A flexible membrane can provide an effective seal.

Avoiding the Ugly Pond

by TIMOTHY G. ANSETT,
Agronomist, Western Region, USGA Green Section

PROBABLY the most exciting and remembered golf holes in the world are those involved with water. Any golfer who has played the 18th at Pebble Beach or the 16th at Cypress Point will always recall the dramatic role of the Pacific Ocean. Of course, not everyone has an ocean to fall back on for scenic beauty, but any body of water, whether a natural lake, artificial pond or irrigation reservoir, can greatly influence the appearance and playability of a golf course. And the memories should be positive ones, not those of a neglected pond slowly turning into an unsavory bog filled with trash. With proper construction and proper maintenance, the eyesore can be changed to an eyecatcher by the golf course superintendent and green committee.

This article will provide pond management information helpful in avoiding the presence of ugly ponds. It should particularly aid the reader in initial pond construction and provide insight into management problems associated with existing ponds and reservoirs.

Purpose

There are many purposes and uses for ponds and reservoirs on the golf course. They frequently serve as a hazard or design feature, provide water storage for irrigation, add visual beauty, or act as a collection point for surface or subsurface drainage. In some cases, a pond may be developed to provide fill material for elevations throughout the property or to provide water storage for fire protection. Establishing a refuge for fish and waterfowl is not unheard of, nor is the possibility of providing a revenue-producing source from lost golf balls.

It stands to reason that few ponds or reservoirs are built for a single purpose; some may actually be intended to serve all the above uses and additional ones as well. Since the purpose will strongly influence the design and construction requirements, those considering building a pond or reservoir should examine their purposes closely. The greater the number of intended purposes, the more difficult it will be to create a pond that will satisfy all of them, because some purposes may be in conflict with one another. For example, many courses could easily provide a pond in front of the 18th green to serve as a hazard, to add a view of water from the clubhouse, and for fire protection. Yet, if the 18th green is the highest point on the course, the new pond cannot also serve easily as a drainage collection point. If the pond is for irrigation water storage, then the pumphouse will need

to be adequately screened from the clubhouse view. Number 18 may even be an extremely demanding golf hole before the addition of a pond.

Certainly a pond or reservoir can serve more than one purpose. But we should recognize that we shouldn't try to have it serve too many purposes, because if we do, it will serve none of them well. Having a pond serve its purpose well is critical to a construction or rebuilding project. Determine which purposes are most desirable, and concentrate on them.

Design & Construction

Already mentioned is the influence of purpose on the design and construction of a golf course pond. Another major influence is that of economics, and this should be of *both* construction *and* future maintenance. The cost of maintenance is too often overlooked in golf course construction projects. An initial savings in construction may often result in future maintenance costs far exceeding the original savings. Initially designing and building it right for efficient maintenance will save money in the long run.

Proper location of a pond is important and illustrates the potential conflict of purposes. As an irrigation reservoir, the ideal location would be centrally on the course at a high elevation, to minimize pumping costs. For use in drainage and water collection, a low elevation would be required for simplest operation. Housing lots with a view of water will bring a higher price, perhaps more than offsetting the construction costs. If a pond is to act as a hazard, proper placement is critical for the desired effect on a golf hole. Water hazard placement and locating a pond for aesthetic purposes are tasks best assigned to a qualified design expert, the golf course architect. Regardless of what location the purpose may dictate, construction costs can force a change in plans. Because the cost of excavation might range from 60¢ to $5 per cubic yard, depending on soil type and the presence of rocks, changing locations may be the only means of affording a pond.

With an almost infinite number of pond shapes to choose from, it is best to rely on the judgement of a golf course architect to assign the desired shape. As to size, the purpose again exerts its influence. If serving to collect excess surface and subsurface drainage, the pond and spillways must be able to accommodate runoff without the pond overflowing. An irrigation reservoir might hold just enough water for one irrigation cycle, being filled in the interval between irrigations, or can be used to increase pumping capacity by accumulating a limited flow source until an adequate supply is available. The largest capacity reservoir is desired if its purpose is to store water for later use during a drought.

