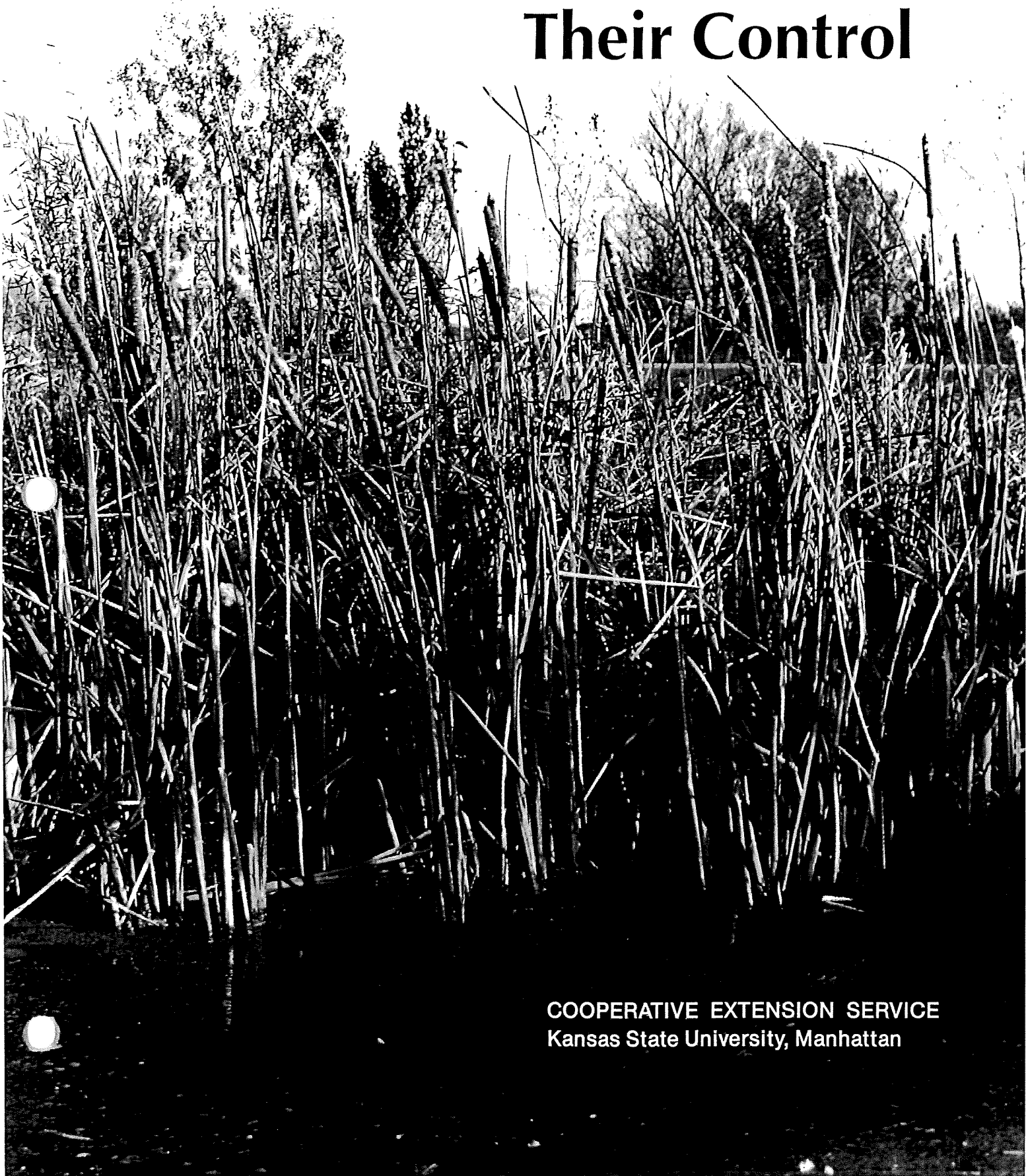


# Aquatic Plants And Their Control



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Stocking new, clear ponds and lakes at 3 to 5 grass carp per acre can prevent development of aquatic weed problems. Grass carp need to be at least 10–12 inches long to avoid predation if predatory fish such as bass are in the pond or lake. The initial stocking should be effective for at least several years since these are long-lived fish. A few replacement fish can be stocked if aquatic weed infestation increases.

