Julius Albaugh, CGCS, and Frank Heery
Westmoreland Country Club

Aggressive Green Aerification: A Case Study

Waterwick on no. 15 green.

In order to understand the thought process associated with our greens aerification program, it is necessary to provide a brief history of the course. The golf course at Westmoreland Country Club was designed and built by Joe Roseman in 1911. During the 1940s and 1950s, all greens were rebuilt. Onsite, a 1-1-1 mix was used, the soil being our native soil. Greens 8 and 14 were the last to be rebuilt, and they differed as a coarse sand was used. This mixture was very high in organic-matter content. The early 1970s saw the lengthening of the 11th hole and rebuilding of its green with imported soil, primarily clay. During the 1992/1993 golf course renovation by Arthur Hills, the 6th and 13th greens were rebuilt to USGA specifications.

The Decision

In November of 2001, International Sports Turf Research Center (ISTRC) sampled and tested all of the greens. ISTRC tested the greens for the following: infiltration rate, subsurface air capacity, water porosity, bulk density, water-holding capacity, organic content 0″–4″, organic content 4″–8″, root mass and feeder roots. Needless to say, the results of these tests were both startling and disheartening. Our clay push-up 11th green had an infiltration rate of 0.00 [IN/HR] and an average organic-matter content of 5.6%. (Miraculously, this green has never had poor turf-quality issues.) Our "best" native-soil green had an infiltration rate of 3.00 [IN/HR] and an average organic-matter content of 5.0%. Matt Poulis from ISTRC probably summarized the condition best when he stated, "This was probably pretty good soil at one time—maybe 65- to 75-thousand years ago."

Westmoreland Country Club clubhouse.

Up until the early to mid-1980s, this poor soil actually sufficed as an acceptable growing medium for quality turfgrass conditions. It was in this time period that some premier courses, including (but not limited to) Augusta National, began dramatically raising the bar, in conjunction with golfers' expectations, by lowering mowing heights and increasing the overall speed of the playing surfaces. Sand topdressing, brooming and verticutting all became standards. These new standards, combined with green mowing heights eventually being lowered from 0.200 to 0.100, have had an impact that has reverberated through the industry and dramatically affected the turfgrass quality on Westmoreland's greens.

(continued on page 12)

Based on these results, it was recommended to the board of directors to completely rebuild the greens to USGA specifications. Due to the primary cost of the construction, the secondary cost of the loss of revenue and the tertiary cost of inconvenience, the board opted not to pursue the ideal option of rebuilding. This decision gave us an unenviable task—find an alternative method/methods to improve our greens from the surface, down. The initial idea (prior to the ISTRC test results) was to methyl bromide the greens and reseed with one of the newer bentgrass cultivars. As this idea was pursued, it became obvious that some degree of soil modification was necessary. With input from various committees, the project started to morph into what most, if not all, superintendents are familiar with. (An unrelated example would be, "Well, if we're going to dredge the ponds and install a new irrigation system, maybe we should reconstruct the bunkers, and if we're going to reconstruct the bunkers and dredge the ponds, well then maybe we should build some new tee boxes with the dredge material." Etc., etc., etc.) The cost of regrassing the greens, approaches and green surrounds (the latter to provide a buffer zone against *Poa* encroachment), soil modification, and loss of revenue was still extremely expensive. We decided to try to simplify the process using the following analogy: "If you're going to build the house of your dreams, it probably doesn't make much sense to build it on a poor foundation." With that in mind, we finally recommended pursuing the soil-modification program. We felt that once we had worked the soil into a decent growing medium, it would then make sense to pursue (if necessary) regrassing. This approach would also buy us some time to remove trees around greens and install a new irrigation system, both of which would be essential if we eventually opted to regrass.

The Process

In April of 2002, we aerified the greens using the Ryan GA-24s with 5/8″ tines. We collected the cores, gradened the greens in two directions, overseeded with A-4 and used subcontracted labor in conjunction with our crew to push-broom sand (45 tons total) into the aerification holes. The soil-modification program began in earnest on October 7, 2002 when the Waterwick machine arrived. The Waterwick is basically a three-pronged vibratory plow pulled by a Case maxicreeper. The plows are on one-foot centers, and "cut" a 5/8″ wide by 12″ deep trench into the ground and backfill the trench with the superintendent's desired material. Initially, we entertained the idea of only running the Floyd McKay drill-and-fill machine to modify the soil. This is a machine that can drill (at maximum) a 1″ hole to a depth of 12″. Over a four-year duration, Congressional Country Club in Bethesda, Maryland used the Floyd McKay no less than 60 times on the Blue Course greens in preparation for the 1997 U.S. Open, effectively modifying the greens mix. Congressional had poorly built USGA greens. The sand used to construct the greens had a rounded particle shape, creating poor growing conditions, therefore Congressional used an angular sand to improve the growing medium and firm the playing surface. Although Congressional was dealing with different soil conditions, the theory remained the same: out with the bad, in with the good. Congressional had two advantages over Westmoreland: first they owned a drill-and-fill machine so they could use it at any time, and secondly they had four years to complete the process as many times as possible. At Westmoreland, we were presented with a minimal amount of time for soil modification, and we had to subcontract the machines. After further research, we discovered that it was only realistic to drill and fill a green four times without hitting holes previously aerified with the machine. Discussions with Dan Dinelli at North Shore Country Club provided a valuable insight into a potential pitfall using this method. (After we complete the process and we get major rainfall in late July or August, "Where does the water go?") If we were to encounter this scenario, we would have effectively created a bathtub and thus increased the potential for catastrophic failure.

