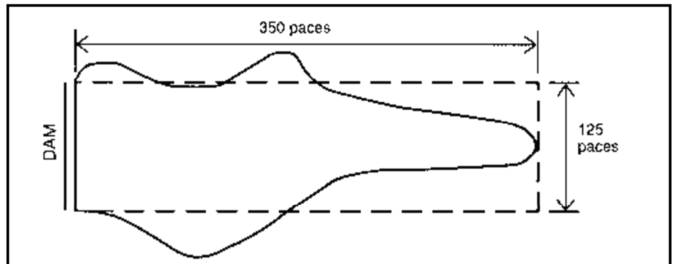
Determining Pond Size and Volume

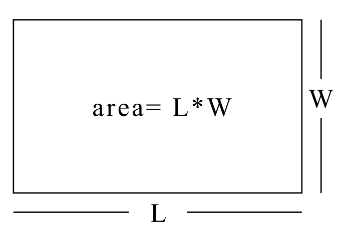
There are many different ways of determining the acreage and volume of ponds. The easiest method requires an internet connection and some light field work. To determine surface acreage, there is a free online tool, which utilizes Google Earth to determine acreages (works great for fields also). Follow this link to visit the site and calculate acreage. www.gravoplex.com/Planimeter/GMapPlanimeter.html

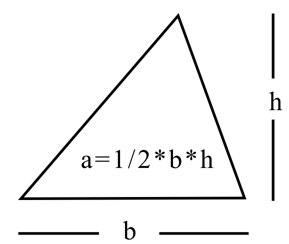
Once there, simply change the view in the top right-hand corner of the screen to "Hybrid" (this shows the aerial image as well as a road map for reference) and then simply zoom in until you find your particular pond on the map. Once you find your pond, zoom in to where you can see all the shoreline, but the pond takes up most of the screen. Then, notice the two buttons on the right: "Delete Last Point" and "Clear All Points". All you need to do to get acreage is click your mouse around the perimeter of the pond until the whole pond is outlined. If you make a mistake or click in the wrong place, click either "Delete Last Point" to undo the last click you made, or "Clear All Points" to start over. Once you are happy with your selection, the area will be displayed in a number of units below the two buttons on the right. Acreage is the 5th area down the list.

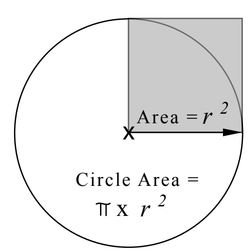
The other method of calculating surface acreage is not as accurate as the aerial photo method, but can still give you a good idea of acreage. If the pond is a rectangle, triangle, or circle, the measurements should be fairly easy. However if the pond is an irregular shape, draw the pond's basic shape onto a sheet of graph paper. Next, draw a rectangle, triangle, or circle over the pond, doing your best to equalize or balance any areas that lie outside of the overlaid shape. See figure below.



Once you have done that, lay out the corners of the drawing on the real pond, and measure or pace the shape. You may then use one of the following area formulas that apply to determine area.

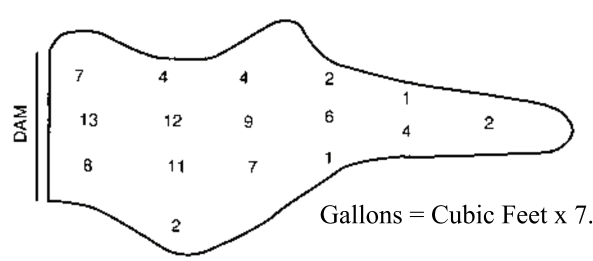






When you have determined the square footage of your pond, you must then convert square footage into acreage. This is a simple calculation:

$$Acreage = \frac{Square\ Feet}{43560}$$



Gallons = Cubic Feet x 7.48

Gather depths throughout the pond as shown above and average them to get an average depth. Volume can then be calculated by multiplying the average depth times the square footage. This can then be converted to gallons using the following formula:

W. P. Law, Inc. would like to cite the following sources for information gathered during the making of this publication.

Clemson University Extension Service
Air-O-Lator Corporation
Southern Regional Aquaculture Center
SePro Corporation
Otterbine Barebo, Inc.

MAIN OFFICE - LEXINGTON
303 Riverchase Way, Lexington, SC 29072
Phone 803-461-0599
Fax 803-461-0598
e-mail lex@wplawinc.com

GREENVILLE BRANCH
1330 Grove Rd., Greenville, SC 29605
Phone 864-295-3810 / 800-660-7569
Fax 864-295-6990
e-mail gville@wplawinc.com

CHARLESTON BRANCH
3636 Belvedere Rd., John's Island, SC 29455
Phone 843-559-3945
Fax 843-559-2740
email coastal@wplawinc.com

GREER BRANCH
2400 Highway 101 S., Greer, SC 29651
Phone 864-879-1045 / 877-835-0714
Fax 864-879-1046
e-mail greer@wplawinc.com

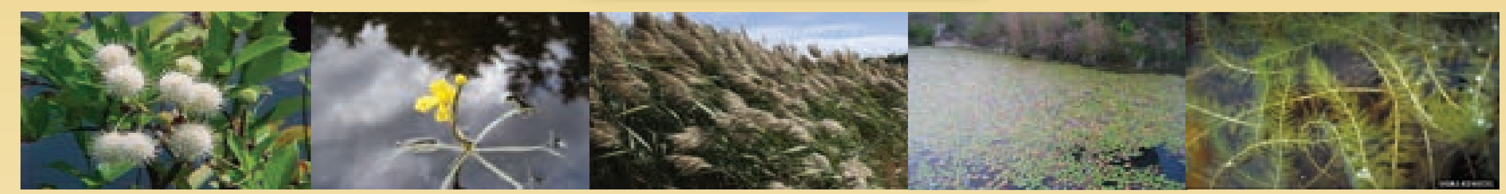
Get the free mobile app at
http://gettag.mobi
After downloading the app, scan this tag to visit our website