Only a few problems are associated with grass carp. They do not reproduce in standing water nor do they seem to compete or interfere with the game fish. They may, however, cause some loss of clarity of the water. Clear weedy ponds when stocked with grass carp become less clear. As the grass carp eat the vegetation, the nutrients are excreted through wastes. These in turn stimulate the production of planktonic algae which decrease the clarity.

Grass carp are highly mobile and they will readily leave a pond or lake during periods of heavy flow over the spillway. Use of mesh fence across the spillway can prevent loss of these fish.

Some states have restrictions regarding the use of grass carp, but Kansas has none. Grass carp are readily available from most commercial fish growers at the current cost of about \$4 to \$8 per fish.

**Fertilizers** added to water have been used to control aquatic weeds. Fertilizers stimulate the growth of planktonic algae which in turn decreases the water clarity, and thus prevents growth of submersed vegetation. Although it appears to be a good practice it usually creates other problems. Additional nutrients may cause an increase of marginal vegetation and also filamentous algae. Increased infestation of algae and other vegetation may cause oxygen depletion as the plants die and decay. Fertilization is not recommended in Kansas since most waters in Kansas lakes and ponds contain sufficient nutrients.

**Waterfowl** have also been used to control aquatic plants. Ducks, geese and swans will eat aquatic vegetation. Many pond and lake owners enjoy waterfowl. However the large number of waterfowl needed for control of submersed and marginal plants results in a large amount of wastes, which fertilize the water. This often results in algae problems.

## Herbicides

Herbicides may be used to control aquatic weeds but control may vary due to such factors as susceptibility of the aquatic weed(s) to the herbicide, stage of growth, rate of application, and the time of application. Some herbicides may also cause injury to fish if not applied properly. This publication provides information on alternative herbicides and their use for aquatic weed control.

Herbicides are frequently the preferred method for control of aquatic weeds in situations requiring fast results and control for several months. However, even chemical methods frequently must be combined with hand or mechanical weeding to remove remaining weeds and to prevent future spread by seed or other plant parts.

Additional information on proper use of registered herbicides for most effective aquatic pest control and least or no effect on non-target organisms or the environment can be obtained from: (1) County Extension offices, (2) Kansas Department of Wildlife and Parks, and (3) information from product labels and manufacturers of herbicides registered by the Environmental Protection Agency (EPA) for use in aquatic areas.

## Herbicides and Their Use for Aquatic Plants

### Improper Use

**Improper application rates:** Proper use of herbicides requires accurate application so that water, vegetation, or soil in an aquatic area is covered uniformly at the rate recommended on the product label. Properly functioning, accurately calibrated equipment is essential. Application of a herbicide below the rate recommended on the label can result in unsatisfactory control of target aquatic weeds. Herbicide application at a rate higher than the recommended rate for the product can result in greater residue and/or toxicity. Herbicides applied at rates exceeding the recommended rate can also create a hazard by contaminating water used for drinking, fish, livestock, other non-target organisms, irrigation, or other purposes.

**Incorrect formulation:** The use of an incorrect formulation can result in:

1. Use of a product that is not effective or safe.
2. Increased toxicity resulting in death or injury to fish and other non-target organisms.
3. Increased hazard to humans during application.
4. Increased hazard of injury to desirable non-target plants.

**Faulty application:** Faulty application can be the result of:

1. Improperly calibrated equipment.
2. Use of improper herbicide.
3. Use of improper rate of recommended formulation.
4. Application at improper stage of plant growth of target weeds.
5. Application of foliar-applied herbicides when weeds are not growing rapidly due to unfavorable growing conditions.
6. Application to plants, water, or areas not registered for treatment on product label.
7. Application during windy or other undesirable weather conditions.
8. Improper determination of volume of lake or pond to be treated.

