FISHPOND MANAGEMENT

Conservation Practice Standard 399 Guidance

Natural Resources Conservation Service (NRCS) **August 2007**

Purpose

To provide additional information for fishpond management outlined in Florida NRCS Conservation Practice Standard, Fishpond Management, Code 399.

Specifications and Guidance

I. All Ponds

Maintaining good water quality and well-balanced fish populations is the best recipe for success.

A. Liming to Adjust pH

1. Soil pH (new ponds)

Add enough agricultural limestone to bring the pH of the soil in the pond basin to 6.0 to 8.0 (7.0 is neutral).

2. Soil pH (established ponds)

The bottom soil of a pond usually becomes increasingly acidic as the pond gets older. This acidic bottom soil is less productive of fish food organisms. Every 5 years, pull a soil test on the pond mud and apply lime accordingly. As a rule, however, one to two tons of agricultural lime per acre should be added to a pond every 5 to 7 years. Ponds with a heavy flow-thru generally require liming more often.

3. Water pH

Research has shown that best fish production occurs in water with the pH range from 6.5 to 9.0. Water analysis is the only accurate way of determining proper pH; however, conditions which suggest that a pond might have a low pH include stained water, poor response to inorganic fertilization, poor fish growth, or very clear water with a bluish cast.

The pH of acid-water ponds (4.0 to 5.5) changes little or none through out the day, on the other hand, ponds having desirable pH conditions may have a pH of 7.0 in the early morning, and the pH may increase to about 8.5 or 9.0 by mid-afternoon on a sunny day. Treat ponds where the pH does not get above 6.5 at any time of the day with ground agricultural limestone. Use one to two tons of lime per acre. Repeat when water tests show the pH is getting low again.

Agricultural limestone is the best liming agent in ponds. Impoundment ponds located in acid soils should have limestone applied before impounding water. When ponds are full of water, best results may be achieved by broadcasting agricultural limestone evenly over the entire pond surface. Bags of limestone may be emptied from a moving boat; however, bulk limestone is much cheaper and may be applied from a plywood platform attached between two boats. Limestone can be added at any time; however, it is best applied in late fall and early winter so that it will react with water and bottom mud before fertilizer is applied in the spring. Limestone will precipitate phosphorus if applied at the same time as fertilizer. Application of liming materials during the summer months will often precipitate algae, thereby clearing the water and encouraging desirable aquatic weed growth.

Conservation practice standards are reviewed periodically, and updated if needed. To obtain the current version of this standard, contact the Natural Resources Conservation Service.

Excavated ponds, which have clear water with a bluish cast, should be suspected of being extremely acid (pH < 4.0) and should not be stocked until the pH has been adjusted to neutral.

Hydrated lime treatment of 50 lbs per surface acre is recommended with frequent water testing to ensure the proper pH is reached. If the pond is already stocked, gradual addition of lime is recommended as drastic shifts in pH can be harmful. Periodic treatment will most likely be necessary, although treatment interval will vary according to site conditions.

Much less common are ponds in prolonged alkaline condition (pH ≈ 10.0). Alum sulfate treatments of 5 pounds per acre foot will reduce pH. To help prevent recurrence, treat these highly alkaline ponds with agricultural gypsum ($Ca\ SO_4$) at 1 ton per surface acre. Note that ponds with heavy plankton blooms may vary from neutral pH to 9.0 or 10.0 for short periods of time. If the pH returns to neutral conditions at night, these ponds should not be treated for alkaline conditions.

4. Total Alkalinity of Water

"Alkalinity" is a chemical term referring to the measurement of bases present in water. It gives an indication of the buffering capacity of water.

Waters too low in alkalinity severely restrict fish growth and production because phytoplankton growth is limited by inadequate supplies of carbon dioxide and calcium concentrations. Larger quantities of fertilizer are needed to maintain plankton blooms in waters with low alkaline conditions.

Waters with less than 10 milligrams per liter total alkalinity should be limed with 1 to 2 tons of agricultural lime per acre.

Waters with 1 to 20 milligrams per liter total alkalinity should be limed if an adequate plankton bloom cannot be established with fertilizer. One ton per acre should suffice.

Waters with more than 20 milligrams per liter total alkalinity are adequate for fish production and waters with over 40 milligrams per liter are very productive.

B. <u>Eradicating Undesirable Fish</u>

Emphasize to a pond owner the importance of eradicating undesirables in a new pond basin. Never assume there are no undesirable fish present unless the basin is completely dry before impoundment. When an old pond is being renovated, the pond should be drained, if possible, either by drainpipes, siphons, or pumping. *Note that FL Department of Environmental Protection (DEP) and Water Management District permits may be required*. If it is impossible to drain the pond completely, use an approved fish toxicant such as antimycin A or rotenone. As with all chemicals, label requirements must be followed for specific dosages. General rules of thumb to use in determining how much to order are as follows:

Antimycin A @ 1 gal./ 6 ac. ft.
Liquid rotenone (5% active) @ 0.65 gal./ac. ft. Powder rotenone (5% active) @ 5 lbs./ac. ft.

