contributed to the Tom Fazio design, and the dream was achieved in the final product.

Looking forward in tall grass after a misplaced shot only exacerbates your frustration and makes the situation worse. I thought a golf course should have hazards so that you had to think and maneuver to avoid them. I also thought those hazards had to be clear and pronounced; you should immediately know when you had failed, yet have the gratification of knowing when you succeeded. You should also see your ball in flight, see it flower, and see it come down. When you did it right, you should have the satisfaction of seeing it roll to a stop. And then, when you got to your ball, the green would be in view for the second shot. Never a blind shot.

I had certain ideas about water that I had gotten from visiting other golf courses. I thought that you should always look down on water, a belief that I know Jack Nicklaus has written about. You should look down on water, and if it was a waterfall, even if you weren't technically looking down on it, you should be looking straight at it as if it came toward you, from high to low. You'd always see it, and I thought that way about all hazards.

Most of all, I wanted our holes to move and I wanted them to have animation. I know a little bit about movement of line. The human eye and the human mind, when they look at a picture or a painting, if there's a line there, your eye will follow the line from beginning to end. Your eye takes that line sequentially, and it's possible to give a static picture the quality of movement. It's a very important thing to remember, because it's a law of nature and the way the human brain works. The sides of the golf course would give a golf hole movement if a golf hole had sides that were well defined. Instead of it just going straight out or taking a right or taking a left, it could meander and you could take advantage of the subtleties of movement. Now, not only do the sides of a hole move if they are well defined in the form of trees or hillsides, but ridges and changes in the earth's surface have lines and movement to them, depending on where your perspective is.

The great thing about designing a golf hole is the architect gets to put the spectator or the player at a certain starting point. It is a perfectly controlled perspective, one of the few perfectly controlled perspectives in life. We put two tee markers down and we say, "Stand here, golfer, and nowhere else, and you will look at what we put in front of you." You have a perfectly controlled perspective and you get a chance to work all kinds of magic with the human eye. You can make people feel cozy or wide and expansive. You can fool the eye by having things go from low to high or put things on a ridge where you're not sure how far away they are. You can do all kinds of tricks when you have controlled perspective.

THAT WAS the theory, the fun, and the philosophy behind the design of Shadow Creek. We had a lot of soft earth and no rock, and that meant that we could move it around relatively inexpensively. Three or three-and-a-half million yards of soil were moved about at a cost of 85 cents a yard, and it only took six weeks because it was just like moving sand at the beach.

We had a rule that we would have no landing area less than 50 or 60 yards wide. We wanted everybody to really kick back and let it rip off the tee. We were going to have hazards, but we were going to have great big wide landing areas like Augusta National.

We wanted to set the greens into the sides of a hill because we always thought that a green should be presented. It shouldn't just happen at the end of a fairway; it should be presented. This would not occur 100 percent of the time, but in the majority of the cases we wanted to present the green as a target dished up to you as if it were on a plate, so that you knew exactly what to do.

In designing this course, Tom Fazio felt that one of the dangers with starting from scratch was that the temptation would be to try and make every hole as fancy and as theatrical as we could. That wouldn't be good because in the best of all possible worlds, if we were able to maintain and get control of this job, like a Broadway show or a great book, it would have a beginning, a middle, and an end, and there would be a progression of constantly increasing interest and excitement. So if we were on our game, the best holes on the golf course would be the last two. Yet, the first and second holes have to establish the character of the golf course, and we could not take the best holes from all the different golf courses around the world.

We studied the mountains by taking pictures with a 35mm camera, enlarging the photos to about 3 feet wide and 30 inches tall and mounting them on cardboard. We made models of the holes in 1/16th scale. The pictures were placed behind the models, and then we used a periscope camera to look at the relationship between the trees, the golf holes, and their contours. It included the sky and the wonderful southern Nevada desert mountains. We wanted to take the desert out of the picture but keep the mountains, ridges, and trees.

We started with a 100 scale model of the 320 acres that was the size of a table top. All the ridges were made out of clay so that we could look at them and see that they all related to one another in a natural way. When we had to move a ridge or alter it, as time went by in the refinement of the design, we always went back to our original land plan to make sure that those ridges kept their integrity.

The one thing that I have observed, and Tom can confirm for me, is that all great golf courses have one thing in common: They have their own personality. It is a function of the terrain that they have a consistent personality of their own. Nobody has ever been able to make a golf course that has been a collection of the 18 greatest holes and have it be memorable. You have to be yourself in life, and that is true of golf courses as well. So our technique developed that we would try and move the golfer along in a series of culminations, plateaus, and crescendos. We would start off with the first and second hole and establish the character of Shadow Creek, then we would get a

little more difficult on number 3. When we get to 4 and 5, we would bring them to the first mini-climax.