Hazards that can result from faulty application are listed above under Improper Application Rates and Incorrect Formulations.

### Proper Use of Herbicides

All chemicals used for aquatic pest control should be applied in accordance with the directions on the manufacturer's label, as registered under the Federal Insecticide, Fungicide and Rodenticide Act.

**Table 1. Response of aquatic weeds to selected herbicides<sup>1</sup>**

Classification of Aquatic Weeds	Aquatic Weed	Aquatic Herbicides (Trade Name)						
		Copper algaecides (several)	2,4-D (several)	Diquat (Reward, Weedtrine D)	Endothal (Aquathol, Hydrothol)	Fluridone (Sonar)	Fosamine (Krenite)	Glyphosate (Rodeo)
Algae	Chara	X			X <sup>2</sup>			
	Filamentous							
	Cladophora	X			X <sup>2</sup>			
	Pithophora	X			X <sup>2</sup>			
	Spirogyra	X			X <sup>2</sup>			
	Planktonic	X						
Floating Plants	Duckweed			X		X <sup>3</sup>		
Rooted Floating Plants	Waterlillies		X			X		X
Submersed Plants	Bladderwort		X	X		X		
	Coontail		X	X	X	X		
	Elodea			X	X <sup>2</sup>	X		
	Naiad			X	X	X		
	Pondweeds							
	American			X	X	X		
	Curly leaf			X	X	X		
	Horned			X	X	X		
	Leafy			X	X	X		
	Sago			X	X	X		
	Water thread			X	X	X		
	Watermilfoil		X	X	X	X		
Emerald Plants	Arrowhead		X					X
Marginal Plants	Cattails			X		X		X
	Smartweeds		X					X
	Willow		X				X	X
	Cottonwood		X				X	
	Purple Loosestrife		X					X

<sup>1</sup> X = Aquatic weeds controlled as shown on product labels of herbicides registered for aquatic weed control.

<sup>2</sup> Hydrothol formulation only

<sup>3</sup> AS Formulation only.

Most herbicides have a low acute oral toxicity, but a few aquatic herbicides are poisonous to human beings, livestock, and other non-target organisms. Some herbicides are toxic to fish but most do not injure fish at concentrations required for weed control.

Proper use of herbicides will result in the most effective control of aquatic weeds and little or no effect on non-target organisms or the environment. Follow these rules:

1. Select the appropriate herbicide to control the identified target weeds. Refer to Table 1 for weed response to selected aquatic herbicides.
2. Consult with Kansas Department of Wildlife and Parks or the U.S. Fish and Wildlife Service for advice if a proposed herbicide application might endanger wildlife, fish, or their habitat.
3. Apply the herbicide in accordance with all directions, warnings, and precautions on the label. Refer to Table 2 for use restrictions of water treated with aquatic herbicides.
4. Store excess pesticides under lock and key—out of reach of children and animals—and away from food and feed.
5. Properly dispose of empty pesticide containers.

## Herbicides for Aquatic Use

### Copper Algaecides

#### Copper Sulfate

**Products and manufacturers:** Copper Sulfate—Chem One Corp and Griffin.

**Copper Sulfate use information:** Do not exceed 4 ppm in potable water. Copper sulfate controls microscopic algae, single-filament algae and *Chara* (stonewort), but is not effective against submersed or emerged leafy waterweeds. Copper sulfate may be used in recommended concentrations without harm in waters for livestock and irrigation. Copper sulfate corrodes galvanized cans and most spraying equipment. Plastic sprinkling cans are convenient for applying copper sulfate.

**Rate of application:** Rates for algae control range from 0.67 to 5.32 pounds of copper sulfate per acre-foot of water. Four pounds of powder or crystals per acre-foot is generally strong enough to kill algae and stonewort in most waters. This concentration kills snails but does

not kill fish. In alkaline water, stronger concentrations may be necessary. Treatment is ineffective in waters with total alkalinity over 250 ppm. In moderate to high alkalinity waters (over 200 ppm), the copper chelated products are recommended. Use only 1.2 pounds of copper sulfate per acre-foot in very soft water as fish may be killed at the 4-pound rate.

