SECTION IV: POND CARE

Algae Control

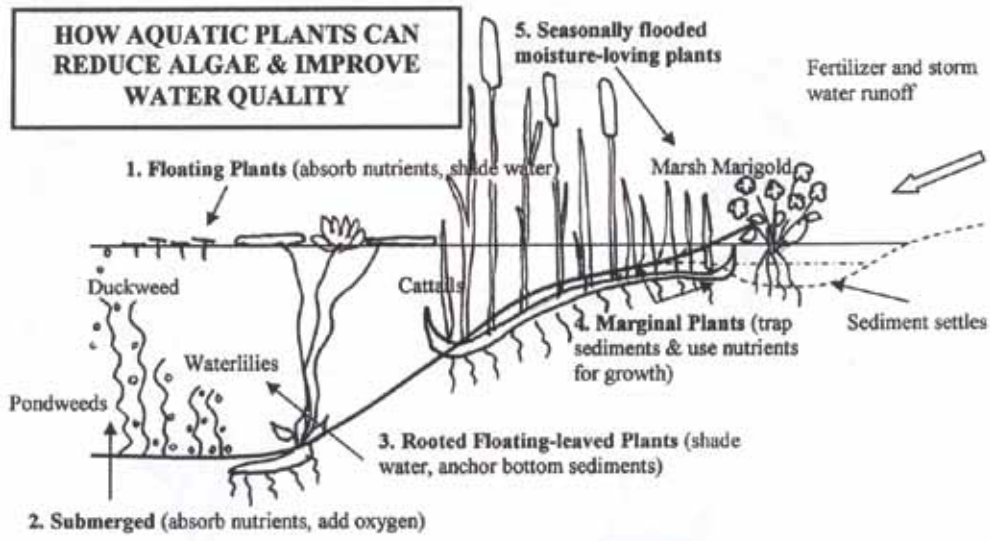
To thrive, algae requires **light, warmth** and **nutrients**

TO CONTROL ALGAE:

1. Low light levels will limit algae growth
   Try
   - ✔ planting floating-leaf aquatics to cover the water surface
   - ✔ using shrubs, trees or shade-producing structures around the pond
   - ✔ adding pond dye to the water
   - ✔ cycling the water through a dark, man-made aquifer.

2. Cold water will limit algae growth
   Try
   - ✔ shading the water (see above)
   - ✔ designing the pond with deep areas (avoid shallow water)
   - ✔ cycling the water through a dark, man-made aquifer.

3. Low nutrient levels in the water will limit algae growth
   Try
   - ✔ diverting runoff away from the pond
   - ✔ not to overfeed fish
   - ✔ biofiltering the water to remove nutrients
   - ✔ introducing zooplankton and bacteria to help consume nutrients
   - ✔ planting lots of submerged aquatic plants to use up nutrients.



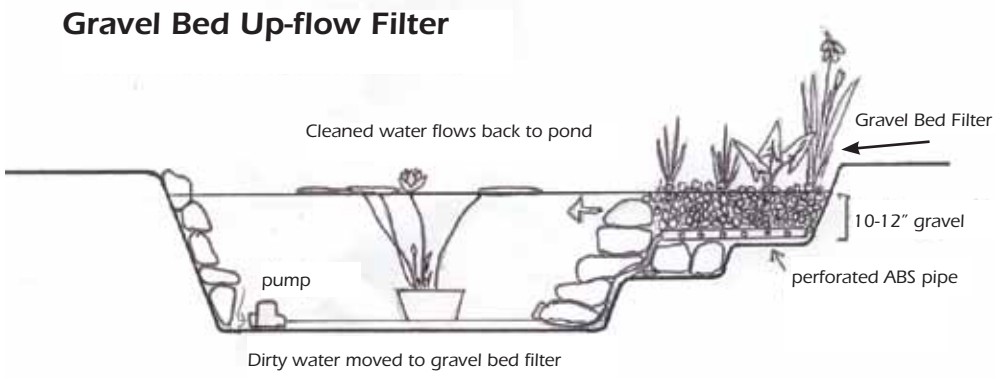
Basin Vac

Bio-filtration

Richard Schuck's '10% Solution'

When using living plants in a natural filter next to a pond, Richard Schuck of Maryland Aquatic Nurseries suggests that the surface area of the planted biofilter should equal 10% of the pond surface area.

The depth of the filter basin should be 10-18". This is the active root zone in aquatic plants.



Water Quality

Notes on Water Quality

Water Hardness—goldfish can survive in 50 to 200 ppm $CaCO_3$. Ideal values for Koi are between 100 and 150 ppm.

pH—a value of from 6 to 8.5 is acceptable for most pond life. A value of 9 may signal trouble for fish. A value of 10 is directly toxic. Koi prefer 6.5—8.5.