The idea of number 4 is very much in keeping with the whole spirit of Shadow Creek. When you are on the number 4 tee, the water is on your left and a huge, wide landing area invites you to let it rip. As you proceed toward the green, it gets ever more narrow, ever more cozy, and the ridges around the green come in more steeply and more tightly. There is a cove of water on the left of the green, but on the other side is a steep rocky face filled with trees. I remember when we shaped the hole, we kept bringing the hillside around the green, in closer and tighter.

Number 5 is also an emotional experience, and we wanted to scare you and get your pulse rate up. I call it the big hole, no bailout, all or nothing. It is 160 yards from the regular tees, 205 from the back tees, over a 60-foot depression filled with several hundred pine trees. The green is big and large enough to catch the shot. This hole looks much more difficult than it is to play, and the way we did it is to take advantage of another trick of perspective.

The tee was placed about six or eight feet below the actual level of the green. When you stand on the tee, the surface of the green is even with your eye and you are almost looking up. That fools you as to the distance to the green. When you look at the card that says 160 yards, you are struck by the deep foreboding nature of the ravine between the tee and the green, and you say, "If my ball goes down there, it's gone. There is no safe place to play but to go for the green." We deliberately made it look a little further than it is.

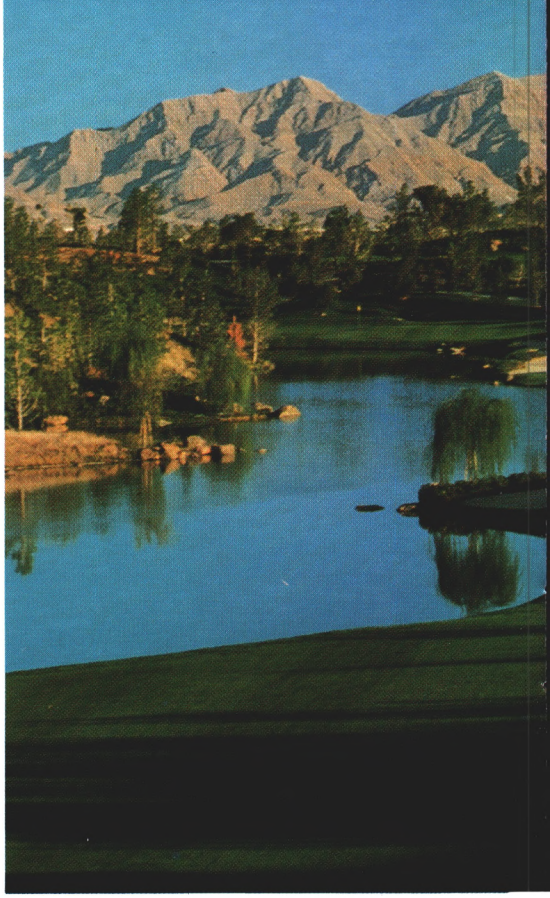
AS A KID, I thought it would be wonderful to have a golf hole where the only way you could go in is through a tunnel and the only way you could come out is through another tunnel. You could neither see it nor experience it any other way, and it would be invisible from any other perspective. A hidden place, a bowl, a valley. We could put a par 3 in there and have the tee inside the bowl so you felt completely encased in this valley with the sides planted with wildflowers. What a wonderful surprise it would be, and it would be part of the big finish of 8 and 9 as we compete the front nine. Interestingly enough, we built the golf hole first, we put the tunnels in, and then we built a ridge on top of the tunnels. This was a little different than the normal way it's done.

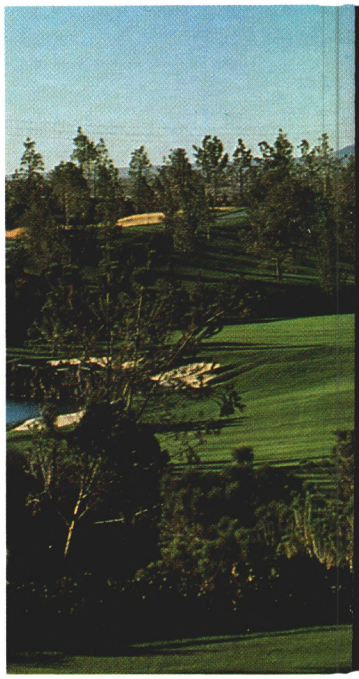
Number 9 presents a beautiful picture because we think here, as much as anywhere else, Tom Fazio's work, his blatant manipulation of nature, playing God, for lack of a better term, is invisible. This looks like it has been there forever. When you stand on this hole, you cannot remember what it looked like as a flat, barren desert. It is believable and looks like Mother Nature, and that's where I think our work was the very best. All the ridges and depressions moved as they would if it had happened by nature.

TOM FAZIO, like most great architects, has a signature habit. He loves to have a reachable par 4 on every golf course, and number 11 is approximately 300 yards and has two greens. The one on the right is heavily trapped. The second green is a very easy green as you hit over a waste bunker in the foreground and down through a narrow avenue of trees. We alternate one green into the other, which is fun to do, and it gives a special personality to number 11.