**How to apply:** Copper sulfate is available in different crystal and granular grades depending on application needs. Crystals may be scattered by hand on the surface of small ponds or placed in a burlap bag and towed behind a boat. Crystals or powder can be dissolved in water and applied by spraying the water surface. If a heavy growth of algae is present treat only one-third or one-half of the pond at a time at weekly intervals. This prevents depleting the oxygen when the mass of dead organic matter decomposes. You may treat an isolated mass of stonewort or algae without treating the whole pond.

**Caution:** Residual copper is toxic to many aquatic animals. Frequent and continued use may result in the kill of a large part of the fish-food supply.

### Copper Chelates

**Products and manufacturer:** Cutrine-Plus and Stocktrine II—Applied Biochemists, Inc. (basic producer), K-Tea and Komeen—Griffin, and others.

**Herbicide use information:** For use in lakes, private farm, fish and fire ponds; fish hatcheries; potable water reservoirs, irrigation systems, and stock tanks (Stocktrine). Apply to control algae including *Chara*, *Spirogyra*, and *Cladophora*. Chelates prevent precipitation of copper with carbonates or bicarbonates in the water. To avoid suffocation of fish due to lack of oxygen caused by decay of heavy infestations treat only 0.3 to 0.5 of the lake or pond at a time. Water treated with this product may be used for drinking, livestock watering, swimming or fishing immediately after treatment. Water treated with this product also may be used to irrigate turf, ornamental plants or crops immediately after treatment. Copper chelates may be toxic to trout and other species of fish in soft water (<50 ppm carbonate hardness).

## 2,4-D

### 2,4-D Low Volatile Ester Granules

**Products and manufacturers:** Aqua-Kleen—Rhone Poulenc; Navigate—Applied Biochemists, Inc.

**Herbicide use information:** For use to control specified water weeds (refer to product labels) in ponds and lakes. Granules sink to bottom and release weed-killing chemical in the critical root zone area. Apply 100 to 200 pounds per acre by portable spreader or mechanical spreader. During growth season, weeds decompose in a 2- to 3-week period following treatment. Apply in spring and early summer during the time

weeds start to grow. Do not apply to more than 0.3 to 0.5 of a lake or pond in any one month because of excess decaying vegetation which may deplete oxygen content of water, killing fish. Do not apply to waters used for irrigation, agricultural sprays, watering dairy animals, or domestic water supplies.

### 2,4-D Amine

**Product and Manufacturer:** Several

**Herbicide use information:** For use to control aquatic weeds and weeds adjacent to water. Apply for control of annual weeds, perennial weeds, and woody plants. Do not apply to more than 0.3 to 0.5 of a lake or pond in any one month because of excess decaying vegetation which may deplete oxygen content of water, killing fish. Do not apply to waters used for irrigation, agricultural sprays, watering dairy animals, or domestic water supplies.

## Diquat

**Products and manufacturers:** Reward and Diquat—Zeneca and Weedtrine D—Applied Biochemists.

**Herbicide use information:** May be fatal if swallowed, inhaled or absorbed through skin. Skin contact will cause severe skin irritation. Do not get material on skin, eyes or clothing. Contact with skin may increase danger of absorption. For application only to ponds, lakes, and drainage ditches where there is little or no outflow of water and which are totally under control of product's user. Diquat is rapidly absorbed by aquatic plants and begins to work immediately upon contact. Plant tissue is destroyed, causing wilting and loss of foliage. Do not use treated water for animal consumption, spraying or irrigation for 14 days after treatment. Do not apply within 0.25 mile of any functioning potable water intake. Treatment of dense weed areas can result in oxygen loss from decomposition of dead weeds. Treat only 0.3 to 0.5 of the dense weed area at a time to avoid fish suffocation from oxygen loss and wait 10–14 days between treatments. *Do not apply to muddy water.* Apply diquat in early season to control submersed weeds before weed growth has reached surface. Diquat will control the following submersed weeds infesting still ponds, lakes and ditches: bladderwort, coontail, elodea, naiad, pondweeds, and watermilfoil. Other aquatic weeds controlled include duckweed, cattails and some filamentous algae.

