Aquatic Management: From Vegetation to Water Quality

By Joel Jackson, CGCS

In doing cover stories on golf courses for the *Florida Green* for more than 14 years, I seldom come across a superintendent who does his own lake or waterway maintenance. It is little wonder I suppose because I also seldom hear about aquatic management in the agronomic curriculum of our major turf schools.

However in today's world, superintendents still must consider how they can impact the water bodies with their turf maintenance programs, and they must be knowledgeable about the basics of aquatic systems so they can enhance their appearance and quality.

Consequently I turned to articles in *Golf Course Management*, IFAS publications and to Mike Martin, president of Lake Masters for information for this issue, since no superintendents jumped all over this topic and bombarded me with articles. Here's what I found out.

The bad news is that there are many factors at work in your lakes and ponds that are in some cases beyond your control, but still fall under your watch. So the trick is to learn how to mitigate and/or correct those factors to minimize negative outcomes. Don't try this unless you're a trained professional. In fact just go ahead and budget for a professional aquatic management service like you do for any of the other contract services for your course maintenance.

Golf course waterways are like any other part of the golf course; they need to be on a regular maintenance program to prevent algae, weeds, bottom sludge, odors, poor water clarity, and the dreaded fish kill. These problems are often related and can stem from the following factors:

Key Points

- Algae, aquatic weeds, fish kills, and odors are all caused by build-up of debris and lack of oxygen.
- Reduce organic matter suspended in the water adjust pH of water to favor chemical breakdown and improve oxygen content to maintain lake's appearance.
- Make sure lakes are designed and constructed properly to prevent problems.
- Protect against nutrient loading by maintenance practices
- Lakes are worth the investment in maintenance by a knowledgeable professional.

- Nutrient overload – natural organics and runoff
- Water Temperature – a function of lake depth, sun light and circulation
- Water Depth – affects light penetration and plant growth and temperature
- Dissolved oxygen – aerobic digestion of nutrients is critical

Nutrient Overload

Obviously when the nutrient influx outpaces aerobic bacteria's ability to digest organic nutrients, the lake can become out of balance, and unwant-

Course employee harvests unwanted weeds. Poor lake design and construction means unwanted emergent vegetation and algae in this shallow lake will be a constant maintenance burden to keep it looking good. Photo by Joel Jackson.

ed weeds, algae, etc can thrive. Sources of these nutrients can often be organic soil layers exposed when the lakes were dug during construction, dead organic matter, animal waste, effluent water and fertilizers applied to the golf course.

Superintendents can control the fertilizer applications and observe "No Fertilzer Zones" around water bodies and monitor part-circle heads along shorelines that might deliver fertigation. The other factors must be dealt with by increasing the aeration of the lake. We'll touch on that later. Sealing a lake bottom with a poly vinyl liner or clay can help prevent nutrients from natural organic and muck layers exposed on lake bottoms.

Water Temperature

It gets hot in Florida and warm water can't hold a lot of dissolved oxygen (DO). According to Mike Martin of Lake Masters, low DO levels are currently a big problem as we are going through a "droughty" spring period right now. Low water levels contribute to the elevated temperatures. Experts say generally no basin should be designed less than 6 feet deep and those 8 feet deep are inherently easier to manage than shallow basins. Depth is a practical way to control temperature and light penetration. Obviously with mandated littoral shelves around lakes there will be shallow areas that have to be monitored. That's where aquascaping can be a positive management tool.

Water Depth

The key here of course is to build it right up front. If a shallow marsh is the intended result, expect to spend a lot of time and money to keep it cleaned up or make sure it's OK to let it go "natural." Deeper ponds prevent light from penetrating to provide growing conditions for bottom algae and submerged weeds. Sometimes blue dyes are used to shade the sunlight from shallow areas and to enhance lake color.

Deeper lakes also provide cooler temperature zones to hold dissolved oxygen for fish to survive hot spells and aerobic bacteria to digest organic nutrient bottom debris. If a lake or pond is too shallow and continues to be a chronic problem it may have to have some extra excavation to provide a solution. As I said, make sure it's done right up front. It will be cheaper in the long run.

Dissolved Oxygen

Dissolved oxygen is the savior of a golf course lake. There are several ways to provide aeration to a lake: surface sprays, horizontal aspirators and bottom diffusers. Bottom diffusers are the best provider for raising overall DO in the water column.

Shallow water/shoreline plantings need to have at least a 12"-16" gap along the shoreline so lake management companies can control any encroaching vegetation without harming the desirable plants. Photo by Joel Jackson.

Fountains are attractive, but they have limited value for aeration of lake water (Note duckweed and floating algae). Bottom diffusers and air injectors are more effective and providing needed oxygen to the water column. Photo by Joel Jackson.

Aquatic vegetation does an excellent job of filtering runoff from the turf and extracting nutrients from the water. If you can't border the entire lake then leave open spaces only in key landing areas. Photo by Joel Jackson.

Martin said, "We had a course in southwest Florida that would periodically have 30- to 40-foot algae blooms. After installation of a diffuser which treated 800,000 gallons of water per 24 hours, the blooms were reduced to 5-6 feet if and when they occurred."

