Extending the Life of Bunker Sands

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DID YOU know that sand begins to age the moment it's placed in a bunker? If you've never thought about the aging process of sand and its implications for the playability of your bunkers, then read on.

The life cycle of a bunker sand typically begins when it is installed in the bunker. At that time it is usually as soft and fluffy as it ever will be, and its appearance will never be better. With repeated rainfall or irrigation, the sand gradually becomes more firm. The primary aging factor affecting bunker sands is the contamination that happens over an extended period of time, involving the mixing of silt, clay, and organic matter with the sand. As this occurs to a greater and greater degree, the sand goes from soft to firm to hard, and its appearance deteriorates as well. Eventually, when the golfers at the course become upset enough, the contaminated sand is removed and replaced with new material, and the cycle starts again.

The replacement of sand in the bunkers at a course is time consuming and expensive, and it is obviously not a process that anybody likes to see done more often than absolutely necessary. By understanding the causes of sand contamination, it is possible to implement preventive measures that can prolong the life of new sand for many years.

Sand Selection

Extending the useful life of new bunker sand begins with proper sand selection. Depending on such factors as particle size range, particle shape, purity (the presence or absence of contaminants), chemical composition, and other factors, some sands are likely to provide years more service than others. For example, a pure quartz sand with a very narrow particle size range and a rounded particle shape would take many more years to become hard and unplayable compared to a contaminated calcareous sand with a very wide particle size range and an angular particle shape. On the other hand, this

Contaminated sand develops much more quickly in poorly drained bunkers.

Severe washouts (above) can be reduced or eliminated with the construction of interceptor drains (facing page) or surface swales.

quartz sand would probably be too soft and would produce fried-egg lies for a long time.

How can you determine the suitability of a sand for bunker use? First of all, contact the USGA Green Section for guidelines concerning bunker sand selection. The guidelines include some general recommendations pertaining to particle size range, particle shape, and chemical composition. A word of warning, though: *Some sands that fall completely within USGA guidelines may not be suitable or acceptable to some golfers, while other sands that fall well outside the guidelines may be considered very acceptable by the golfers at that club.*

Much of this incongruity has to do with factors such as personal preference, sand availability, cost, installation procedures and sand depth, environmental factors (*e.g.*, high winds), etc. Thus, don't let USGA guidelines be your sole judge. Instead, use them as a means of eliminating the obviously unsuitable sands from your list.