## Endothall

**Products and manufacturers:** Aquathol and Hydrothol 191—Elf Atochem

**Herbicide use information:** Aquathol and Hydrothol 191 are different formulations of endothall and are both available as granular or liquid formulations. Hydrothol controls most algae and submersed plants, but is toxic

to fish at dosages in excess of 0.3 ppm. Aquathol controls most submersed plants and is not toxic to fish, but does not control algae. Apply in late spring or early summer when weeds are actively growing. Do not use treated water for irrigation, agricultural sprays, livestock, or domestic purposes for at least 7 to 25 days after treatment.

## Fluridone

**Product and manufacturers:** Sonar AS and Sonar SRP—SePRO

**Sonar use information:** For management of aquatic weeds in fresh water ponds, lakes, reservoirs, drainage canals and irrigation canals. Sonar is absorbed from water through leaves and shoots, and from hydrosol by the roots. Sonar causes chlorosis at terminal bud or growing points of plant, then plants slowly deteriorate. Complete weed removal may require 30 to 90 days. Sonar AS is effective in controlling duckweed; certain emerged weeds including spatterdock and waterlily; certain submersed weeds including bladderwort, coontail, elodea, naiads, pondweeds, and watermilfoil; and certain shoreline grasses. Sonar provides partial control of certain vascular aquatic weeds including American lotus, arrowhead, cattail, rush, and smartweed. For best results, apply Sonar before initiation of weed growth or when weeds begin actively growing.

**Users must consult their State Fish and Game Agency or the U.S. Fish and Wildlife Service before making applications.** Do not apply in lakes, ponds, or other bodies of water where crayfish farming is performed. There are no label restrictions against swimming or fishing in water treated with Sonar. There are no restrictions on consumption of treated water by humans, pets, and livestock.

## Fosamine

**Product and manufacturer:** Krenite—DuPont.

**Krenite use information:** For control of susceptible perennial weeds and brush species on non-cropland adjacent to and surrounding domestic water reservoirs, streams, lakes and ponds, as well as drainage ditch-banks. Krenite, a water-soluble liquid, is non-flammable and non-volatile. Brush controlled includes cottonwood and willow. Apply with surfactant and make a single foliar application during the period from July to first fall coloration. For control of only a portion of a plant, as in trimming, direct the spray to thoroughly cover only the section of the plant to be controlled. Do not apply Krenite directly to water.

## Glyphosate

**Product and manufacturer:** Rodeo—Monsanto.

**Rodeo use information:** This product may be used in and around aquatic sites, including all bodies of fresh and brackish water, which may be flowing, non-flowing or transient. This includes lakes, rivers, streams, ponds, seeps, irrigation and drainage ditches, canals, reservoirs, and similar sites. There is no restriction on use of water for irrigation, recreation, or domestic purposes. Apply Rodeo plus nonionic surfactant approved for aquatic sites as directed on the label to control or partially control marginal weeds, woody brush and trees listed on the label. Aquatic plants controlled include cattails, annual and perennial smartweeds, spatterdock, and willow. Perennial plants generally are best controlled when treated during the flowering stage of growth. Do not apply this product within 0.5 mile upstream of potable water intakes, unless intake is turned off for a minimum of 48 hours after application.

## Aquatic dyes

**Product and manufacturer:** Aquashade—Applied Biochemists.

**Aquatic dye use information:** These products are a mixture of blue and yellow dyes that intercept light penetration in water. Aquatic dyes do not directly control the plants through herbicidal activity, but limit growth of plants below the water surface through shading effect. Primarily for control of submersed, rooted weeds, and some algae. Should only be used in bodies of water with little or no through-flow, in order to maintain dye concentration. Products should be applied before foliage reaches the water surface. These products are nontoxic to fish, wildlife, livestock, humans, and turf. Do not use where water is used for human consumption. Safe for swimming after complete dispersal. May be undesirable to some individuals due to artificial appearance of water.