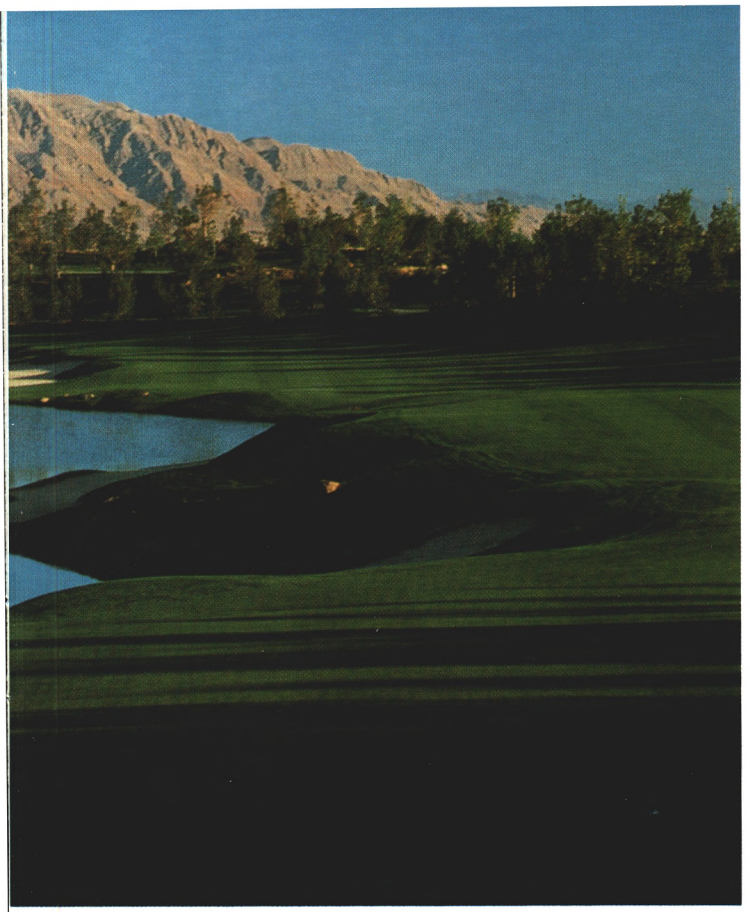
Your eye is accustomed to a couple of very simple truths: If you look at two straight lines that go parallel into the distance, they seem to come closer and converge. Similarly, it is another optical truth that as things recede and get farther away from you, they get smaller. Tom Fazio and Andy Banfield used this idea in the design of number 12. It actually is a 375-yard par 4, but when you stand on the tee, you swear it is a par 5. A series of sand traps were placed down the left and the right sides of the hole as you proceed toward the green. These parallel sand traps move closer together and get smaller so that the two traps closest to the green are rather tiny. The fairway gets narrower, comes to a point, and makes the green seem about 470 yards away. We absolutely fooled the golfer for 125 yards.

If you build a creek on a golf course, you have to do it foot by foot on both sides of the creek bed. You just can't bring the grass down to the water; that's not the way Mother Nature does it. Creeks are carved from the earth and they erode. The creeks were steeply cut and carved as if the high-speed water coming out of the mountains had made the creek sides steep. Rocks were installed to look like they have been exposed by erosion. These rocks were placed in the sand and dirt, and turf was put around them. As you get down by the tee, the creek bed widens and flattens out as if it has lost some of the force that Mother Nature gave it as it came out of the steep mountains.





The builders started with a blank piece of desert. They hadn't built the fairway and they had done no contouring. Hundreds of various size boulders and stones were brought in and dumped in a string along the desert. The boys would move the rocks around with a forklift. They would stand in the desert and look at this big stone in the middle of the dust and say they were visualizing



(Above left)
Shadow Creek Golf Course hole number 6.

(Above)
Shadow Creek Golf Course hole number 10.

(Left)
Shadow Creek Golf Course hole number 17.

the stream. Two young men built that creek, piled up the sides, put in all the landscaping, built the fairway around those rocks and made Michael's Creek look like it was created by nature. Every time I go out there, I walk up the left side of that hole and I look at that creek and I still cannot get over it.

Tom was under a good deal of pressure for a big finish when we got to the 18th hole, and he let it all go. When you're on the tee, you are in the trees, but if you walk to the back of the tee, you can look over the ridge, down onto the desert the way it was before we built Shadow Creek. We deliberately left a window there so you can see the before and after shot. On the 18th hole, where construction and manipulation of the earth was at its maximum, we wanted you to be able to look out and see what it was all like before construction started.

It is a wonderful thing when people have a chance to work together on a project in pursuit of excellence and not have to compromise. That's a rare privilege and a wonderful moment in life. Anyway, that's what you can do in the southern Nevada desert with a pile of money and a couple of bulldozers.