The toxicants must be distributed evenly throughout the entire pond, with special attention in shallow water and heavily vegetated areas. Both toxicants are more effective in warm water (above 70 F). Allow 2 weeks before stocking after use of toxicants. The *Florida Fish and Wildlife Conservation Commission (FFWCC) and/or DEP may require a permit to use a fish toxicant.* The landowner should contact them before using. Do not recommend eating fish killed by a toxicant.

See NRCS' Agriculture Handbook 590: *Ponds-Planning, Design, Construction* for determining pond capacity.

C. <u>Aquatic Vegetation Control</u>

In a fish pond that is to be managed intensively for fishing, some aquatic vegetation is desirable since they provide habitat. To discourage some nuisance weeds, slope the pond shore steeply to 3 feet below the water surface at pond edges. Troublesome vegetation may be controlled by mechanical removal, application of herbicides or biological methods.

A permit from the FL DEP is required before using herbicides in state waters or waters connected to state waters. All use of herbicides must be in accordance with their label and Florida NRCS Conservation Practice Standard Pest Management, Code 595. Only use chemicals that are approved for use where fish may be used for human consumption. When

treating aquatic vegetation chemically, it is safer to treat only a portion of the pond at a time since decaying weeds can cause an oxygen deficiency. Treat no more than one-fourth to one-third of heavily infested ponds at 14-day intervals.

Biological control by triploid grass carp (*Ctenopharyngodon idella*) can be very effective in controlling submersed vegetation. Florida FWCC permits are required prior to stocking herbivorous fish.

Very few ponds are actually intensively managed for quality fishing. In non-intensively managed ponds, aquatic plants may not be desired. However, the range of aquatic vegetation tolerable in a pond that is only occasionally fished can be quite wide, and ranges from none to considerable vegetation before it becomes a problem.

D. Diseases and Parasites

Fish in well-managed ponds are generally quite resistant to disease and parasites; however, a problem should be suspected when dead fish are regularly found in a pond (Note: It is not unusual to find a dead fish occasionally in any pond.) Other indications of disease problems are sores or fungus growth on fish.

The diagnosis of disease or parasites requires a well-trained fish pathologist – contact a FFWCC fisheries biologist for guidance. Diagnosis usually requires the collection of living fish, because tissue changes after death may mask a disease and parasites vacate dead fish.

Treatment of ponds for parasites and disease is difficult and costs may exceed the worth of the fish.

E. Clearing Muddy or Stained Water

Impounded water may become muddy due to a failure of clay particles to settle out. This failure may be due to the continuous mixing of the clay particles in the water from wave action, heavy rains, bank erosion, livestock watering in ponds, or large numbers of bottom feeding fish such as common carp. If these types of issues are not the problem, then the problem may be a failure of the clay particles to flocculate (to settle out). In this case specific treatments can be applied to the water to induce the clay particles to flocculate. But prior to treating a pond for water turbidity, make sure the turbidity is from suspended particles rather than from phytoplankton.

To clear muddy ponds apply:

Non-Summer Months (October to May) (lbs/surface acre)

75 lbs/ac. of cottonseed meal &
25 lbs/ac. of super phosphate

or

4-6 bales of *green* hay (hay that is green in color and has not dries) (60 lbs) spread evenly over the pond.

Summer Months (lbs/surface acre):

50 lbs/ac. of super phosphate

Note: Do not use green hay or cottonseed meal during summer months as these supplements will delete dissolved oxygen (DO) levels.

Other Treatments:

80 lbs/ac of commercial alum *in combination* with 30 lb/ac of hydrated lime.

or

125 lbs/ac. of agricultural gypsum to start; additional gypsum may be required to be effective (*Note:Gypsum provides rapid results, but large applications may be necessary. Use gypsum when it is desirable to not raise the pH*)

To clear stained water apply:

2,000 lbs/ac of agricultural limestone.

F. Oxygen Deficiency Detection and Correction

Oxygen depletion is the most common cause of fish die-offs in ponds. Indicators of low dissolved oxygen (DO) levels are:

1. Fish swimming on surface or "piping.'"
2. Change in color of water.
3. Musty or foul odor.
4. Fish going off feed (food supplemented ponds)

The warmer the water becomes, the less oxygen it will hold. Most of the oxygen in the water is produced by the photosynthesis action of microscopic algae. The algae, however, should not be so thick that light cannot penetrate to a depth of a few inches. Do not allow ponds to develop a "soupy", "pea green" appearance.