Ammonia—high levels are stressful to fish; the higher the pH reading is above 7, the more toxic the ammonia can be if it starts to accumulate (use biofilitration or bacteria to solve this problem). As water temperature rises, more of the total ammonia present in solution changes into free ammonia, which is very poisonous to fish. The maximum recommended exposure level for free ammonia is 0.02 ppm in water.

Oxygen—keep O_2 levels up, specially in warm summer weather (aerate or splash water with a fountain, stream or over falls). Minimum dissolved oxygen concentration for healthy fish is 6 ppm in water. Ideally levels should be greater than this, especially of there are lots fish in the pond.

Biological Oxygen Demand– this refers to the use of oxygen by microbial flora. Bacteria will convert ammonia to nitrate, but in doing so use oxygen. To convert 1 gram of ammonia requires 4 grams of oxygen.

Thermal Stratification—refers to the layering of water due to different densities of water at different temperatures. This generally applies to water bodies greater than 2 feet deep. Water is heaviest at 39° F (4° C) and will result in warmer or colder water to be found above this strata.

Destratification– the loss of layering. The mixing of water at various temperatures and depths within the water column until a uniform temperature is reached. This usually happens in the spring and fall. It can also be induced using aeration equipment.
Summer kill of fish- usually caused by oxygen depletion. Results from aquatic plant decomposition or respiration and the inability of warm water to retain high enough concentrations of dissolved oxygen.

Winter kill of fish– usually caused be oxygen depletion during ice cover. The decomposition of plant materials below the ice will use up the available oxygen in the water. Gas build-up, as a result of this organic breakdown, may also occur and cause fish kill.

Supersaturation of water– this occurs when dissolved gas levels become very high. This can cause gas bubble disease in fish. It is known to occur in winter with aeration. To remedy this, raise air diffusers to about 12 inches below the water surface.

Phosphates & algae– .25 ppm P are sufficient to permit algae to grow. 2.0 ppm will permit filamentous algae (blanket weed) to thrive.

Foam buildup on water– protein waste or Dissolved Organic Carbon (DOC) will cause foaming and yellow water below falls and in streams.

Calculations & Conversions

Pond Volume
(Length (ft.) x width (ft.) x depth (ft.)] x 7.5 = gallons
e.g. [8' x 4' x 2'] x 7.5 = 480 gallons

Pump Size
As a rule of thumb, we try to circulate the pond water once every two hours.
Pond Volume (gallons) ÷ 2 = Pump Size (GPH). It is usually best to choose a pump with a slightly larger rating since losses occur due to friction, curves in the plumbing, height the water must be raised, filter resistance, etc.

Pond Liner Size
Length of pond + (Depth x 2) + 2 ft. = Liner Length
Width of pond + (Depth x 2) + 2 ft. = Liner Width

Reservoir Size
When building a stream or waterfall it is recommended to have a minimum of 2 to 3 times as much water in it versus that which is in the stream or waterfall.

Electrical Conversions
Amps x Volts = Watts
e.g. 110 V x 5 A = 550 W
Watts ÷ Volts = Amps
e.g. 550 W ÷ 110 V = 5A

Area Conversions
1 acre = 43,560 sq. ft. = .405 hectares = 4052 sq. m.
1 foot = .305 meters

Volume Conversions
1 gallon = 3.785 liters
1 fluid ounce = 29.57 milliliters
1 Imperial gallon = liters x 0.22
1 US gallon = liters x 0.26

Water Relationships
1 gallon of water = 8.345 pounds
1 liter of water = 1000 grams
1 metric ton of water = 1000 liters
1 metric ton of water = 1 m^3
1 metric ton of water = 264 gallons
1 cubic foot of water = 7.48 gallons

Parts per Million Calculations
1 PPM =
1 milligram/liter
1 milligram/kilogram
1 gram/metric ton
3.78 milligrams/gallon

Tubing Flow Rates

Tubing Size	Maximum Flow	
Inside Diameter (in)	Gallons per Hour (GPH)	Gallons per Minute (GPM)
1/2"	300	5
3/4"	720	12
1"	1200	20
1 1/2"	3000	50
2"	4800	80
2 1/2"	6000	100
3"	9000	150
4"	12000	200

Waterfall Flow Rates

Width of Waterfall	Waterfall Water Thickness			
	1/4" GPH	1/2" GPH	3/4" GPH	1" GPH
1"	240	780	1440	2160
2"	540	1560	2820	4380
3"	780	2340	4260	6540
4"	1080	3060	5640	8700
5"	1380	3840	7080	10860
6"	1620	4620	8520	13080
7"	1920	5400	9900	15240
8"	2160	6180	11280	17460