FEATURE ARTICLE II

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# The Drainage Dilemma

*Construction, renovation, or ongoing maintenance of a golf course is often thought of in a romanticized way – an art form with a minor element of underground engineering required to keep the "artwork" in its most beautiful condition. Professionals in the industry know differently. A functioning golf course is primarily an evolving engineering project with an element of art thrown in for good measure. The core of this engineering project is its drainage system.*

The elements of a well-drained golf course go far beyond pipes and structures. The development of a good drainage system starts with a thorough understanding of the basic characteristics of the soil. The soil's abilities to percolate, shed, and retain moisture are all factors in determining the requirements of the drainage system. The quality of the irrigation water is also a consideration in the design of the drainage system. Before embarking on any major drainage additions, it is always a good idea to work closely with a qualified soils laboratory to determine the special conditions that may exist on the golf course.

The second consideration in developing a practical drainage system is developing an understanding of the natural drainage patterns of the site. It is important:
1) to determine where water leaves the site,
2) to determine the size of the offsite drainage basin that flows runoff through the site, and 3) to determine the amount of water the existing outfalls can handle without causing floodwaters to back up into the course. All the golf course drainage in the world cannot overcome a debris-strewn, plugged up outfall. Before investing in interior drainage systems, it is prudent to review the site with a competent engineering firm to make certain that additions to the system will function as intended and provide value to the golf course.

The next element in designing or improving the golf course drainage system may seem obvious — determining where drainage can be effectively installed. But going to the worst wet spot on the course, installing a perforated drain or catch basin, and running a pipe to the nearest low area or pipe is often not successful in solving the problem. The existing slope and initial grading of the course are important factors in determining what and where supplemental drainage can be most effectively installed. A rule of thumb in the Midwest is that, to avoid wet conditions, a minimum three percent slope should exist in playing areas, and water should not be carried on the surface for more than 150 feet before it is run into a catch basin. When water is run further on the surface, it tends to accumulate in the low areas regardless of the drainage installed. There is a good chance that diverting water into swales or grading catchments and installing basins far above the "worst wet spot" may be far more effective than attacking the problem locally.

## A couple of other pertinent rules of thumb:

To take reasonable advantage of the pipe that is installed, the diameters of the catch basin grates and risers should be at least three times the size of the pipe installed.

When trying to dry up a wet swale, install the trunk line (perforated or solid) parallel to the swale and out of the lowest area with perforated spur lines crossing the swale at regular intervals. In this manner, water has to cross the graveled lines as it moves downstream and is more likely to be collected in the pipe. And, in a major storm, the drainage system is far less susceptible to being washed out.

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Relatively flat installations (< than 1% slope) require larger diameter pipe than might normally be thought necessary to effectively carry water, as small diameter pipe in low velocity situations is prone to being plugged with sediment.

A variety of products are specified to solve different drainage issues. For large diameter pipe installations, reinforced concrete pipe (RCP) is often specified, as it is the strongest and most durable product on the market. Less often, corrugated metal pipe (CMP) is specified and installed. While less expensive than concrete, it is not as strong and is subject to corrosion. Triple-walled, high-density polyethylene (HDPE) pipe is used primarily on golf courses for several reasons. It is durable; it is easy to cut and configure; its new structure provides much greater strength and much better flow characteristics than the single-walled pipe that was used many years ago; and, until the recent massive upturn in petroleum prices, it has been relatively inexpensive.

Catch basin construction varies. Pre-fabricated basins such as those manufactured by Nylo-Plast and NDS are durable and provide a very uniform look. But homemade basins, utilizing perforated risers fashioned from HDPE pipe with a poured-in-place concrete bottom can be just as effective. Even though plastic basin lids have become much stronger and more durable, it is hard to damage or misalign a round, cast-iron grate. When installing a basin, the slope in the immediate vicinity of the basin should be slightly greater than the surrounding area in order to avoid eventual puddling around the inlet.

Perforated drainpipe is most frequently HDPE, either slotted throughout or with larger round holes on half the pipe. If using the latter style pipe, install it with the holes toward the bottom on the trench. Gravel selection is a key factor in making a perforated tile system efficient. The superintendent is faced with the challenge of moving surface water into the drain lines while still managing to grow grass over the pipeline. Gravel that is too small can be plugged with silt or even result in a perched water table (remember a primary function of the gravel blanket in the USGA green is to perch water in the sand level). Gravel that is too large can result in a permanent eyesore and potential playing and mowing hazard. Half-inch stone is generally a good choice as backfill for perforated drains and perforated risers on catch basins. A shallow layer of coarse sand over the gravel can help facilitate turf growth while allowing water to penetrate into the tile line.

Flat tile, as opposed to the traditional round pipe, also has its applications. In rocky conditions, the installation of flat tile serves the primary drainage purpose without the expense of trenching and subsequent cleanup. It is especially useful in situations where it is important to maintain the integrity of the existing sub-grade – subsurface drainage in greens and tees and sand-plated fairways are good examples.

Vertically installed slit drains are also being used on golf courses. In new construction and renovation projects, this product is used as a conduit to transfer water at the interface of two different growing mediums (topsoil to sandcap, greensmix to topsoil are examples). This product can also be incorporated into slit drain systems of existing tees and greens, allowing drainage issues to be addressed with minimal disruption to play.

In summary, there are many factors to consider and many products to employ in the process of improving golf course drainage, but the quest for the perfectly drained golf course is ongoing. When the "worst wet spot" on the course is drained, what you have really done is promoted another troublesome area into the position of "worst wet spot."

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*Images courtesy of Tim Anderson, CGCS, Naperville Country Club and Michael Heustis, Chicago Highlands.*