Pond Guide

W. P. LAW INCORPORATED

Aquatic Weed Control Guide

www.wplawinc.com



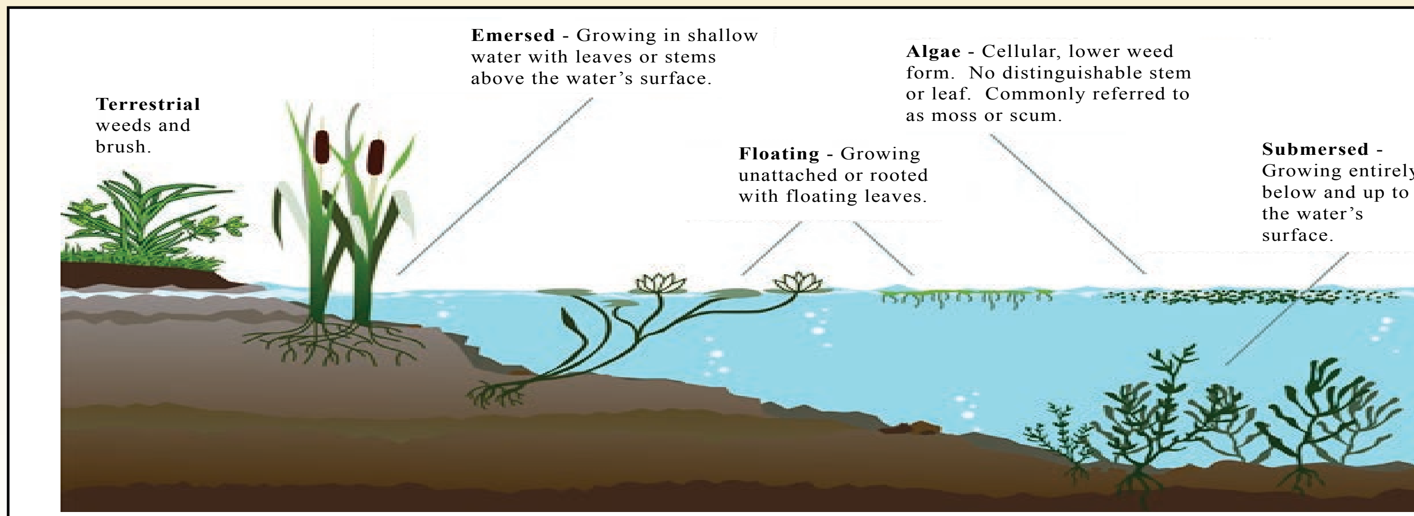
Introduction

Aquatic weeds can be problematic in pond systems due to their aggressive nature and ability to interfere with recreational activities. Aquatic weeds also can lessen the aesthetic qualities of pond systems and cause equipment problems if the pond is being used for irrigation purposes. This guide is designed to offer practical advice on managing aquatic weeds. All chemicals recommendations should be verified by referencing the herbicide label. The herbicide label is the law and should take precedence over all recommendations. Most aquatic herbicides have certain restrictions that limit the body of water they can be applied. Always consult the label for determining restrictions in regards to swimming, livestock watering, irrigation, etc.

Biology

Aquatic weeds begin actively growing during the spring months when water temperatures range from 55-60° F. The best time to begin applying aquatic herbicides is when water temperatures are in the 70-80° F range. At this point, weeds are usually smaller and easier to control. In addition to being easier to control, dissolved oxygen levels in ponds are usually higher at this time of the year. If aquatic weeds herbicides are applied according to the label, they are not toxic to fish. Fish kills usually are brought about by too low of dissolved oxygen levels due to the decomposition process of dying aquatic weeds. In order to limit potential risk, applicators may only want to treat ¼ to 1/3 of the pond at one time in two week intervals. Also, limiting herbicide applications during low water level conditions and high water temperatures will lessen the likelihood of depleting adequate dissolved oxygen levels. It should be noted that not all aquatic herbicides are labeled for partial treatments.

There are many different types of aquatic weeds found in southern ponds. Although there are many types, they all fall into one of five categories: algae, floating, submersed, terrestrial and emersed. The following graphic shows where these types of weeds are located in a pond system.



While aquatic herbicides can play a crucial role in controlling unwanted aquatic vegetation, they are only part of the equation in reducing weed pressure in pond systems. Pond depth is an important factor effecting submersed weeds and algae. Like all plants, these weeds rely on sunlight to produce food for their survival. In shallow pond systems, sunlight can easily penetrate to the floor of the pond and fuel unwanted growth. Ponds should be at least 2-4 feet deep at the edge to limit submersed weed and algae growth.

Another important factor effecting aquatic weed growth is nutrient load. This term refers to the amount nutrients (nitrogen, phosphorus and potassium) that runoff into the pond. Excessive nutrients can lead to unwanted algae blooms and can increase aquatic weed growth. To alleviate this problem, buffer areas high in plant material can be planted around the pond or runoff water can be diverted.

Description of Various Aquatic Herbicides

Diquat (Littora®)
Diquat is a contact herbicide that can be sprayed or injected into water to control submersed weeds and filamentous algae. It can also be used as a foliar application to control duckweed . An approved non-ionic surfactant must be added when diquat is used as a foliar application. Diquat binds tightly to clay particles and is not effective in muddy water. Diquat quickly kills plants and should be used as a partial pond treatment for dense vegetation.

Fluridone (Sonar®)
Fluridone controls most submersed and emersed weeds and is available as a liquid or pelleted formulation. Liquid formulations also control duckweed and watermeal. Fluridone is a translocated herbicide that slowly kills plants over a 30- to 90- day period. Its slow action generally prevents the depletion of dissolved oxygen. Fluridone is not effective as a spot treatment. The entire pond must be treated to control the target weed species.

Chelated copper (K-Tea®,)
Copper that is held in an organic complex is known as chelated copper. Chelated copper formulations do not readily precipitate in high alkalinity waters, but stay in solution and remain active longer than copper sulfate. Chelated copper is less corrosive to application equipment than copper sulfate. Because it is more soluble, chelated copper is generally used at slightly lower rates than copper sulfate. Chelated copper formulations are slightly less toxic to fish than copper sulfate. However, in waters with low alkalinity (≤ 20 ppm), or in water with an alkalinity of ≤ 50 ppm that contains trout, using chelated copper is extremely risky, particularly during the summer. Some of the chelated copper compounds work on higher plants (e.g., hydrilla)

Penoxsulam (Galleon®)
Galleon® is a very effective herbicide on selective floating, emergent, and submersed aquatic weeds such as hydrilla, watermill foil, water hyacinth, water lettuce, salvinia and duckweed. Galleon® is considered a reduced risk aquatic herbicide. Since Galleon® works through systemic activity in the plant, it takes longer to achieve total control. Galleon® can be used as an in-water application or surface application depending on the targeted weed.