One of the most frequent mistakes in building golf course ponds is the failure to provide adequate depth. Particularly in warmer climates, a shallow pond is prone to algae and aquatic weed problems. Even if a pond is only to serve as a hazard or design feature, eight to 10 feet should be the minimum depth considered. Failure to provide this depth will increase weed control costs, if not create a permanent eyesore. Evaporation losses are also reduced in deep ponds.

Bank maintenance makes up a large part of pond maintenance costs, and, therefore, bank characteristics must be adequately considered. Although reducing the safety factor, steeper slopes (but no less than 4 to 1) are preferred for several reasons: They minimize the amount of shallow water, reducing weed control problems, limit the time spent searching for golf balls during play, and they reduce the bank surface area exposed to erosion from wave agitation.

Above the water surface, many different bank materials have been successfully used. They include gabions, rocks of assorted shapes and sizes, concrete poured or applied as gunite, and crushed concrete or asphalt. Other types of banks include steep slopes of natural vegetation, which require limited maintenance, or more gradually sloped banks of turf mowed regularly along with roughs. Probably the best above-water bank design is that which requires minimal maintenance or one which can be maintained in the same manner as other parts of the course.

On most courses, the more natural look of turf, rock, or native vegetation would be considered more desirable than the manufactured look of a poured concrete ring. When constructing banks, remove fertile topsoil and you will minimize aquatic weed problems. Also, to avoid deposition of organic matter and debris into a pond, it will be desirable to prevent surface runoff from entering the pond through appropriate contouring around banks.

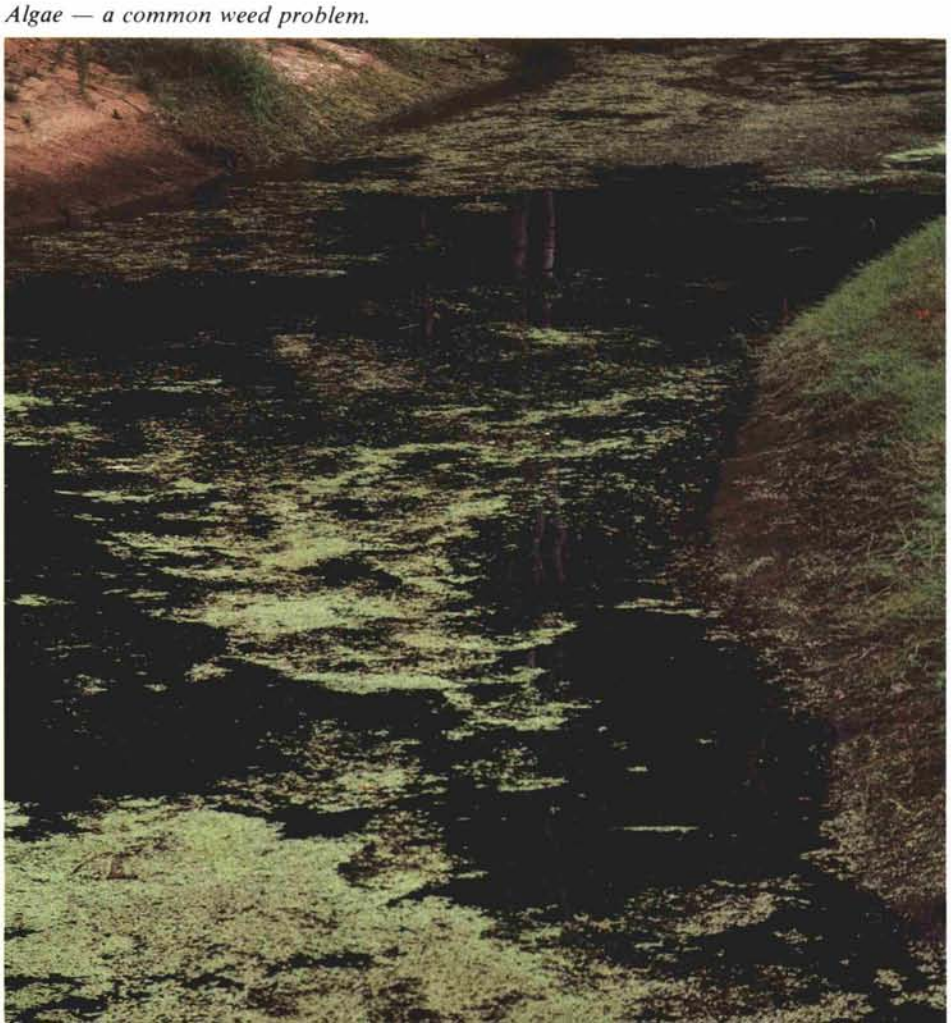
Actual pond construction methods will vary greatly, depending on location. To minimize excavation costs, a low area of a course might serve as a pond