## How to Calculate Area and Volume of a Body of Water

**Area**—Some chemicals are applied at a certain rate per surface area (square feet or acres). Area can be calculated by multiplying average length times average width. This is easy if the body of water is rectangular or oval in shape. If a more accurate estimate is desired, or if the body of water is an irregular shape, the graph paper method should be used. Length and width should be measured in several places. These measurements should then be transferred on to a sheet of graph paper according to a scale. Then the shoreline can be drawn in with the proper curvatures. The area can then be determined by counting the

**Table 2. Aquatic-herbicide-treated-water use restrictions.**

Herbicide	Human		Fish Consumption	Livestock		Irrigation	Agricultural Spray
	Drinking	Swimming		Dairy	Meat		
	Number of days after treatment before use <sup>1</sup>						
Copper Sulfate	0 <sup>2</sup>	0	0	0	0	0	0
Copper Chelate	0 <sup>2</sup>	0	0	0	0	0	0
2,4-D	----- (Varies with formulation. Consult the label) -----						
Diquat	14	1	0	14	14	14	14
Endothall	7–25	1	3	7–25	0	7–25	
Fluridone	X <sup>3</sup>	0	0	0	0	7–30	30
Fosamine	----- (Do not apply directly to water) -----						
Glyphosate	2	0	0	0	0	0	0
Aquatic dyes	X	0	0	0	0	0	0

<sup>1</sup>X = Do not use treated water for that purpose.

<sup>2</sup> Elemental copper concentration should not exceed 1.0 ppm if water is used for drinking.

<sup>3</sup> Do not apply within 0.25 mile of any functioning potable water intake.

squares and multiplying this by the scale area for each square. For example: if the scale is 1 square = 5 feet, then the area of 1 square = 5 × 5 or 25 square feet.

The area then can be expressed as square feet or acres. One acre = 43,560 square feet.

$$\text{Surface area of pond in acres} = \frac{\text{pond area in square feet}}{43,560}$$

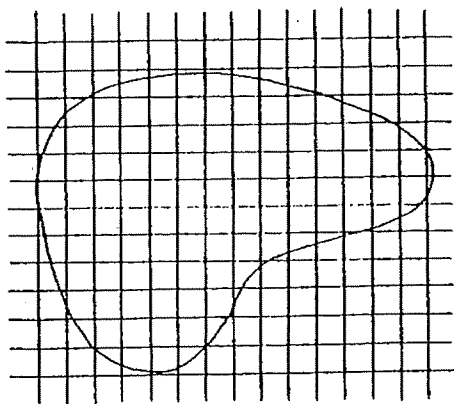
**Volume**—Most herbicides are applied on the basis of volume as a certain number of parts per million (ppm) or as a certain amount per acre-foot (1 acre of surface water that is one foot deep). To find volume, the average depth must be determined. This is done by taking numerous evenly spaced depth measurements. The accuracy of the average depth estimate is increased as the number of depth measurements increases. Shallow measurements must also be included or

the estimate will be too high. This calculated average depth is then multiplied by the surface area determined by the method described earlier. If all the measurements were made in feet, the calculated volume will be in cubic feet. This number can be used to calculate the amount of herbicide product recommended on the label. Aquatic herbicide application is often expressed on a per acre-foot basis.

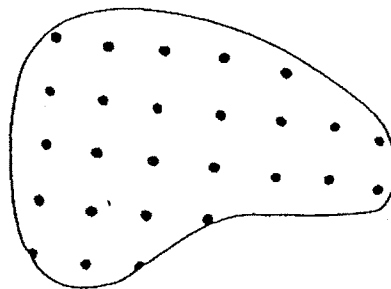
$$\text{Volume of pond in acre-feet} = \frac{\text{Pond volume in cubic feet}}{43,560}$$

$$= \frac{\text{Pond area in square feet} \times \text{average depth in feet}}{43,560}$$

$$= \text{Pond area in acres} \times \text{average depth in feet}$$



**Area Determination**



**Depth Readings for Volume Determination**