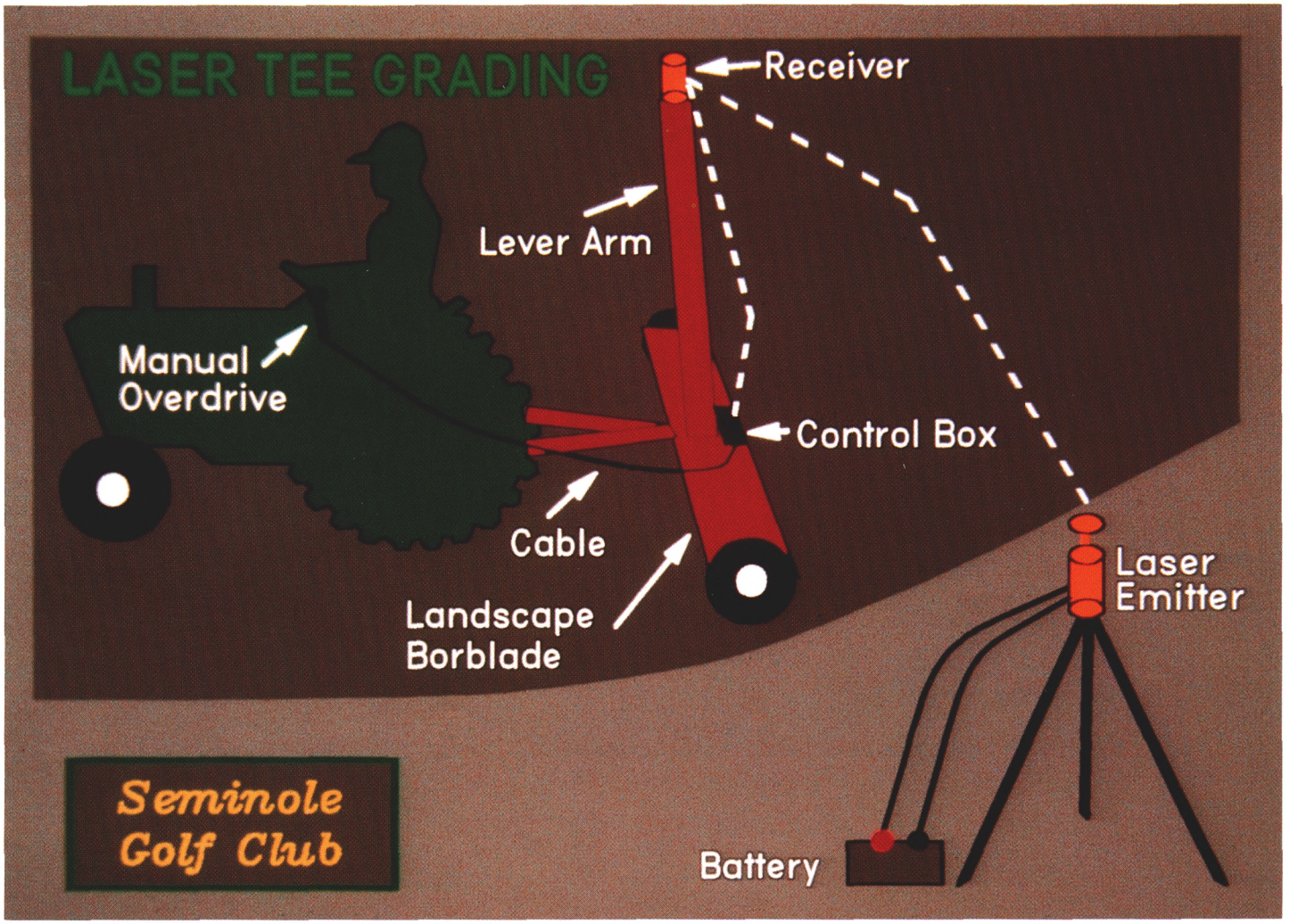
Tee Construction with Laser Technology

by PATRICK M. O'BRIEN
Director, Southeastern Region, USGA Green Section

CONSTRUCTING level tees is a big challenge for golf course builders and golf superintendents. Traditional grading techniques many times result in surface irregularities. A new laser grading technology, however, is a faster and more efficient method for tee construction today.

The Seminole Golf Club, in Florida, recently rebuilt its tees using the new laser tee-grading operation. The essential equipment includes a tractor, a landscape boxblade, and the laser apparatus. A laser emitter is stationed adjacent to the tee and is programmed for the amount of slope associated with the nearby terrain. The laser emitter rotates and sends a signal to a receiver mounted on the lever arm of the landscape blade. The receiver relays this signal to the control box on the boxblade itself. The control box connects to the hydraulic lift, which commands the rise and fall of the boxblade based on the laser beam

The laser tee-grading equipment is stationed adjacent to the tee and sends a signal to a receiver mounted on the boxblade.