Sodium carbonate peroxyhydrate (GreenClean®)
Sodium carbonate peroxyhydrate is a granular contact algaecide with hydrogen peroxide as the active agent. It selectively controls blue-green algae at lower application rates and controls many types of algae at higher rates. It is not effective on the macroalgaes, Chara or Nitella, or on any higher plants. The granules should be broadcast across the surface or dispersed below the surface to make direct contact with the maximum amount of algae. Solutions or foams can be prepared from the granules (see the label); some liquid formulations also are available. Treat early when algal growth first appears. Sunlight and warm water temperatures enhance its efficacy. Bubbling, bleaching and/or discoloration of the algae should be evident soon after application.

Triclopyr (Renovate 3®)
Triclopyr is a systemic herbicide used to control many floating, submersed and emersed plants. It may be particularly effective on plants such as alligatorweed, willows, water hyacinth and milfoils. It can be applied to the leaves or to cut surfaces. Triclopyr works by translocating to the roots and
disrupting growth metabolism. Therefore, it should be applied while plants are actively growing and leaves are fully developed. A non-ionic surfactant should be added when treating floating and emergent vegetation.

Glyphosate (AquaPro®)
Glyphosate is a foliar-applied, translocated herbicide used to control most shoreline vegetation and several emersed weeds such as spatterdock and alligatorweed . Glyphosate translocates from the treated foliage to underground storage organs such as rhizomes. It is most effective when applied during a perennial weed's flowering or fruiting stage.

2, 4-D (Navigate®)
2,4-D is a translocated herbicide that is available as a granular or liquid formulation. Granular 2,4- D controls submersed weeds such as coontail and emersed weeds such as waterlily . Liquid formulations of 2,4-D are used to control floating weeds such as water hyacinth and several emersed weeds. 2,4-D is available as an ester or amine formulation. Amine formulations are slightly better for aquatic applications because they are less toxic to fish. The granular ester form is safer to use in aquatic applications than the liquid ester form.

Dosage rates for aquatic herbicides are expressed three different ways. Consult the label for usage rates once a product has been selected. The following calculations will demonstrate how to determine how much herbicide you will need based on label rates.

Surface Acre Treatments

Use the following formula if the amount of herbicide needed is expressed in surface acres.
Surface acres refers to the area of the surface of the pond.

F = A x R

F = Amount of formulated herbicide product
A = Area of water surface in acres
R = Recommended rate of product per surface acre

Acre- Foot Treatments

An acre foot of water is defined as one surface acre of water that is one foot deep. To determine acre-feet, multiply surface acres times the average water depth in feet. Use the following formula:

F = A x D x R

F = Amount of formulated herbicide
A = Area of the water surface in acres
D = Average depth of the water in feet
R = Recommended rate of product per acre-foot

Parts per Million Treatments (ppmw)

The treatment rate of some aquatic herbicides may be listed as the final concentration of the chemical in the pond on a parts per million weight. The amount of herbicide needed for a parts per million weight is determined by the following formula:

F = (A x D x CF x ECC x AI)

F = Amount of formulated herbicide
A = Area of the water surface in acres
D = Average depth of the water in feet
CF = 2.72# per acre-foot (This is a conversion factor. 2.72# of herbicide per acre-foot of water is equal to 1 part per million)
ECC = Effective chemical concentration needed for the herbicide (see label)
AI = (consult label for following information)
For liquid products AI = 1 gallon ÷ pounds of active ingredient per gallon
For dry products AI = 100% ÷ % of active ingredient

Ex. Pond has the following conditions:

Surface acres = 2 CF = 2.72#
Average depth = 5 ECC = 3 parts per million

AI = 80% active ingredient dry product

$$F = 2acres * 5depth * 2.72cf * 3ppm * \frac{100\%}{80\%} = 102\#\ product$$

If you were treating the same pond with a liquid herbicide that had 2# of active ingredient per gallon, here is what the equation would look like:

$$F = 2acres * 5depth * 2.72cf * 3ppm * \frac{1gal}{2\#} = 40.8gal\ \ product$$

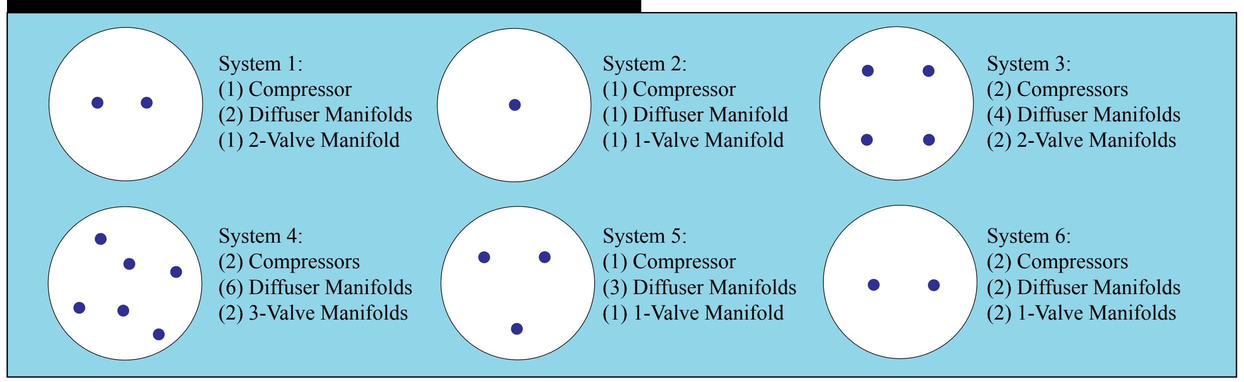
The layout for an air diffuser system is based on the area, water depth, and compressor horsepower required. The following Otterbine, Air Flo 2, chart will demonstrate the number of compressors and diffuser manifolds needed per acre and depth of water.