simply by construction of one or more dams. On an extremely flat course, total excavation of the pond area may be the only means of providing a pond. Typically, pond construction involves both damming and excavating in a cut-and-fill process. As mentioned earlier, excavation is a major cost in pond building and may vary considerably, but saving excavation costs initially by building a shallow pond should be avoided.

The second major construction cost is that of sealing, and several methods deserve consideration. Perhaps the best and least expensive one is the use of two to three six-inch layers of impervious clay subsoil, alternately placed and compacted. Unfortunately, if such a clay material is not available near or on location, the costs of transport are likely prohibitive. The most expensive, although not necessarily the most effective method, is using a rigid material such as concrete, either poured or applied gunite. Other than cost, the chief disadvantage of a rigid lining is the possibility of cracking, thus reducing effectiveness. More commonly used sealing methods include the use of chemical or bentonite linings or a flexible membrane such as PVC.

A beautiful view from the clubhouse, Fort Wayne Country Club, Fort Wayne, Indiana.

Algae — a common weed problem.



Bentonite and chemical liners both rely on clogging soil pores to block seepage, bentonite being effective because of its extreme swelling characteristics when wetted. Although an effective seal can sometimes be gained using bentonite or a chemical sealant, and at up to 50 percent savings over a flexible membrane lining, there are serious limitations. Greater amounts are required for more permeable soils, reducing the cost advantage, and in very coarse or gravelly soils, an effective seal may not be possible.

It is probably due to past sealing failures that more pond builders today are using flexible membrane liners. When properly installed, a PVC liner can provide a 100 percent seal over a long period of time. Normal procedure calls for excavation of the pond basin to a depth of one foot below the desired final elevation. The surface must then be checked for any sharp rocks, etc., which could damage the liner. In some cases, a fill material might be utilized for protection between sharp objects and the liner. For a pond less than 30 feet deep, a 10mm PVC liner thickness will be adequate, and after installation it should be covered carefully with 12 inches of fill soil, preferably infertile,

which is compacted for added protection. An "anchor" trench of about one foot in depth is dug approximately two feet above the intended water level, where the edge of the liner can be secured. The cost of a PVC liner and the installation procedures discussed above will vary with the size of the pond, the price of labor, and the availability of fill soil, and current estimates range from 30¢ to 50¢ per square foot. It must be emphasized that the best time to effectively seal a pond is during original construction. Failure to do this results in additional costs for later sealing, if possible, and a poorly performing pond in the interim.

Another desirable design feature is providing a means to control the pond water level through inlets and outlets. An important aspect of pond inlets is the avoidance of bank erosion from water flow. By directing inflowing water out away from the banks or providing an erosion-proof surface such as concrete at the inlet, erosion will be reduced. If water flows into the pond from surface runoff and subsurface drainage, outlets and spillways must be of sufficient size to avoid frequent pond overflow when it rains. Outlets can also provide the capability to totally drain a pond, which can aid in weed and fish control, bottom cleaning and repair of leakage.

Maintenance

Proper pond design and construction will minimize maintenance requirements and potential problems, but even the "perfect" pond will still need some types of regular care. They include marking, bank maintenance, and aquatic vegetation control.

