Drainage Is Important to Turfgrass Management

Surface risers with grates are installed in low areas for additional drainage and serve as visual checkpoints of water flow through drain lines.

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GOOD TURFGRASS management is synonymous with good water management, and drainage is one of the keys to good water management. I remember O. J. Noer saying that "the two most important ingredients for building and maintaining a good golf course are common sense and drainage. If you are short on common sense, then put in more drainage." Drainage is the removal of excess water from the soil, and that results in a better environment for the grass plant, the golfer and the maintenance staff.

The word drainage is an all-encompassing word. It can be divided into two general categories: surface and subsurface drainage. Surface drainage systems are designed primarily to remove water that has not entered the soil profile. That is done by developing the slope of the land so that the excess water will flow by gravity into streams, ponds or storm sewer pipes.

Subsurface drainage, the other category, removes water that has already entered the soil profile. Unfortunately, this type of drainage is often overlooked during golf course construction. Subsurface drainage is basically the type of drainage to be discussed here, but actually any drainage problem must be considered a combination of surface and subsurface water removal. They are related, and you will see that our approach combines the two.

Three basic steps must be followed:

1. Identify the problem.
2. Develop a plan of attack.
3. Implement the plan.

IT IS USUALLY EASY to locate the place where a drainage problem exists. Next we need to determine why it is a problem. Perhaps it is a heavy impervious soil with tile that is not functioning or with no drain tile at all. Sometimes we must study a course for several years before we really know the extent of the drainage problems. At Mayfield, we found a problem on 17 of the 18 fairways that extended to many areas in the adjacent rough. Of our 92 bunkers, no more than six drained properly. Three or four greens and several tees also had poor drainage. The problems were generally due to a very heavy clay soil with an underlying shale base and non-functioning tile lines.

Developing a proper plan of attack is most important. There are countless aspects to consider and many questions to answer. If the problem lies with existing tile, a study must be made to determine if it is feasible to make the old tile functional or to install new tile. Will French drains — holes filled with gravel or gravel-filled slit trenches — suffice without drain tile? Does the problem exist in only a few isolated spots, or is it extensive? Should the work be done by the maintenance staff or by an outside contractor? Who will plan and design the drainage system?

The Soil Conservation Service (SCS), an agency of the U.S. Department of Agriculture, is a source of expert planning assistance. The SCS provided us with a soils map of the course, along with a description of each major soil type and provided a comprehensive

design of a drainage system for the entire course. It must be recognized that the Soil Conservation Service people are specialists in farm drainage and are not accustomed to working with fine turf. While their advice must be modified to fit golf course conditions, the basic engineering principles will be the same. For us at Mayfield, they produced a design from a topographic map that would drain every square foot of fairway without consideration for actual conditions on the course. We therefore had to modify the plan significantly because many areas needed very little or no drainage at all. Any plan should make use of all existing drainage pipe that is functional. We had no plans of any of the existing pipe and we knew of very little that was functional. During our installation process, we did discover a considerable amount of drain tile, and we were able to use some of it. We found that at first we followed the modified version of the SCS plan rather closely. As we gained experience with installation and observation of the course through varying moisture conditions, we began to disregard the formal plan and to develop a plan right on the site to custom-fit the situation.

After the drainage system has been designed and approved, it is important to decide who will do the job. Each club must decide whether it will be contracted out or done by the golf course staff. We decided to do the work ourselves with additional personnel. We felt that it was absolutely necessary that we not borrow personnel from the regular maintenance operation and sacrifice routine course maintenance. A contractor was hired for a short period to install some main lines to expedite the program.

Since our soil was a very heavy clay and impervious to water movement, we decided to remove all soil and to backfill to the surface with gravel. This would also provide for removal of excess surface water. With the gravel backfill, we have followed the theory used in the USGA putting green construction system of keeping the particle diameter sizes of layers within a ratio of one to seven. Theoretically, this restricts downward movement of the finer aggregates. We used one to three inches of ⅜" gravel under the tile, then filled the ditch to within three or four inches of the top with ¾" gravel and capped it off with ⅜" gravel to the surface level. After a few months, the gravel will settle an inch or two, and then we level it off with a layer of sand of 0.25 to 1.00 mm range. This allows faster covering of turf than is possible if grown over the gravel.

THE FIRST PHASE of implementation is to lay out a part of the system on the ground where it is to be installed. Begin at the outlet where the water is to terminate. This might be a pond, creek, existing tile line or a ravine. The proposed pattern should be marked with stakes or paint. If there is any question about grade, shoot some points with a transit level. Decide the depth of drain needed. This can be determined from experience and information available from the Soil Conservation Service. We used an average depth of close to three feet. We try never to be shallower than two feet, but sometimes the shale bottom was as close as 15 inches below the surface. In such cases the lines had to be closer together. We provided additional surface drainage

Ditching frame tapered at bottom to provide fall of 2.34 inches in 100 feet. Bubble on carpenter's level immediately tells if drain ditch fall is correct.

Equipment used to remove soil from ditching site.

by putting surface risers with grates in many of the low spots. These risers also provide good visual checkpoints. We use a double tee or cross clay pipe in the line for the riser, because the basin below the flow line provides a trap for sediment which can be cleaned out periodically.

When the tile installation requires removal of the soil, it means a tremendous amount of material handling. Soil spoilage must be hauled away and gravel hauled in. Disposal of the soil can sometimes be a problem. Proper equipment is necessary to make the operation as efficient as possible. We purchased a large trencher with a conveyor to move the soil away from the ditch. Another conveyor was added which would then take the soil up into a dump truck. We also experimented with conveyor attachments on the dumptruck for backfilling the gravel, but we found that dumping from small trucksters was just as fast. Since there was some soil and gravel spillage and occasional damage to the turf surface by equipment, we found it best to lay 4′ x 8′ panels of ½″ plywood on each side of the line before digging. After the ditch is filled and the work completed in that section, the panels are lifted, and the turf will still be in good condition.

We also have a smaller trencher which is used in confined areas and in bunkers. We have found a cast-iron pipe and tile cutter to be very useful. It helps to determine correct riser heights, and the correct length when connecting to existing clay tile lines. We also built a gadget that we call a ditching frame. It is a wooden frame eight feet long with two horizontal surfaces that are 3/16 of an inch out of parallel from one end to the other. This provides 2.34 inches of fall in 100 feet. By setting it on the bottom of a ditch or on the tile in a ditch and checking with a carpenter's level, it can be readily determined if minimum grade has been obtained.

Since we began our program in 1969, we have installed nearly seven miles of drain pipe. We found that short lateral lines of under 20 feet worked satisfactorily with gravel backfill only. We have mainly used the perforated-corrugated plastic pipe with a section of rigid plastic or steel outlet pipe to a creek. We prefer clay tile in bunkers because it can be more easily flushed in case sand accumulation becomes a problem.

INSTALLING A DRAINAGE system is no simple task; it requires a great amount of supervision. It is probably the nastiest, messiest and dirtiest job on the golf course. This can create morale problems and it takes a constant effort to instill a sense of pride of accomplishment among those involved. One of the ways we found to improve morale was by encouraging the development of a rivalry between the regular crew and the drainage crew through the challenges of softball and touch-football games.

Once the drainage system has been installed, it will require periodic maintenance. Grass and debris must be cleaned off of riser grates, and traps at the bottom of risers must be inspected and cleaned as sediment deposits accumulate.

Finally, it should be understood that even though an area seems to be thoroughly drained, underground water flow patterns are subject to change, and new wet spots can always develop. This does not necessarily mean that the drainage line was improperly installed. Drainage on silt clay soils is not only difficult, it often is an endless task too.