Silt and clay in sand can block greens' drainage

Many options allow superintendents to protect the quality of the sand in their greens' root zones.

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Key points

- Dirty sand can damage the drainage qualities of a green even if tests show that the sand particles are of optimal size.
- Silt and clay particles can enter a root zone from many sources.
- Washed sand is best for new construction.

The construction of a golf course putting green can be very expensive. Through many years of research and experience, some very specific criteria have been developed for the materials that go into the green and the way these materials come together to produce the green.

All this trouble and expense is related mainly to water drainage, especially vertical or internal drainage. Poor drainage has always been the No. 1 enemy of the golf course putting green. The quality of the putting surface can be so easily affected by the results of poor drainage.

Sand has become the key ingredient in green construction. In past years, it was very common for a golf course to be built with push-up greens — mounded native soil. Most native soils have significant clay content. Clay tends to hold water and reduce drainage. These greens relied mostly on surface drainage, and a turtle-back design was not uncommon. They had very little internal drainage.

As golf became more popular and the number of rounds increased, native soil greens began to lose putting quality. Turf thinned and lost density. The problem was soil compaction. It became apparent that there was an inverse relationship between the clay content of the green and the number of rounds the green could support without declines in turf quality. As the percentage of clay in the green was reduced, more rounds could be played without damaging the green.

Ultimately, it became evident that even a small percentage of clay in a green's root zone could have a negative effect on internal water drainage. Greens then became nearly 100 percent sand. Because, by definition, the term "sand" refers to soil particles ranging in size from 0.5 to 0.25 millimeters, it was determined that particles smaller than 0.25 millimeters and larger than 0.5 millimeters were not desirable. Greens constructed by using sand in this "ideal" particle-size range have proved to have excellent drainage. Why then, do some new greens built from the best materials, using current construction standards, fail before one season of play has passed?

Dirty sand

These failures are caused by very fine soil particles finding their way into the green and plugging up internal drainage pathways. How can this happen when so much care is given to construction? It is possible, and maybe not too uncommon, that the sand that has passed the sieve test and is the correct particle size is "dirty." It may be coated with very fine clay particles. After the green is constructed using dirty sand, the clay particles will wash off the sand and accumu-

Photos courtesy of William Knoop

"Washed" sand may not readily reveal contamination from silt and clay particles.

late in the soil profile. Now the green is in trouble. Drainage is reduced. The turf may begin to thin, and the green may be susceptible to disease attack.

It's easy to check sand as it is being delivered to make sure it meets particle-size criteria, using a set of commercially available sieves. It's also easy to check the sand for "dirt." Put a sample of the sand in a clear container, shake it up and see just how dirty the water becomes. Let it sit for a few hours and find out just how much very fine, undesirable material that sand would add to the green. Washed sand should always be specified for the construction of greens and for topdressing, but it doesn't hurt to grab a sample or two just to make sure. Once the "dirt" gets into the green, it cannot be easily removed.

Dirty water

Dirty sand is one possible source of contamination, but there are others. Dirty irrigation water can be a significant source of clay particles. Many courses use lakes or ponds to capture and hold runoff water for irrigation. Because water is expensive and somewhat limited in some parts of the country, it makes good sense to capture and hold as much water as possible. The problem begins if soil is allowed to erode into these future lakes and ponds during course construction. Erosion can be so severe that a high percentage of the lakes' capacity can be lost before they're filled.

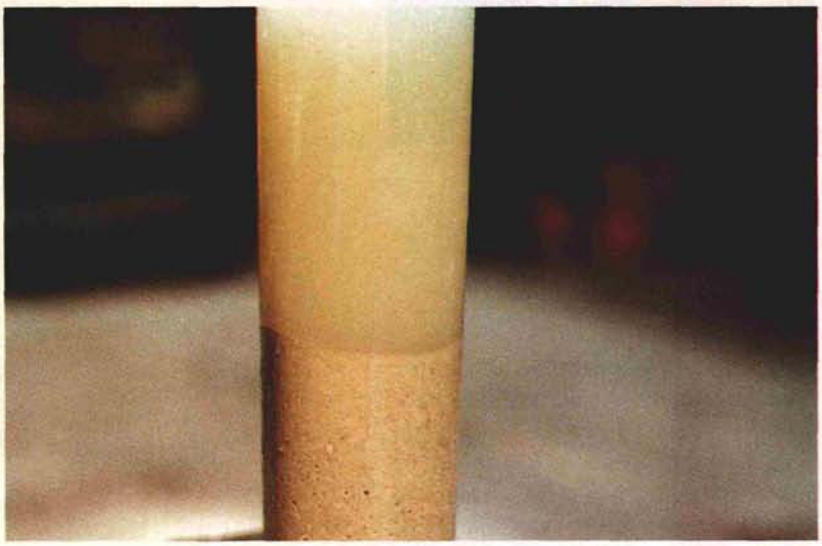
If the irrigation system's intake is at the bottom of the lake or pond, or pointed toward the bottom of the pond, loose material may be sucked into the system. The intake must be located so it does not pull water from the bottom of the lake or pond.

If possible, the mud should be filtered from the water, especially if the water is intended for irrigating greens. The source of irrigation water may be directly from an already muddy pond or river; there may be no holding pond at all. Set out a few clear glass containers to catch water samples the next time the irrigation system runs. Let the water settle for a few hours and find out just what, if any, material is being deposited

on the greens via the irrigation system. As much as greens are irrigated, it doesn't take a lot of muddy water to plug up the system.

Topdressing

One further source of "dirt" may be associated with any organic material that was used in the original green mix or is being used as part of the topdressing. Ideally, organic matter should decompose completely and leave nothing behind. Any residue left behind after organic matter decomposition may also reduce drainage. There is a lab test that reduces organic matter to ash. The amount of ash in relationship to the original weight of the sample determines the percent of non-decomposable material in the organic sample. The cleaner the sample, the lower the percentage and the lower the chance of reducing drainage.



When placed in water, an unwashed sand releases a cloud of smaller particles that are not wanted in a putting green root zone.

After settling in water, a layer of silt and clay particles from a sand sample rests on the top of the sample.

Fallout

Clean sand, clean water and clean organic matter are all more or less controllable, but one source of very fine particulate material being deposited on greens is not controllable — atmospheric fallout. The potential for fallout varies across the country. It can be fairly significant.

The golf course putting green must be protected from every possible source of contamination. Part of the defense against this kind of contamination must be the use of the core aerifier, assuming that clean topdressing is used to fill the aerifier holes. The ideal is to replace any dirty sand with clean sand.

In a way, the life or death of a putting green depends on its vertical drainage. As vertical drainage becomes inhibited, the life of the green is shortened. Some golf courses rebuild their greens to modernize the design, but many others are forced to rebuild because of poor drainage. Clean sand, clean water and clean organic matter must be considered in the overall green construction and management program. There is no question that if they had been, more than one course might not have had to spend hundreds of thousands of dollars to rebuild greens. ■

References

1. Hummel, N.W., Jr. 1993. Rationale for revisions of the USGA green construction specification. *USGA Green Section Record* 32(2):7-21.
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