Air Flo 2 Systems Sizing and Placement Guide

All Air Flo 2 systems are single phase, include 3/4HP compressor(s) with a standard cabinet enclosure mounted to an equipment pad, and a valve box. Variances between systems will be voltage, the number of compressors per cabinet, and the number of diffuser manifolds and valves. Choosing between air stone diffusers and dome diffusers will not change the number of manifolds required. Tubing is orderd separately and is available in weighted and unweighted.

All systems are available in 115V and 230V 60Hz single phase, Diffuser placement, along with sizing parameters are listed below with the varying system components. Contact W. P. Law, Inc. for more information and pricing, or to inquire about three phase systems.

Air Flow 2 Diffuser Placement Guide



Air Flow 2 System Sizing Guide

Air Flo 2 System Selection Guide		Surface Aera Affected					
		1/2 Acre (2023m²)	1 Acre (4047m²)	3 Acres (12140m²)	5 Acres (20234m²)	8 Acres (32376m²)	12 Acres (48562m²)
Operating Depth	4-7ft (1-2m)	Systems 1, 3, or 5	Systems 3 or 4	System 4	Call for Custom System		
	8-14ft (2-4m)	Systems 1, 3, or 5	Systems 1, 3, or 5	Systems 3 or 5	Call for Custom System		
	8-18ft (2-5m)	Systems 2, 3, or 4	Systems 3 or 4			System 4	Call for Custom System
	14-19ft (4-6m)	Systems 1, 2, or 4		Systems 1 or 4	System 4		
	14-26ft (4-8m)	Systems 1 or 2		System 1	Call for Custom System		
	19-40ft (6-12m)	Systems 1, 3, or 5			Systems 4 or 5	Call for Custom System	

Pond shape and varying depths will contribute to system selection. Call W. P. Law, Inc. if your system is over 40ft or 12m. Custom sizing is available.

W. P. LAW INCORPORATED

Pumping & Piping Systems

Aquatic Weed Control Chemical Index

E	= Excellent Control (90 to 100%)
G	= Good Control (80 to 89%)
F	= Fair Control (70 to 79%)
P	= Poor Control (<70%)

* A blank space indicates weed response is not known

Click for list of available herbicides

Click for Application Rates

Click for Water Use Restrictions

Weed	Copper complexes, copper sulfate (various)	2,4-D (various) Navigate®	Diquat (various) Littora ®	Endothall		Fluridone Sonar®	Glyphosate AquaPro ®	Triclopyr Renovate®	Imazapyr Habitat®	Sodium Carbonate Peroxyhydrate PAK 27 ®
				Aquathol K Aquathol G	Hydrothol G Hydrothol 191					
ALGAE										
Filamentous	E	P	P		G					E
Planktonic	E	P	G		G					E
Branched (Chara)	E	P	G		G					
Nitella	E	P	G		G					
FLOATING PLANTS										
Bladderwort	P	P	E			E				
Duckweeds	P	G	G	P	P	E	P		E	
Water Hyacinth	P	E	E			P	G	E	E	
Watermeal	P	P	P			G	P			
SUBMERSED PLANTS										
Broadleaf watermilfoil	P	E	E	E	E	E	P	E		
Coontail	P	G	E	E	E	E	P			
Egeria	P	P	G	F	F	E	P			
Elodea	P	P	E	F	F	E	P			
Eurasian watermilfoil	P	E	E	E	E	E	P	E		
Fanwort	P	F	G	E	E	E	P			
Hydrilla	F	P	G	G	G	E	P			
Naiads	P	F	E	E	E	E	P			
Parrotfeather	P	E	E	E	E	E	F	F	E	
Pondweeds (potamogeton)	P	P	G	E	E	E	P			
EMERGENT PLANTS										
Alders	P	E	F	P	P	P	E			
Alligatorweed	P	F	P	P	P	G	E	E	E	
American lotus	P	E	P	P	P	F	G	E	E	
Arrowhead	P	E	G	G	G		E		E	
Buttonbush	P	E	F	P	P	P	G		E	
Cattails	P	G	G	P	P	F	E		E	
Common Reed	P	P	P	P	P	P	G		E	
Fragrant & white waterlily	P	E	P	P	P	E	E	E	E	
Frogbit	P	E	E					E	E	
Maidencane	P	P	F			F	E		E	
Most grasses	P	P	P	P	P	P	G		E	
Pickerelweed	P	G	G			P	F	E	E	
Pond edge annuals	P		G			E	E		E	
Rush	P	P	F	P	P	F	E		E	
Sedges and rushes	P	F	F	P	P	P	G		E	
Slender spikerush	P		G			G	P			
Smartweed	P	E	F			F	E	E	E	
Spatterdock	P	E	P	P	P	E	E	E	E	
Southern watergrass	P	P				G	E			
Torpedograss	P	P	P			F	G		E	
Watershield	P	E	P			G	G			
Water pennywort	P	G	G	P	P	P	G	E	E	
Water primrose	P	E	F			F	E	E	E	
Willows	P	E	F	P	P	P	E		E	

* Information thanks to Clemson University Horticulture Dept.

Table 2. Restrictions on the use of water after treatment with aquatic herbicides[1] (number of days after treatment before use in private waters only).

Common name	Human use: Drinking	Human use: Swimming	Human use: Fish	Livestock: Watering	Irrigation: Turf	Irrigation: Crops
copper sulfate [2]	0	0	0	0	0	0
copper complexes	0	0	0	0	0	0
2,4-D	*	*	*	*	*	*
diquat	2-3	0	0	1-3 [3]	2-3	5
endothall [4]	7-25	1	3	7-25	7-25	7-25
glyphosate [5]	0	0	0	0	0	0
fluridone [6]	0	0	0	0	7-30	7-30
triclopyr	#	0	0	0	0 [7]	120 [8]
imazapyr	@	0	0	0	120 [9]	120 [9]

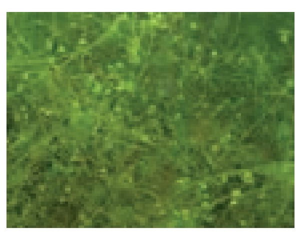
1 Aquatic vegetation control (particularly algae) can result in periods of low dissolved oxygen that can stress and/or kill fish. It is best to treat most aquatic vegetation early in the growing season when plants are rapidly growing. Treating small areas (e.g., one-fourth) of a pond at a time at 10- to 14-day intervals will allow for decomposition usually without causing an oxygen depletion.