Laser grading technology aids in the construction of level tees.

signal to the receiver. A manual override also exists, which allows the tractor operator to make soil adjustments, if necessary.

"A golf superintendent can spend two to three days leveling a tee with a transit, and I'll take a laser-guided boxblade over that tee and discover inaccuracies with just one pass," says Hal Hicks, Seminole's golf superintendent. The boxblade produces a flawless surface as long as the rootzone mixture is free of debris and old roots.

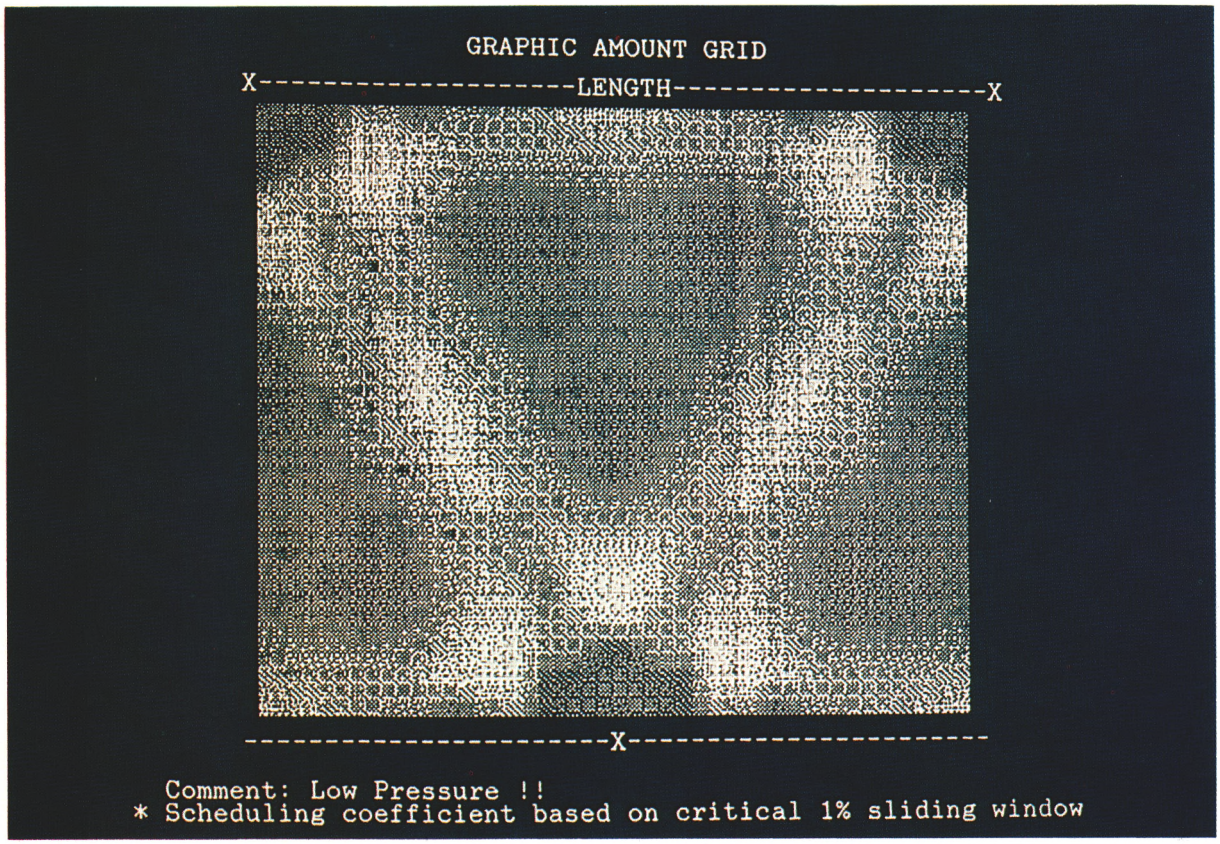
The laser method is also faster than using a transit, according to Superintendent Hicks. All tees on a golf course are easily constructed in 7 to 10 days with the laser grader method, compared to 40 to 50 days with other methods. Golf course renovator Ed Connor, who uses this technology, did the Seminole project.

For smaller tees, a modification of this laser technology is possible. The Honors Club, in Tennessee, didn't have enough room for the tractor and boxblade to operate on their smaller pod-type tees. Instead, a method similar to laying a concrete foundation was selected by golf superintendent David Stone. However, the laster emitter, rather than a transit, determined all perimeter stake elevations. A unique wooden border, set one inch above the grade with a laser emitter, allowed for accurate placement of the rootzone mixture over the subsurface. Once the new rootzone was compacted through vibration with a concrete finisher, a flat board was pulled across the foundation border for final grading.

The new laser tee-grading operation has helped these two golf courses. For new golf courses or older tees that have become unlevel, consider using this technology for the most level tees ever at your golf course.