The amount of DO in a pond will vary throughout the year, and since cooler water holds more DO, average concentrations are usually higher during the winter. DO content of water also varies during a 24-hour period, with the lowest level being reached at sunrise. This is because no oxygen has been released by the plants during the night, but oxygen has been used continuously by both plants and animals. DO concentrations in warm water ponds commonly vary from 10 parts per million (ppm) to 4 ppm or less at sunrise.

A combination of hot temperatures, little wind, and cloudy cover for several days is conducive to oxygen shortages. Strong winds with cold rains may cause a "turnover" whereby bottom waters that have little or no DO (and possibly toxic gases) are mixed abruptly with surface waters. Dying and decaying aquatic plants may also cause oxygen shortages. If any of the above situations are present, and/or if oxygen drops below 2 ppm at a depth of 12 inches, corrective measures should be taken.

Aerate the water at once or add fresh water over a baffle or splashboard. Aerate by lifting and spraying from the top 2 feet of water or by using mechanical aerators. If possible, release water from the bottom of pond at the same time. If fish have been on feed, discontinue feeding until water quality problems have been corrected.

G. Fertilization

Nutrients are added to increase a ponds carrying capacity for fish production and to control vegetation. Fertilization causes a phytoplankton bloom that helps enhance the food chain and shade out undesirable vegetation.

Consider the location of the pond prior to making fertilizer recommendations. Ponds proximal to lawns, pastures, cropland, etc., may be receiving fertilizer run-off and do not need fertilization or reduced fertilization. Fertilization is not a recommended practice for most of central and south Florida.

In order for the fertilizer to have the desired effect, the water pH must be correct and intensive monitoring and frequent applications are required. It is better to not fertilize if a commitment to properly fertilize is not strong.

When water temperatures are 65˚ F or higher, add 1 gal/ac. of a liquid 10-34-0 fertilizer every 10 to 14 days until a bloom capable of hiding a white object held 18 inches below the surface develops. Discontinue fertilization during the fall when temperatures decrease below 60˚ F. Use the following white object guidelines to determine when additional fertilizer applications are needed:

13 – 18”, white object is visible = fertilize
12 “, white object is not visible = do not fertilize

Once a pond has been properly fertilized for 3 to 5 years, an application of 40 lbs/acre of super phosphate may be all that is required to maintain a phytoplankton bloom. Follow the same white object tests above to determine when additional applications are needed.

A single platform is the most economical and best means to apply granular fertilizers on ponds up to 10 acres. The platform should be 12 – 18 inches beneath the surface and 6 feet or more from shore. *Never distribute fertilizer in water deeper than 4 feet.* Tear off the top or slit the sides of each bag and water currents will distribute the nutrients.

Less desirable methods are to broadcast fertilizer along shallow areas from a boat, the shore or an anchored burlap covered inner-tube with fertilizer placed in the middle. Once again water depths should not exceed 4 feet.

Ponds should have a water retention time of at least 30 days in order for fertilization to work properly. A trickle tube with flow taken from bottom waters can be installed to increase retention time of the fertilized surface layer (see Figure 1).

H. Supplemental Feeding

Pelleted fish foods may be used to raise the carrying capacity of ponds for bream and catfish. Either floating (preferred) or sinking feeds (less expensive) can be used for catfish. A mixture of 75% sinking and 25% floating will provide benefits of both. Floating pellets are recommended for bream.

A feeding program is recommended only where there is heavy fishing pressure or fertilization is not feasible. Costs greatly increase due to feeding and there is a greater likelihood of fish kills. If a feeding program is initiated, it should be continued as stopping may result in stunted fish.

Feed when water temperatures are greater than 65˚ F and less than 95 ˚ F according to the following guidelines:

- 2 lbs/ac./day to start,

- 20 lbs/ac./day at a maximum, and
- no more than fish will eat in 15 minutes.

II. Stocking and Harvesting

The following stocking ratios all provide different, but acceptable fishing. The stocking ratio used should be the landowner's decision.

A. Bass, Bluegill and Redear Sunfish

1. Fertilized Ponds, Conventional Management

a) Stocking

Stock a total of 1,000 fingerling bluegills and redear sunfish (combined) per acre during the fall. The bluegill - redear (bream) should be about 70 to 80 percent bluegill and 20 to 30 percent redear sunfish. Add 200 bass fingerlings per acre during the following spring.

b) Fishing

Start fishing after the bass spawn, usually the second June after they are stocked. About 125 to 175 pounds per acre of fish can be taken each year from a well-managed, fertilized pond. About 15 to 25 pounds of this catch should be bass and the remainder bream and channel catfish.