2 If water is for drinking, the elemental copper concentration should not exceed 1.0 ppm (i.e., 4.0 ppm copper sulfate pentahydrate).
3 Depending on formulation - **Read label.**
4 Length of use restriction for endothall varies with concentration used. **Read label.**
5 Do not apply within 0.5 mile of a functioning potable water intake.
6 Do not apply within 0.25 mile of a functioning potable water intake.
7 No restriction on irrigating established grasses but **do not harvest hay for 14 days after application. Read label.**
8 Or until non-detectable concentrations in immunoassay analysis.
9 Or until <1.0 ppb.
* Water restrictions on 2,4-D vary by state with formulation, rate and time of year. **Read label.**
\# Minimum setback distances from potable water intakes required and laboratory tests to determine < 0.4 ppm for use. **Read label.**
@ > 1/2 mile from potable water intake.

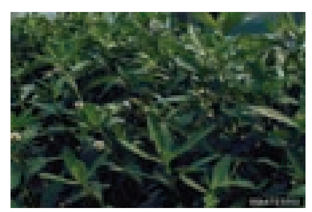
This chart is an informal reference of restrictions associated with aquatic herbicides. Always consult the label for exact restrictions on any product. This chart is not intended to replace or supplement any current product labels.

Aquatic Weeds

FILAMENTOUS



NITELLA

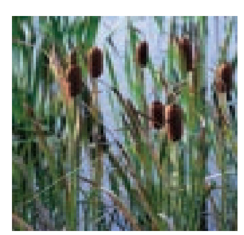


ALLIGATORWEED

AMERICAN LOTUS

ARROWHEAD

BUTTONBUSH

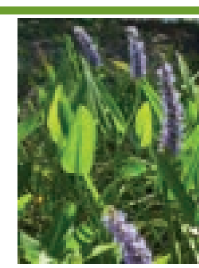


CATTAILS

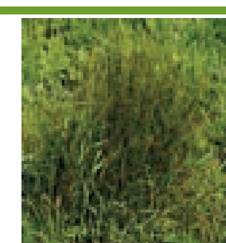
COMMON REED

FROGBIT

MAIDENCANE



PICKERELWEED

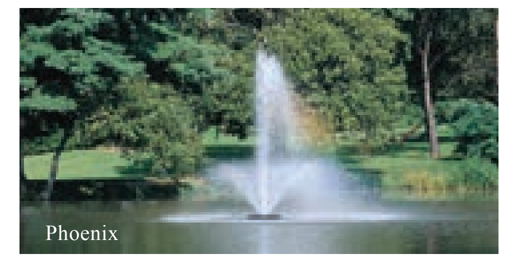


RUSH

Otterbine Products and Specifications on Selected Aerators and Fountains

	STARBURST		PHOENIX		ROCKET	
60 HZ	1/2 HP	3/4 HP	1/2 HP	3/4 HP	1/2 HP	3/4 HP
Spray Height (ft)	2.5	3	UPPER: 8 LOWER: 4	UPPER: 9 LOWER: 6	12	15
Spray Diam. (ft)	12	19	UPPER: 2 LOWER: 12	UPPER: 2 LOWER: 16	2	2
GPM	125	135	80	90	80	90
Volt/Ph/Amp 3450@60hz	115/1/12 230/1/6	230/1/8	115/1/12 230/1/6	230/1/8	115/1/12 230/1/6	230/1/8

60 HZ	1 HP	2 HP	3 HP	5 HP
Spray Height (ft)	11 -13	17 - 19	20 - 22	23 - 25
Spray Diam. (ft)	5	5	8	8
GPM	110	155	200	290
Volt/Ph/Amp 3450@60hz	115/1/14 230/1/7.5	230/1/12.4	230/1/14 230/3/8.6 460/3/4.3	230/1/23 230/3/13.4 460/3/7.2



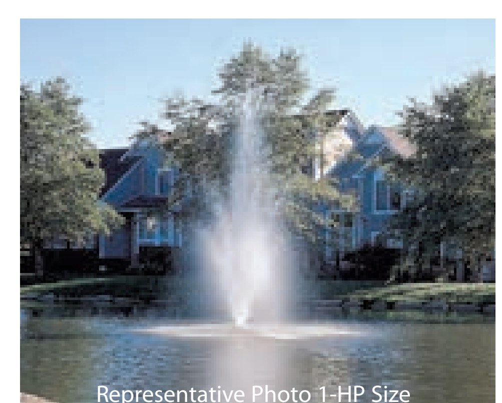
60 HZ	1 HP	2 HP	3 HP	5 HP
Spray Height (ft)	UPPER: 8 LOWER: 4	UPPER: 11 LOWER: 6	UPPER: 15 LOWER: 9	UPPER: 18 LOWER: 10
Spray Diam. (ft)	UPPER: 2 LOWER: 14	UPPER: 2 LOWER: 20	UPPER: 3 LOWER: 28	UPPER: 3 LOWER: 34
GPM	150	210	275	400
Volt/Ph/Amp 3450@60hz	115/1/14 230/1/7.5	230/1/12.4	230/1/14 230/3/8.6 460/3/4.3	230/1/23 230/3/13.4 460/3/7.2

60 HZ	1 HP	2 HP	3 HP	5 HP
Spray Height (ft)	UPPER: 8 MIDDLE: 5 LOWER: 3	UPPER: 12 MIDDLE: 7 LOWER: 4	UPPER: 16 MIDDLE: 11 LOWER: 7	UPPER: 19 MIDDLE: 13 LOWER: 8
Spray Diam. (ft)	UPPER: 2 MIDDLE: 9 LOWER: 13	UPPER: 2 MIDDLE: 10 LOWER: 17	UPPER: 3 MIDDLE: 13 LOWER: 23	UPPER: 3 MIDDLE: 15 LOWER: 27
GPM	150	210	275	400
Volt/Ph/Amp 3450@60hz	115/1/14 230/1/7.5	230/1/12.4	230/1/14 230/3/8.6 460/3/4.3	230/1/23 230/3/13.4 460/3/7.2