Sprinkler Uniformity Evaluation

by PAUL VERMEULEN
Agronomist, Western Region, USGA Green Section



The heavily shaded areas indicate dry spots in the irrigation area.

IN THE PROCESS of evaluating the performance of an irrigation system, many of us have become well versed with the importance of proper sprinkler head spacing, mainline looping, and pumping station and operational pressure. Having checked all of these major system components, the final step is to take a closer look at how evenly the sprinkler head itself distributes water over the course.

The distribution of water from a sprinkler head using information taken from a typical rain gauge test is plotted on a graph. The X-axis is the distance of the rain gauge from the sprinkler head, and the Y-axis is the amount of water captured in each rain gauge. While this chart shows us the water distribution for a single sprinkler head, it fails to reveal the water distribution when operated in relation to its neighboring, or backup sprinkler heads.

A computer program developed at the University of California, Fresno, Center for Irrigation Technology under the direction of Kenneth H. Solomon reveals a figure showing what happens with respect to water distribution. This figure, referred to as a "denso-gram," is based on the same information as the graph for the single sprinkler head. The lightly shaded areas of the denso-gram indicate wet spots, whereas the darker areas indicate dry spots.

To interpret the meaning of the denso-gram, the computer also generates a scheduling coefficient. This value indicates the amount of extra water required to provide enough moisture to the dry areas indicated on the denso-gram. For example, if the pumping station is capable of applying 0.2 inches of water every 30 minutes, then the irrigation cycle must be scheduled for 51 minutes (30 × 1.17) in order to adequately moisten the critical areas. Naturally, this is a waste of water and a needless expense from the standpoint of water and electrical costs.

In the Southwest, reducing the scheduling coefficient is vital for water conservation; however, this Turf Tip can also be used in other areas of the country for improving turfgrass quality. For example, take a case where dry spots in the fairways require hand watering during the summer months, or where wet spots are affecting playability. More than likely an effort has been made to check sprinkler head spacing, mainline looping, and pumping station and operational pressure. If so, the time has come to check sprinkler head water distribution by using this new technology.

If you would like information, contact: The Center for Irrigation Technology, California State University, Fresno, CA 93740, (209) 278-2600.

HELP FROM ABOVE

by JAMES CONNOLLY
Agronomist, Northeastern Region,
USGA Green Section

A helicopter effectively moved the bridge when soil conditions were too soft for heavy equipment.

GOLF COURSE superintendents need ingenuity to solve unforeseen problems, but John Adamonis, superintendent of the Spring Valley Country Club, had people "looking up" to find his solution.

Spring Valley Country Club, located in Sharon, Massachusetts, was constructed in 1960. Almost from the beginning the club was faced with drainage problems due to its flat terrain and inadequate drainage channels. To overcome the problem, engineers determined that many of their drainage canals needed to be enlarged. The project involved digging out the existing brook system, stabilizing the banks, lining the canal with geotextile blanket, and covering with rip-rap rock.

The reconstruction was scheduled during the winter, when the membership was absent and the course was closed. Heavy equipment operations on the frozen turf would minimize damage to the fairways and reduce soil compaction. A very cold December provided ideal conditions for the operation of heavy equipment. January and February brought warmer temperatures, but by March conditions had deteriorated to the point that the staff was faced with a roadblock for completion of the project. Many tons of rip-rap rock and four two-ton bridges had yet to be installed.

The staff brainstormed for ideas of a way to move the rock without the heavy equipment while still completing the project by the time the course reopened in spring. After much deliberation, a suggestion was made to move the rock by air. After contacting seven airfields, John Clark of C&W Ag-Air, a specialist in heavy construction lifts, was located and hired.

With a crowd of onlookers, 2,000-pound loads of rip-rap were placed on military-issue tarps. The tarps were lifted "knapsack style" and released in the desired location. After a few trips, the pilot had mastered the technique so that he could release one side of the tarp, laying the rip-rap into place with precision. Minimal handwork was required to finish the area.

Careful planning allowed 25 tons of rip-rap and four 2-ton prefabricated bridges to be put into place in about 1½ hours. The total cost was approximately $2,500, which was considered reasonable compared to the cost of contracting heavy equipment and the amount of work that would have been needed to repair damage to the turf and soil.

Picturesque rip-rap channels now thread through the golf course along with the new bridges. This demonstrates yet another example of today's golf course superintendent applying his flexibility and imagination to succeed in the face of a unique challenge.

Using Your Head and the Golfers' Feet for Better Grass on Small Tees

by STANLEY J. ZONTEK
Director, Mid-Atlantic Region, USGA Green Section

"THIS TEE is simply too small to handle the traffic it receives" is a commonly used explanation for why turf is in poor condition on a particular tee. This problem is especially common on public golf courses which typically receive heavy play and on private golf courses which receive nearly the same amount of traffic. In some parts of the country, this small tee/heavy play problem is made less severe by growing aggressive grasses, such as bermudagrass, in combination with overseeding in the fall with perennial ryegrasses.