No. 18 green after completion of the Waterwick. (Note scarring in bottom-right corner.)

We first encountered the Waterwick machine during the 2001 GCSAA national conference. Here was a machine that could incorporate 10 times the amount of sand (versus the drill-and-fill) and provide subsurface drainage to greatly reduce the bathtub effect created by the drill-and-fill. It was felt that although this machine had been seldom used on greens, it would provide an excellent starting point in addressing the soil-modification and drainage issues associated with our greens. The Waterwick process began October 7, 2002, and we completed 210,000 square feet on October 26, 2002.

Drill-and-fill machines in action.

In 19 days of using the Waterwick machine, we incorporated 420 tons of flint 12 silica sand into our greens. The flint 12 silica sand was chosen for its drainage capabilities and its compatibility with our existing soil and topdressing material (this required additional testing using ISTRC). Another 60 tons of sand was incorporated with a single (double on selected greens) pass with the drill-and-fill machines using 1″ drill bits to a depth of 10″, and the greens were rolled several times with a one-and-a-half-ton vibratory roller. Following these processes, we conventionally aerified with 1/2″ tines on the Ryan GA-24 quad-tine package. We collected the plugs and used 100 tons of sand to fill the aerification holes. Once we had completed the conventional aerification, we gradened the greens in two directions, overseeded with A-4 and T-2 bentgrass and topdressed with an additional 30 tons of sand. Just prior to the winter of 2002-2003, the greens were blanketed with 60 tons of sand. In the spring of 2003 we vertidrained the greens using 3/4″ hollow tines, followed by 1/2″ tines on the quad-tine package and gradened in one direction. After overseeding with A-4 and T-2, we were able to incorporate another 125 tons of sand. We repeated this process in the fall of 2003 and again in the spring of 2004.

Results

ISTRC again tested the greens in August of 2003. These results indicate that on average the infiltration rate has increased by 0.75 [IN/HR]. Organic matter on average had dropped one full percentage point. The 2003 season was difficult at Westmoreland because of the cosmetic "scarring" that remained after the Waterwick process. Even though we had incorporated a tremendous amount of sand, the playing surfaces remained bumpy and there were areas on the heavier-soiled greens that remained "heaved" despite countless rollings with the one-and-a-half-ton vibratory roller and Salscos. Frequent topdressings (60 tons of sand applied on a three-week average) were used in an effort to smooth the playing surfaces. To eliminate the "scarred" areas, we used A-4/T-2 plugs from our nursery, in addition to an increased overseeding practice. The Waterwick is an aggressive machine, and not for the faint of heart. Any greens that had a poor root structure prior to the process (less than 3″) were at the complete mercy of the machine and received the highest percentage of damage. High-percentage *Poa* and shaded areas were the most susceptible. "Scarring" in these areas remained until the spring of 2004. From an observational standpoint, there are several encouraging observations that have been made on the greens this season.

1. The drainage is vastly improved—prior to the process a half-inch of rain at midnight was enough to disrupt/cancel our a.m. greens-mowing schedule.

2. The root structure is improved. Our average root depth varies between 4-1/2″ to 5-1/2″.

(continued on page 15)

When our cup-cutters find a drill-and-fill hole, vertidrain hole or Waterwick channel, the root depth varies from 9″ to 16″ and fortunately we have a high percentage of these areas.

3. The overall plant health and turfgrass quality is very good.

4. Prior to the process, green speed (specifically the lack of) was a major issue. We used to double-cut, double-roll, mow at 0.090, all in an effort to generate speed. Currently we can single-cut, single-roll and mow at 0.102 and easily achieve our desired speeds.

Obviously these observations must be put into perspective. The Chicagoland area to date has not received a true heat wave. From a grass-growing standpoint, Mother Nature has been extremely kind this year so our greens have not truly been tested—yet. In all honesty, it is perfectly acceptable with us if these weather conditions persist and the greens do not receive a true heat test. One observation that is readily apparent is that if the dog days of summer do arrive, we will be able to meet the challenge with much stronger turf than in years past.

Completed green.

One-and-a-half-ton vibratory roller.

Completed product.