Fountains in lakes might make for lovely dancing waters and provide eye candy to the observer but they only affect a certain amount of surface water volume and don't affect the total water column. According to Charlie Barebo, CEO of Otterbine Barebo, Inc. in his March 2000 article, "Cleaning Troubled Waters," horizontal aspirators have a directional flow and are good for narrow lakes and canals, and bottom diffusers are not really too effective in lakes less than eight feet deep and shouldn't be used in less than 5 feet of water. Barebo also mentions ozone systems for severely troubled lakes, but says they are definitely more costly than aeration systems.

Aquascaping

One of the best investments a course can make is to install desirable aquatic plants. They can occupy the shallow water areas to prevent weed growth, they can filter and metabolize nutrients in the lake water and they provide food, habitat, and cover for wildlife.

Martin said, "We like to use aquatic plants in the waterways that we manage. Some folks like that groomed shoreline look so we plant clumps of vegetation along the homeowner side of the lake or along the landing area of a golf hole, but we try to fill in the offside shoreline as much as possible. The more plants the better for the water quality.

"However, if a course wants to add plants they should leave a 12- to 16-inch space between the shoreline and the plantings so the shoreline can be sprayed easily without harming the aquatic plants. That's also why clump plantings are easier to maintain. When we have sections planted on 1- to 2-foot centers we have to use back pack sprayers and make spot applications among the beneficial plants."

Martin says the top-performing aquatic plants for shoreline zone planting are arrowhead, giant bulrush, pickerelweed and spike rush.

"As long as the soil stays moist, these plants will thrive even during low water levels. They may brown back in a severe cold snap, but they are good seed producers and will replenish themselves in the spring. Cannas lilies are a great color accent plant. Some of the best applications I've seen in central Florida are at the new Eagle Creek G.C. in Orlando and the Interlachen C.C. in Winter Park"

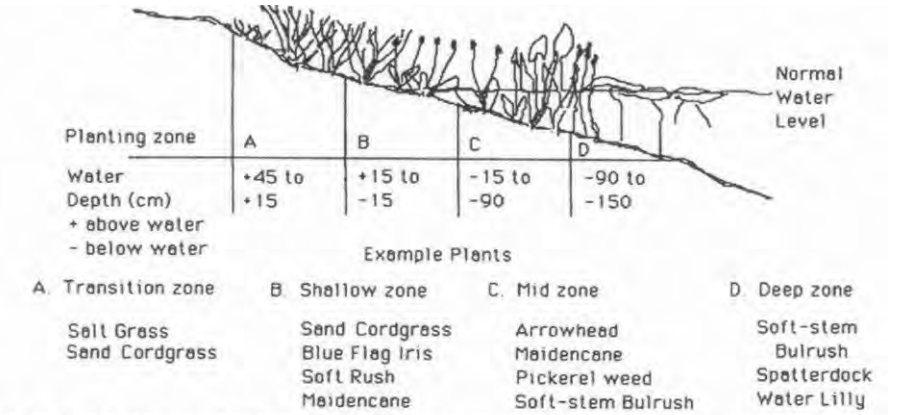
I asked Martin about the current major

Lake maintenance is just like turf maintenance; it needs to be on a regular schedule. This torpedograss was left untreated too long. Now the spraying for control creates an obvious and unsightly burn ring around the lake. Photo by Joel Jackson.

Surface algae blooms can be prevented with better lake aeration systems. Photo by Joel Jackson.

Mike Martin of Lake Masters, Inc. says duckweed can be controlled by the proper use of Sonar. Photo by Joel Jackson.

problems in lake management from his perspective. He said, "Right now some low DO levels in lakes are due to low water levels and warm temperatures. The lakes can get so unstable so fast after a rainstorm and a flush of nutrients and stormwater runoff from road-ways that lakes "turnover" or "flip" and the DO levels are too low and we can get fish kills pretty easily. Low dissolved oxygen levels are the primary and over-



e 2. The four planting zones for a typical marsh shoreline planting: transition, shallow, mid-, and deep zones.

The four planting zones for a typical marsh shoreline planting with suggested plant material: transition, shallow, mid-, and deep zones. Illustration from WEC-4, An Introduction to Aquascaping by Frank J. Mazzoti; http://edis.ifas.ufl.edu.

whelming cause of fish kills, not pesticide or herbicide applications. The only pesticide-related incident I can think of happened more than 10 years ago when a torrential rain hit a golf course soon after applying Nemacur. That was unfortunate."

Bottom algae and duckweed are two other problems that can be hard to control. Martin says the triploid grass carp and tilapia in contained lakes can be helpful controls and the carp will also eat other submerged weeds. Duckweed grows exponentially and can overtake a lake quickly. Martin says that Sonar used properly can control duckweed even in an irrigation lake, but superintendents are leery of herbicides in their water source.

While copper sulfate remains a mainstay in the arsenal of lake managers and products like Sonar and Reward are also used Martin said, "As we lose more products we have to turn to natural methods to maintain the lakes. There are some biological products that are very promising, but they are also very costly for the average golf course budget. Even though I own a lake-management company, I can foresee that 10-15 years down the road, we may have developed good enough natural methods that I may be out of business, and oddly enough that may be better for all of us."

References

- Cleaning Troubled Waters by Charlie Barebo from Golf Course Management, March 2000
- An Introduction to Aquascaping (WEC-4) by Frank J. Mazzoti, Ph.D., associate professor, Wildlife Ecology and Conservation department, University of Florida, Everglades REC, Belle Glade, FL, Florida 33430, Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida Gainesville, 32611.