In areas where bermudagrass cannot be used, however, golf course superintendents must rely on periodic reseedings to maintain some type of grass cover on small tees. Unfortunately, this practice is rarely successful in the Transition Zone, where crabgrass and goosegrass thrive in the summer. Normally, tees begin the season with a good stand of grass due to overseeding the previous fall and the use of temporary tees during the winter. A preemerge herbicide is routinely applied during the spring to control crabgrass and goosegrass. Regretfully, preemerge herbicides do not distinguish between germinating weed grass seeds and turfgrass seeds, so most reseedings into treated tees usually result in a poor catch. Besides, goosegrass tends to germinate in the divots. Needless to say, trying to grow a good stand of weed-free grass on small, heavily used tees in the Transition Zone has been an exercise in futility . . . until now.

Following is a tip on how to break this cycle. It is the result of several ideas coming together, two derived from science and one from common sense. In years past, golf courses lacked a truly effective and safe postemerge herbicide for crabgrass and goosegrass control, but this changed with the introduction of Acclaim. This product seems to have a particularly wide margin of safety on perennial ryegrasses, giving the golf course superintendent the option of using postemerge instead of preemerge herbicides for crabgrass and goosegrass control. This program also reduces the total amount of chemicals applied to the soil.

The next step is to look at another product of science, the turf-type perennial ryegrasses. Ryegrasses exhibit extraordinary seedling vigor and can germinate and develop a stand of grass far more quickly than creeping bentgrasses, Kentucky bluegrasses, or fescues.

The perennial ryegrasses also are some of the toughest and most wear-resistant turfgrasses available. Once established, they handle foot traffic

Reseeding to perennial ryegrass.

better and can sometimes recover from divoting due to their deep crowns. They also are quite tolerant of close mowing, producing good-to-excellent turf quality even under heavy traffic.

The next step is establishment. Though various overseeding equipment can be used, including aerators, slicers, and seeders, Mr. Lou Rudinski, golf course superintendent of the Eisenhower Golf Course in Annapolis, Maryland, uses an interesting and common-sense approach in overseeding his tees. Periodically during the year he simply broadcasts seed on his non-preemerge tees and lets the foot traffic of the golfers push the seed into contact with the soil, where it germinates and grows. It sounds so simple, yet it works very well!

Following is a general outline of his tee management program:

1. Tees are routinely aerated, sliced, and seeded in the fall using perennial ryegrass blends (selected for their performance in Maryland) at a rate of 10 lbs. per 1,000 sq. ft.

Tees are maintained at ⅝-inch cutting height.

A total of about 5 lbs. of nitrogen per 1,000 sq. ft. as a complete fertilizer is applied during the growing season. Most of the fertilizer is applied in the fall, with lighter applications made during May and June, and light applications of a soluble material are put down during the summer months.

2. The tees are reseeded at a rate of 4 to 5 lbs. of perennial ryegrass seed per 1,000 sq. ft., approximately 4 to 5 times per season. The larger tees usually receive less seed, and the more heavily used par-3 tees are reseeded more frequently and/or receive more seed. The seed is broadcast over the surface and the golfers' traffic presses it into the soil.