AIR-O-LATOR Products and Specifications on Selected Aerators and Fountains

CARNIVAL - PROPELLER PUMP 4 VANE

NAME PLATE HP	1	1-1/2	2	3	5
VOLTS/PHASE	230/1	230/3	230/1 OR 3	230/1 OR 3	230/1 OR 3
MAX AMPS	9.8*	5.9*	13.2/8.1*	17.0/10.9*	27.5/17.8*
AVG HT (ft.)	8	8	8	9	11
AVG DIA (ft.)	25	25	25	30	35
G.P.M.	1000	1000	1200	1400	1400



DIANA - CENTRIFUGAL PUMP

NAME PLATE HP	1	1-1/2	2	3	5
VOLTS/PHASE	230/1	230/3	230/1 OR 3	230/1 OR 3	230/1 OR 3
MAX AMPS	9.8*	5.9*	13.2/8.1*	17.0/10.9*	27.5/17.8*
AVG HT (ft.)	20	20	23	28	30
AVG DIA (ft.)	20	20	23	28	30
G.P.M.	80	80	116	120	140

 Continued from page 7

Oxygen also plays a critical role in how organic matter and waste is broken down. When oxygen is present, microbes can breakdown organic matter more readily and build up on the bottom of the pond is generally not a problem. If oxygen is not present, organic matter breaks down much more slowly and during this anaerobic process hydrogen sulfide gases can be produced causing a foul odor to the pond. Factors that contribute to low oxygen levels are numerous. The main culprit comes from excessive plant growth. Although plants produce oxygen during the day, they also consume oxygen at night. Also heavy organic loads can lead to rapid algae blooms that further deplete dissolved oxygen levels. When oxygen levels are not sufficient, the natural degradation process is inhibited.

Pond aerators are useful management tools for ensuring a healthy pond system. Aerators work by injecting O2 into the water and by helping to mix the stratified layers in order to evenly disperse O2 between the top and bottom of the pond. The aerators used in ponds and lakes today are offshoots of the ones used in the aquaculture industry. The aquaculture pond mixers make use of equipment such as submersible axial flow pumps, paddlewheel aerators, propeller-aspirator pumps and diffusing air systems.

The systems widely used in pond management today make use of a hybrid between the axial flow and the propeller-aspirator pump. The basic unit consists of a submersible motor, propeller, straightening vane or nozzle and float. These units are also known as vertical pump aerators and they are capable of adding 2-6 pounds of O2/hp/hr. The most widely used aerators in this class seem to fall in the 1-5hp range with pumping volumes from 1000 to 1400 gpm. These units can aerate and destratify ponds up to one acre. Multiple pumps will be needed to treat larger acreage ponds. It is important to note that pumping units used for aesthetics in this hp range are not aerating pumps due to low volumes pumped and the low induction rates created.

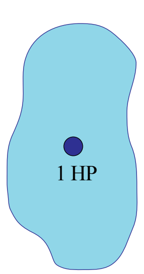
Diffusing air systems consist of a shore-mounted air compressor, weighted air tubing and air diffusers. This system causes destratification by disrupting the layers that the air bubbles pass through on their way to the surface with oxygenation happening at the same time. In order for this system to work efficiently, the water depth should be at least 15 feet or greater. This allows the column of air to spread outward encompassing and then churning large areas of water. The number of diffusers and compressors used will depend on the depth and area to be aerated.

Sizing and Layout

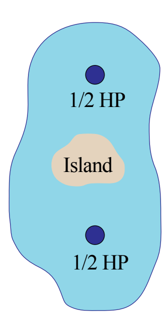
Vertical pump aerators require sufficient water depth for proper operation due to the length of their motors. 1/2 - 5 hp models are the ones most commonly used and require a minimum operating depth of 24 - 48". A 1/2 - 2 hp aerator requires a minimum operating depth of 24". 3 - 5 hp aerators require a minimum operating depth of 48". Aerators in excess of 5 hp require even greater operating depths. The sizing of an aerator is calculated based on the surface area of the pond or lake and is as follows: 1/2 acre pond requires a minimum of 500 gpm = 1/2 hp unit. 1 acre pond requires 800-1000 gpm = 1 hp unit. 2 acre pond requires a minimum of 2000 gpm = two 1 hp units. 3 acre pond or lake requires a mimium of 3000 gpm = three 1 hp units.

Utilization of a single large aerator in large impoundments is not advised because adequate mixing and aeration will be localized to the unit. In this situation, it would be more efficient to use multiple smaller horsepower units. Other considerations concerning layout is, available power, control panel location, equipment location and equipment power cable selection. Generally speaking, the most efficient power available to the general public is 230 volt single phase. This voltage allows the installer to run smaller gauge wire longer distances. When motors over 10 hp are needed, 3 phase voltage is required. As to wire sizing, the factory will make recommendations about the proper size to run between the control panel and an aerating unit but, it is imperative for the consumer to use a qualified electrician to size and run the wire to the control panel.

Aerating units or floating fountains utilizing electric motors submersed in ponds or lakes should never be located where swimmers or fishermen can come into contact with them. These units are prohibited in swimming pools. The air system devices can safely be used in swimming areas as the compressor motors are installed away from the water. With vertical pump aerators, the prevailing wind and the size of the area to be treated should be accounted for to minimize drift and to keep the spray pattern in the area to be treated. The control panel for aerating units and the compressor for the air systems are mounted at the ponds edge. In the event that several aerators are used, the control panels should be located at a central point to the aerators, reducing long wire runs from the power source to the panels and to reduce the length of cable between the panel and aerator. Air systems only have power running to the compressor. Keeping the wire runs to a minimum length helps to keep the wire gauge to the optimum size thus reducing wire cost.

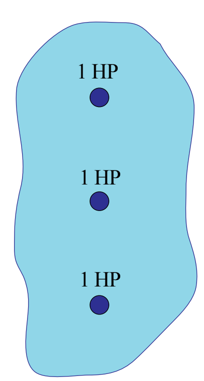


1 Acre Pond =
One 1 hp Unit



1 Acre Pond =
Two 1/2 hp Units

The example in the middle shows a situation where two 1/2 hp pumps are used because the island causes an obstruction to the mixing of the water.