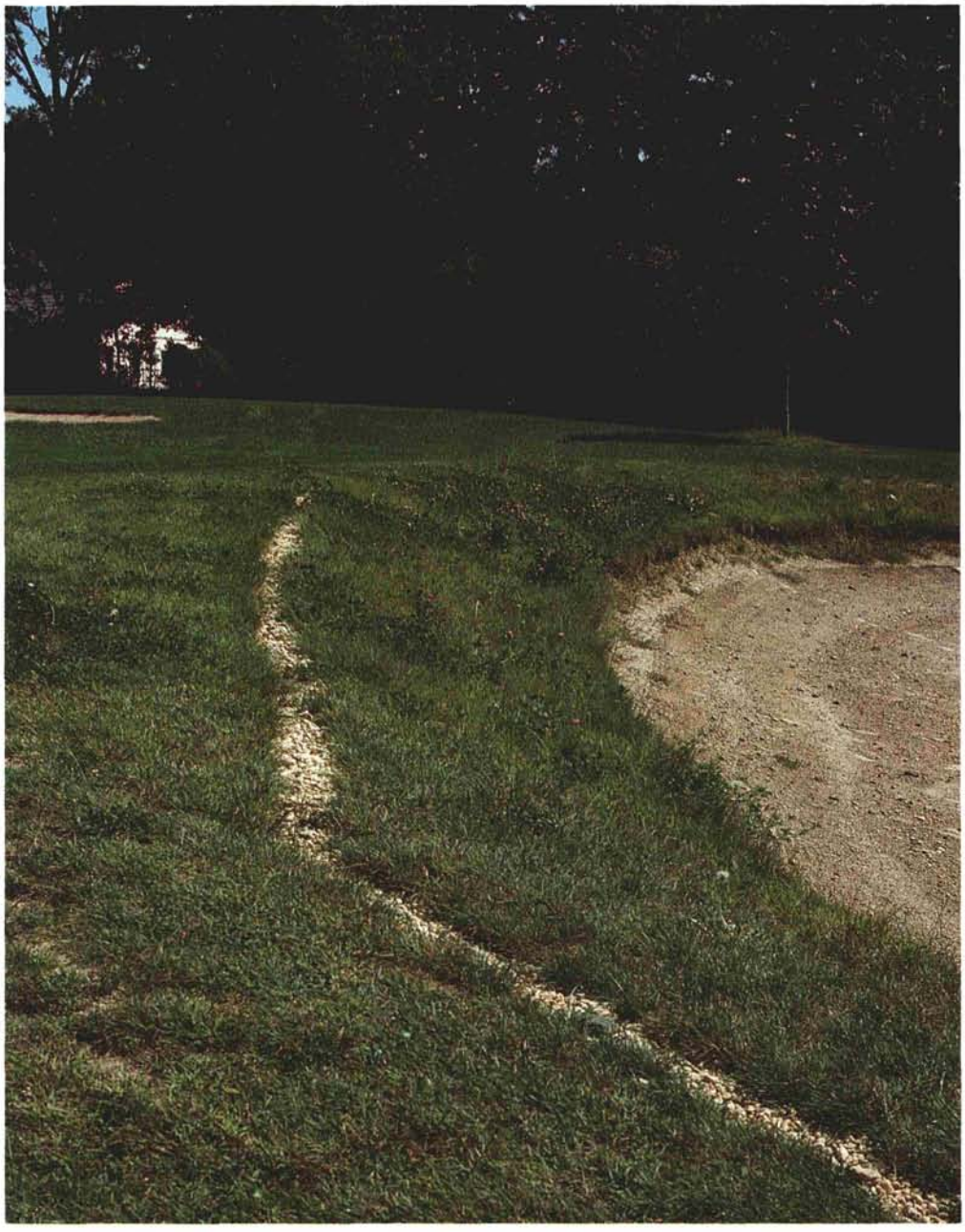
After narrowing the list to one or several sands, it is advisable to have them tested at a good soils laboratory, one that is knowledgeable and experienced in analyzing bunker sands. The lab, like the USGA guidelines, can't account for the personal tastes of the golfers at a particular course, but it can predict the general behavior of the sands being considered and provides a basis for making a final decision. When sending a sand to a laboratory, always keep an equal amount of material at your office. This allows you to compare the sand you have tested to the one that is actually delivered.

Before spending tens of thousands of dollars in a sand replacement program, testing sands in trial bunkers on the course is a common and often worthwhile practice. However, be aware that most good sands will seem quite soft and fluffy until they have had the opportunity to settle for several weeks or months. Indeed, if a bunker sand seems "perfect" immediately after it has been installed, it will probably be too firm or hard in too short a period of time.

Generally speaking, the best bunker sands are quartz based, angular in shape to provide reasonable firmness, confined to a relatively narrow particle size range (a large majority between .25mm and 1.00mm), and contain no contaminants in the form of silt, clay, and organic debris.

Preventing Contamination

After a good-quality sand has been selected for bunker use, the best way to extend its useful life is to prevent its contamination with silt, clay, and organic matter. These fine particles, which largely come from the soil on the bottom of the bunker and from the



bunker edges, gradually fill many of the pore spaces between the sand particles and cause the sand to drain poorly and to become hard and crusted. Fortunately, with some forethought and advanced planning, there are a number of good ways to reduce the rate of soil/organic buildup in bunker sands.

The earliest opportunities for contamination occur before the sand ever reaches the bunkers. When taking delivery of new bunker sand, inspect it to be sure that there are no telltale signs of previous loads of soil or other debris (and check to be sure it is precisely what you ordered). Also, delivered sand should be placed on a concrete or asphalt base so that soil contamination does not occur when the sand is being moved from the stockpile to the bunkers.

One of the best means of preventing contamination is to avoid bunker washouts caused by heavy rainfall or irrigation. When washouts occur, sand is washed down the face of the bunker and some of the soil is eroded off the slope as well. When the washout is repaired, the eroded soil is intermixed with the sand and the contamination process is begun, and with each washout the situation worsens. To minimize the effects of washouts, be sure that surface water does not enter the top edge of a sloped bunker from an adjacent sloped turf area. This can be assured by constructing interceptor drains or surface swales above the bunker to carry surface water around its sides.

Another good way to minimize the impact of washouts is to construct a deep vertical lip along the top edge of the bunker, leading to a flat, perpendicular plateau at the base of the lip. The cut is then packed with sand, the result being a significant reduction in the amount of soil eroded from the face when washouts occur. (For more details, see "How to Rebuild Eroding Bunker Faces," USGA GREEN SECTION RECORD, May/June 1983.)