Unless the ponds on a golf course are totally out of bounds, they should be marked in accordance with the Rules of Golf. Failure to properly mark water hazards results in incorrect drops, inappropriately grounded clubs by golfers, and potential arguments about casual water. From the Rules of Golf, a "water hazard" is defined as any sea, lake, pond, river, ditch, surface drainage ditch or other open water course (regardless of whether or not it contains water), and anything of a similar nature. All ground or water within the margin of a water hazard, whether or not it be covered with any growing substance, is part of the water hazard. The margin of a water hazard is deemed to extend vertically upwards and should be defined by yellow stakes or lines.

A "lateral water hazard" is defined by red stakes or lines. It is a water hazard or that part of a water hazard so situated that it is not possible or is deemed by the Committee to be impracticable to drop a ball behind the water hazard and keep the spot at which the ball last crossed the margin of the hazard between the player and the hole.

Either type of water hazard should include within its marked boundaries the water area, rough banks, and unkempt growth relating directly to it. A natural break or abrupt change in slope is often used as the hazard boundary. When stakes are used, since the line from stake to stake determines the limit of the hazard, care must be used to assure that no area which should be a part of the hazard lies outside the line. For that reason, the use of painted lines may be appropriate for some or all water hazards. A disadvantage of marking paint is the need to regularly repaint the margins, but use of a non-selective herbicide on the narrow line prior to painting will minimize the repainting requirements.

Maintenance costs will be minimized if banks are designed to be virtually maintenance-free, such as rock or stone, or if turf is maintained which can be mowed regularly with other areas of the course. Another low-maintenance possibility is the use of native or introduced plants which form a dense cover. Weed invasion will occur in many types of pond banks, and to keep weeds in check, regular herbicide applications may be required. Regular repair of bank erosion is also necessary, because eroded areas can quickly increase in size if they are neglected.

Probably the most frustrating aspect of pond maintenance is that of controlling aquatic vegetation. This topic alone is worthy of a series of articles; only a few key points will be addressed here. Already mentioned are the needs for adequate water depth and to minimize the amount of shallow water by utilizing steep banks. Deeper water is less subject to aquatic vegetation growth because of its lower temperature and the reduced sunlight it receives. Also affecting aquatic growth is the fertility level of water and soil on pond banks or bottoms. It is probably impossible to do anything but accept the fertility level of the water you obtain, and there are benefits to being able to irrigate with nutrient-rich water. However, to minimize pond nutrient content, any organic matter and nutrient deposition into ponds should be avoided. Beneficial practices include reducing fertilization of turf around ponds and preventing surface water from depositing grass clippings and other organic debris.

Other means of minimizing aquatic growth include the use of dyes and pond aerators. The effect of dyes is to restrict light penetration, reducing some aquatic growth by limiting photosynthesis. Aerators prevent excessive temperature buildup by circulating water throughout a pond. The increased oxygen levels generated encourage organic matter decomposition, limiting the buildup of dead vegetation, which reduces pond depth and water-holding capacity. By promoting decomposition, the unpleasant odor of stagnant ponds is also lessened through aeration. The reduced carbon dioxide level present in aerated ponds limits algae growth, and the improved water circulation enhances distribution of applied chemicals, increasing effectiveness. Despite all the other advantages, the attractive appearance of water streaming toward the sky may be reason enough for the installation of a pond aerator.

Even when design and management practices favor reduced aquatic weed populations, some control measures will usually be necessary. Options include physical removal, chemical treatment, control through changing the water level, or biological control using vegetation-eating fish. Control measures should begin early enough in the growing season (when the water temperature reaches 56 degrees F.) to insure staying ahead of the problem. As with any type of pest control, proper identification of the pest is the appropriate first step. Aquatic weeds are typically placed in one of four groups: emersed, submersed, floating or algae. Without correct identification, control may be unsuccessful. Use of chemicals for aquatic weed control requires special precautions because of the potential to contaminate fresh water supplies used for irrigation or human or animal consumption. Utilize local expert sources on the subject and always read, understand, and follow label directions.

Summary

Many existing golf course ponds are plagued with problems, do not perform their intended function, or their appearance detracts from, rather than enhances, the golf course. Much of the blame can be placed on a desire to save money during original construction. Through careful planning in the initial construction (or in later rebuilding) and regular maintenance, ugly ponds can be avoided. That eyesore can become an eyecatcher!