3 Acre Pond =
Three 1 hp Units


SLENDER SPIKERRUSH


SMARTWEED

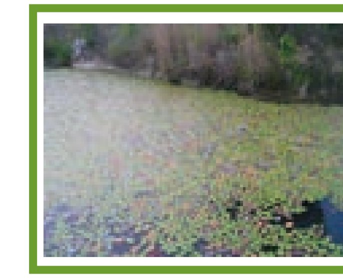

SOUTHERN WATERGRASS


SPATTERDOCK


TORPEDOGRASS


WATER PENNYWORT

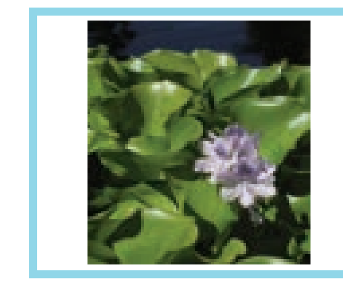

WATER PRIMROSE

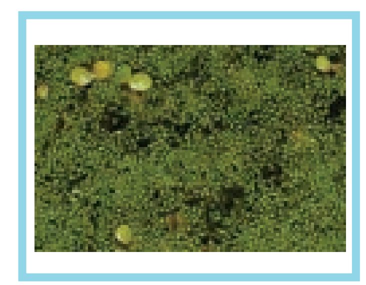

WATERSHIELD


WHITE WATER LILY


BLADDERWORT


DUCKWEED

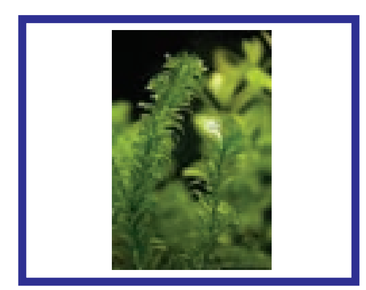

WATER HYACINTH

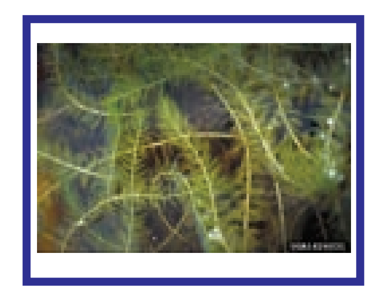

WATERMEAL


BROADLEAF WATERMILFOIL


COONTAIL

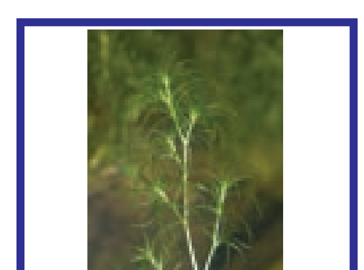

EGERIA


ELODEA

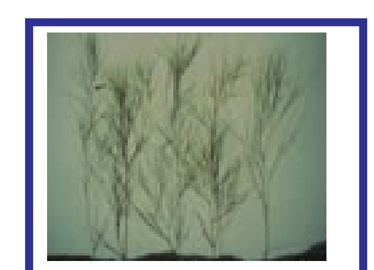

EURASIAN WATERMILFOIL


FANWORT


HYDRILLA


NAIADS


PARROTFEATHER


PONDWEED

LEGEND

Algae

Emergent Plants

Floating Plants

Submersed Plants

Fertilizing Ponds

These pond fertilizers are available through W. P. Law, Inc.

Product	Size	Form	Rate (per surface acre)
11-61-0	50#	Powder	4-8# / Acre
12-48-8	25#	Solid Granular	4-8# / Acre
8-24-8	2.5 Gal.	Liquid	1 Gal. / Acre

Fertilizing ponds can increase water quality and improve fish production by up to 300%. Before choosing to fertilize your pond several factors should be considered. Not all ponds will benefit from fertilizer applications. If the soil pH or water harness is too low, there will not be any benefit from the fertilizer application. Once the pH has been adjusted from a lime application, wait 4-6 weeks before applying any fertilizer. If ponds are suffering from aquatic weed growth, they do not need to be fertilized. Aquatic weed growth should be controlled before applying fertilizers. Also muddy or black water ponds do not need to be fertilized or ponds that receive runoff from organic fertilizers and animal manure.

The main reason for fertilizing fish ponds is to increase the phytoplankton (microscopic algae) population that is present in the water. Organisms feed on the phytoplankton leading to the beginning of the food chain for small fish. As the population of phytoplankton increase, the water color will become darker and limit the amount of sunlight that can penetrate the water. Darker water will limit unwanted algae growth and submersed aquatic weeds.

Phosphorus is the generally the limiting nutrient in ponds. As a general rule, ponds need little nitrogen and almost no potassium. It is important that fertilizers be highly water soluble since you do not want them to come in contact with the pond bottom. Fertilizers that come in contact with the pond bottom will bind with the soil and be ineffective in fertilizing the water. Pond fertilizers are available in two types of formulations: solid (granular and power) and liquid.

Pond fertilization should begin when water temperatures reach 60° F (March – April). After the initial application, wait two weeks to determine if additional applications will be necessary. Fertilizer treatments should continue until an object can not be seen 18" under water. As a general rule, ponds will need to be fertilized at least three times per year. Liquid fertilizers should be mixed at 10 parts of water to 1 part fertilizer before being broadcast across the pond. When using soluble granular or powdered fertilizers, mix with water to dissolve and then mix at the same rate you would liquid fertilizers before broadcasting in the pond. Fertilizer applications should not be made after water temperatures fall below 60° F (Sept. – Oct.). Fertilizing during cooler months yields no benefit and can lead to filamentous algae problems the next spring.

Liming Ponds

Liming fish ponds is no different than liming you garden are yard. The main reason for applying lime is to adjust the pH to the proper level to improve the activity of fertilizers. Most South Carolina ponds are low in pH except for some coastal areas that are high in calcium carbonate. The proper water pH for ponds is between 6.5 and 9.0. There are two ways to determine the liming requirement of your pond. The first way is by using a water quality test kit and adjusting the hardness of the water to the level of 20 ppm of calcium carbonate. The most accurate method is to take 10 mud samples from the bottom of the pond. Allow the samples to dry and then mix together. Sample can be sent to Clemson University's Soil Testing Lab to determine the liming requirement. Typical lime applications will range from 1 to 4 tons per acre.