Finally, it is no secret that washouts are much more prevalent and severe on bunkers with steeply sloped sand faces. Current architectural styles, which emphasize grassed slopes and minimal sand flashing, greatly minimize washout concerns and would be worth considering if bunker reconstruction is being contemplated.

Providing good subsurface drainage is another key to preventing sand contamination. When water puddles in a poorly drained bunker after a heavy rainfall, fine soil and organic particles float to the surface of the puddle and then settle on the sand surface as the water recedes. When the sand is raked, the fine particles are mixed with the sand and contribute to the contamination problem. Installing subsurface tile drainage, or clearing existing drainage, prevents puddling in all but the worst of circumstances and thereby prevents contamination.

Sand is often contaminated with soil when riding mechanical sand rakes are carelessly used. When the machine is run too close to the edge of the bunker, the scarifying teeth dig into the soil below the sand, or the bar digs into the lip or edge of the bunker, causing a mixing of sand and soil. Also, sand tends to become shifted around by the mechanical rake over a period of time, leaving only a very thin layer in some parts of the bunker. When the scarifying teeth hit these areas, soil is again mixed with the sand. This suggests a need to keep enough sand in the bottom of the bunker, at least four to six inches in depth, and to periodically monitor sand depth when mechanical rakes are used. Also, keep the mechanical rake away from the edges of the bunkers and off

the slopes and faces. Hand raking should be done in these areas if at all possible.

Another opportunity for sand contamination occurs when the bunkers are edged. Too often the edges are cut back too severely, allowing a significant amount of soil and other debris to fall into the bunkers. A more modest edging or a trimming of the long grass on the bunker edge would reduce this contamination and would better preserve the original contour and size of the bunkers.

Finally, care should be taken when mowing around the perimeter of a bunker to avoid blowing large volumes of clippings into the sand. If this occurs with too much regularity, the organic matter from the clippings can contribute to the aging process of the sand.

A word about geotextile liners is in order. Yes, liners do an excellent job of preventing contamination from the soil below the sand layer. Many courses have installed liners, but in the end a large majority have taken them out. It is very difficult to keep a uniform depth of sand on the liners, especially on sloped faces, and courses that use riding mechanical rakes almost invariably snag the liners with their rakes. Courses with flat-bottomed bunkers and those who hand rake their sand have the best opportunity for success with liners. If liners are used, they should be placed under, not over, the drain tile in the bunker, as the liners occasionally become plugged with soil and organic debris and can inhibit drainage.

Dealing With Existing Hard Sand

When sand approaches the end of its useful life, the effects of soil and organic contamination make it crusty, hard, and unattractive. Because of the time and expense involved, most courses are hesitant to rush out and replace all their sand. Instead, they try to cultivate the old sand more frequently and deeply, which works for only a day or two at a time. Some try rototilling the old sand, hoping to loosen the material to

This sand-cleaning machine allows high-quality, expensive sand to be recycled many times. The Country Club of Buffalo, Williamsville, NY.

a greater depth. Because of the silt, clay, and organic content, though, the sand quickly compacts to its original hard state.

Most courses respond by adding a couple of inches of fresh sand on top of the old material. This practice works for a few months, but the new and old sand eventually become mixed, and even more sand must be added. Indeed, it is not uncommon to find three or four feet of sand in old bunkers when they are finally renovated.

Ultimately, hard, contaminated old sand must be dug out and replaced with new sand. This can be an extremely time consuming project for the grounds crew, detracting from routine maintenance operations and other projects. Many courses with modest-sized crews are best advised to contract out much of the sand replacement work. If done in-house, then small loaders, adequately sized dump vehicles, and extra workers must be provided for the crew.

When old sand is removed from a bunker, it is usually discarded, used for fill on some construction project, or perhaps added to leaf and clipping compost. A more suitable use for the old sand has been found at the Country Club of Buffalo, where superintendent Norm Leising has for many years washed the contaminants out of the old sand and put it right back in the bunkers. Their sand-washing machine is put to good use whenever there are a few extra hours in the schedule. Interested parties should contact local quarries for the names of manufacturers of stone and sand grading equipment. Where expensive, high-quality sand is used for bunkers, washing equipment of this type might be a good investment.

As it turns out, then, there are many ways to extend the useful life of bunker sand while guarding a large investment in time and materials. By taking the time to test and select the best-quality sand, and by carefully avoiding the sources of contamination noted above, the appearance and playability of bunker sand can be protected and maintained for many years.

To help prevent contamination of bunker sands, keep mechanical rakes off slopes and at least two feet away from edges. This rake is too close.