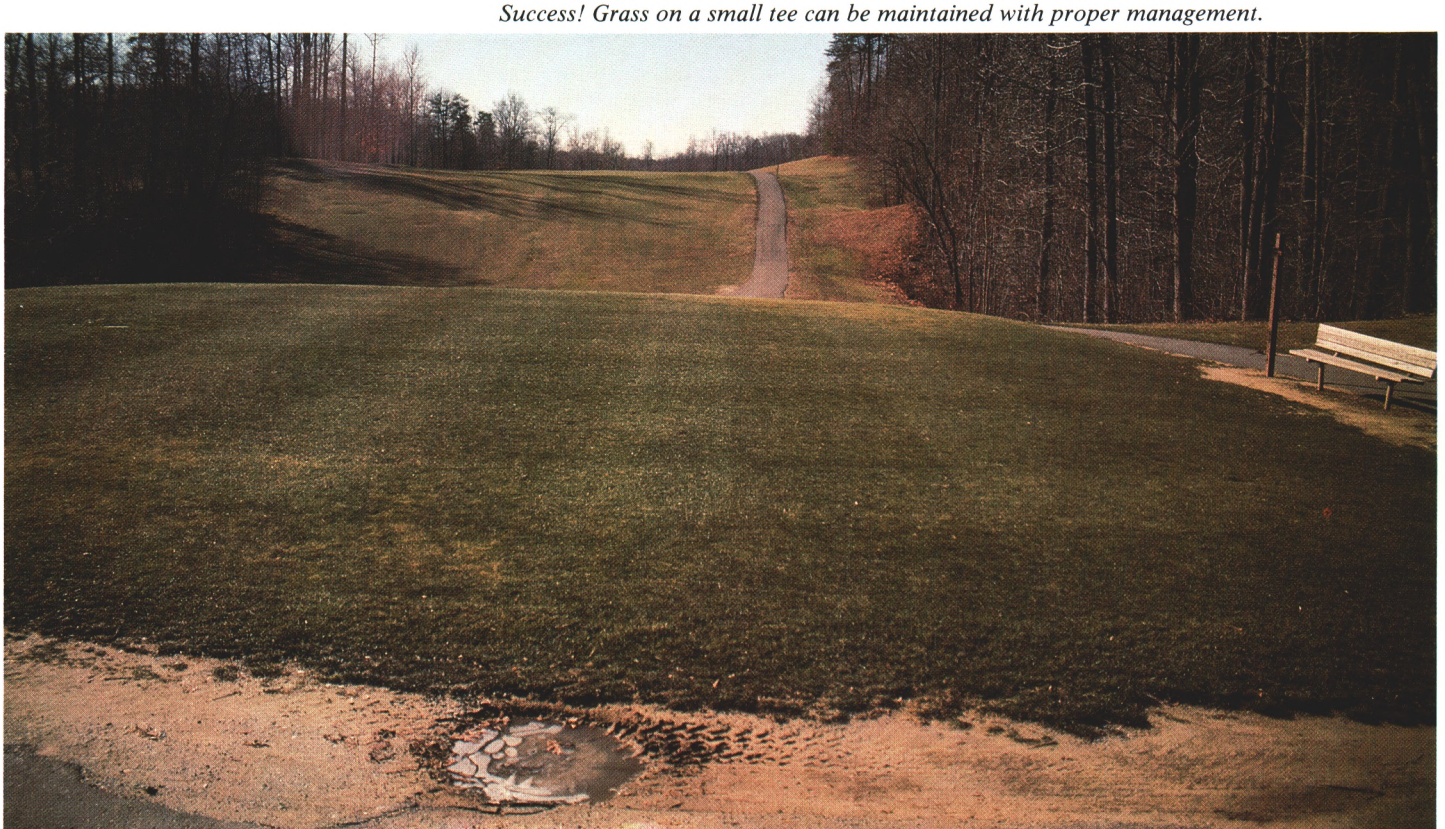
3. The irrigation program is not altered for the sake of the seeding work. The perennial ryegrasses seem to germinate just fine using normal irrigation cycles, without the need to overwater the tees.

4. Normally, two applications of Acclaim at the lightest labeled rate normally controls any crabgrass or goosegrass that may develop.

In the fall, the cycle begins again with step 1.

Briefly, the Eisenhower Golf Course receives more than 50,000 rounds of golf per year. The tees are small, but as a result of this program, they now have grass on them. Mr. Rudinski and his staff have put a number of different ideas together to create a successful program. They used their heads and the golfers' feet to help them grow grass on their small tees.

Success! Grass on a small tee can be maintained with proper management.



TURF TWISTERS

TIME IS RUNNING OUT

Question: We want to perform preventive maintenance on our equipment based on the hours it has run. Unfortunately, not all equipment comes with hour clocks, and on those that do, the clocks seldom last the life of the machine. Any suggestions other than buying new, expensive clocks? (Kansas)

Answer: Almost every shop has a time clock for keeping track of employee hours. Make cards for each piece of equipment you want to monitor and have the operator punch the card when the machine leaves the shop and as it's returned. Your mechanic also could punch the back of the card whenever he works on the equipment to monitor how much down-time occurs with the machine. The type of repair performed also can be recorded on the card next to the down-time.

TO INVEST IN TOMORROW —

Question: We have hundreds of deciduous and evergreen trees on our golf course that pose year-round cleanup problems. I am having trouble convincing the Green Committee at our low-budgeted golf course to invest in modern cleanup equipment. Is this equipment justifiable? (Oregon)

Answer: Proper cleanup equipment is absolutely justifiable on any golf course with numerous trees. In many cases, multiple sweepers and tractor-mounted blowers are recommended. However, the addition of a large-capacity sweeper and tractor-mounted blower would do wonders in minimizing hand labor. These labor hours can be transferred to more important areas of your operation.

JOIN THE AUDUBON COOPERATIVE SANCTUARY PROGRAM

Question: During the past few years, our club has been interested in creating a more natural look on our golf courses. We have done some work with wildflowers and native grasses. Do you have any other suggestions? (Delaware)

Answer: Absolutely! The USGA, in cooperation with the Audubon Society of New York State, is promoting the Audubon Cooperative Sanctuary Program for golf courses. Participating golf courses work constructively to incorporate wildlife and resource conservation projects throughout the golf course. Contact the Audubon Society of New York State (518/767-9051) and they can provide all of the details.