Dolomitic limestone should be used to fertilize ponds due to its long lasting nature. Applications should be made evenly across the pond. When applying lime, you are actually liming the bottom of the pond, not the water. Fall and winter months are the best time to apply lime since it may take four to six weeks to adjust water quality. Liming and fertilizing a pond should not take place simultaneously since the calcium in the lime can bind with phosphorus.

Pond Colorants and Dyes

As an alternative to fertilization, pond dyes can be used to reduce light penetration into the water column. Pond dyes block the wavelengths of light that are necessary for photosynthesis. The upper two feet of the water column remain productive and provide food for fish. Application rates depend on the volume of water to be treated. Treatments usually are effective for six months or occasionally longer, depending upon the rate of water loss from the pond and the amount of fresh water entering the pond. If dense growths of algae or other weeds are present, mechanical removal or an herbicide treatment may be needed before applying a pond dye.

Controlling Turbidity in Ponds (Flocculation)

General Rates for Alum and Gypsum Applications (Pounds per Acre)

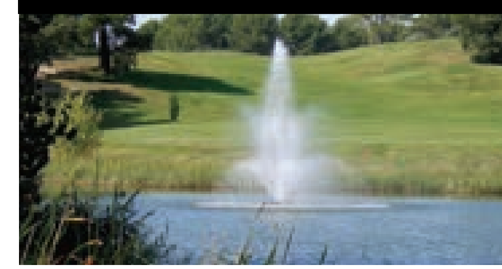
	12" Visibility	6" Visibility
Alum	150	250
Gypsum	1000	2000

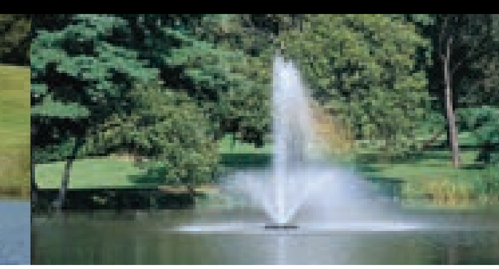
The term turbidity refers to the cloudiness or the muddiness of pond water. There are several things that can contribute to this including microscopic algae, suspended clay particles, stained water, and other organic substances. Turbidity from suspended clay particles is most common in ponds where red clay is the dominant soil type. Suspended soil particle type of turbidity can smoother fish eggs, clog fish gills, affect the taste of fish and be aesthetically unappealing. Some types of turbidity like that from phytoplankton are desirable since they provide food for microscopic animals and filter-feeding fish. Ponds with excessive turbidity from suspended soil particles tend to have lower amounts of dissolved oxygen than those from phytoplankton.

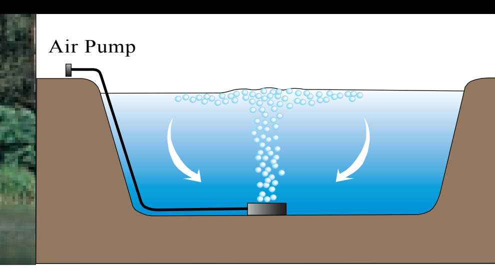
Flocculation is a term used to describe the process of controlling suspended particles in water by adding substances to bind the particles together. Once the suspended particles are bound, they become heavy and settle out to the bottom of the pond. In general, there are two different products used to flocculate ponds: alum (aluminum sulfate) and gypsum. Alum in the most effective of the two and is used most often. Gypsum requires higher application rates and is not very effective in hard water pond systems since the water is already saturated with calcium.

Alum applications can make ponds more acidic. In alkaline ponds, it may be necessary to mix ½ part of lime to every part of alum to ensure pH is not affected. Also coagulants such as alum and gypsum can remove phosphorus from water. It may be necessary to apply a high phosphorus fertilizer after flocculation. The key to applying alum is to get it thoroughly and quickly mixed with the water. To accomplish this, mix 10 parts water with 1 part alum to create a slurry. Pour this slurry into the prop wash of a boat to adequately disperse it.

Pond Aeration







The proper management of ponds not only requires attention to weed control and fertilization but water quality as well. Water quality impacts the overall ecosystem of the pond by providing an environment conducive to proper food chain development, oxygenation, proper mixing and subsequently promoting the processes necessary for the decomposition of organics. Ponds that are fed by springs or depend on runoff as their sole source of water may encounter periods of stress due to low oxygen levels and the inability for proper mixing to occur.

Small ponds whose water supply is largely augmented by water pumped from wells fall into this category because well water contains very little dissolved oxygen. Detention ponds which are used to control runoff are also susceptible to high levels of nitrates from the runoff as well as low oxygen levels. Aeration is crucial in combating these problems.

Pond aerators generally used by the public and landscape contractors fall into two categories, surface and submerged diffusion or bubbler. The surface aerators also known as vertical pump aerators consist of a submersible electric motor hung beneath a float. A Propeller is attached to the motor shaft and faces skyward. A nozzle or deflector directs the water into the air where the pattern usually takes on a trumpet or funnel shape. This type of aerator is capable of adding between 2-6 lbs. of oxygen per hour depending on the horse power and is capable of moving 1000-2700 gpm. Fountains used for aesthetics typically do not provide enough volume to aerate water and therefore should not be used for this purpose. However, if aesthetics and aeration are required, both types of units should by used.

Diffusion or bubbler aerators use a surface mounted air compressor connected to a series of diffusers by weighted airline. The diffusers bubble air from the bottom of the pond. As the column of air bubbles rise and expand, they mix any stratified layers and introduce oxygen to the water. The main requirement for the successful use of this equipment is that the water depth be a minimum of 15 feet deep.

Because ponds are living breathing ecosystems, they need the proper amount of dissolved oxygen to keep them functioning properly. Low oxygen levels can lead to many problems. The major problem encountered from low oxygen levels is fish kill. Fish require a certain amount of oxygen and without it will perish quickly. Another common problem in low oxygenated ponds is stratification. This term refers to segregated layers that form in ponds. The upper layer will contain a sufficient amount of oxygen, while the bottom layer will not have enough oxygen to support living organisms. When water becomes stratified, the amount of livable area for fish decreases, placing more of a demand on the oxygenated area.

Continued on page 8