2. Unfertilized Ponds, Conventional Management

a) Stocking

Stock a total of 500 fingerlings fingerling bluegills and redear sunfish (combined) per acre during the fall. The bluegill - redear (bream) should be about 70 to 80 percent bluegill and 20 to 30 percent redear sunfish. Add 100 bass fingerlings per acre during the following spring.

b. Fishing

Start fishing after the bass spawn, usually the second June after they are stocked. About 50 pounds of fish per acre can be harvested, with only about 10 pounds being bass.

3. Fertilized Ponds, Quality Fish Management

a) Stocking

Between November and the end of December, stock 1,000 fingerling bluegills and redear sunfish (combined) per acre and 2 to 4 adult bass ($\geq$ 10 inches) and 1,000 fathead minnows per acre during spring. The bluegill-redear combination should be 70 – 80 percent bluegill and 20 – 30 percent redear sunfish. Adult bass are available from commercial dealers (see references). The minnows will provide initial forage for bass.

b) Fishing

Start fishing the second June after stocking. At that time, the larger bluegills and redear sunfish will ideally be 7 to 8 inches long. There should be numerous 1 to 2 pound bass available. About 100 pounds per acre can be harvested, with no more than 25 pounds being bass. Harvest pressure should be distributed evenly throughout the year.

To enhance the production of bass greater than 15 inches in length, 12 to 15 inch bass should be released for several years after stocking. A slot limit where bass 8 to 12 and 15 or more inches in length are removed should be established with total bass harvests not exceeding 25 pounds per acre.

4. Unfertilized Ponds, Quality Fish Management

a) Same as for fertilized ponds, except stock only 500 bluegills and readear sunfish (combined) per acre. Stock bass and minnows the same as for II(A)(3)(a) above.

b) Halve the harvest recommendations for II(A)(3)(b) above.

B. Bass, Bluegill, Redear Sunfish and Channel Catfish

1. Fertilized Ponds, Conventional Management

a) Stocking (Ponds < 3 ac.)

Stock 1,000 fingerling bluegill and readear sunfish (combined) per acre and stock 100 4 – 6 inch channel catfish fingerlings per acre during the fall. The bluegill-readear sunfish combination should be 70 to 80 percent bluegill and 20 to 30 percent readear sunfish, respectively. Add 200 bass fingerlings per acre during the following spring.

b) Fishing

Start fishing after bass spawn, usually the second June after they are stocked. About 125 to 175 pounds per acre of fish can be

harvested from a well-managed, fertilized pond. About 15 to 25 pounds of the harvest should be bass with the remainder bream and channel catfish.

c) Restocking

Stocking with larger catfish fingerlings at least 7 or 8 inches in length every year or two is necessary in order to maintain good fishing for catfish. The larger catfish fingerlings are necessary because smaller ones will not survive bass predation. The fingerlings can be bought from commercial dealers at this large size or purchased at the smaller size of 3 to 4 inches and raised to the larger size before releasing into the pond. Cage culture works very well for this purpose.

2. Unfertilized Ponds, Conventional Management

a) Stocking

Same as for fertilized ponds except reduce stocking rates by one-half.

b) Fishing

Start fishing after the bass spawn, usually the second June after they are stocked.

c) Restocking

Same as for fertilized ponds.

C. Channel Catfish, Sport Fish Management

1. Fertilized Ponds, No Supplemental Feeding

a) Stocking

Stock 400 channel catfish fingerlings (at least 4 inches) and 1000 fathead minnows per acre during the fall or winter. Add 50 to 100 bass fingerlings per acre the following spring.

Fathead minnows provide food for bass. Bass are stocked to help control the reproduction of less desirable fish and to provide some bass fishing. In spite of all precautions, most ponds become inhabited by non-target fish after a few years.

b) Fishing

Start fishing for catfish when they reach ½ pound or more in weight. Four-inch fingerlings stocked before March 1 should reach that weight by September. Bass should not be caught until after they spawn, which is usually the second June after they are stocked.

c) Restocking

Catfish may reproduce in this combination if spawning containers are present, but bass will prey upon and remove most young. After two or three years, ponds must be either drained or restocked with catfish fingerlings of at least 7 to 8 inches.

2. Unfertilized Ponds, No Supplemental Feeding

a) Stocking

Same as for fertilized sport fish channel catfish ponds, except reduce by ½ the stocking rates.

b) Fishing

Same as for fertilized sport fish channel catfish ponds.

c) Restocking

Same as for fertilized sport fish channel catfish ponds.

3. Unfertilized Ponds with Supplemental Feeding

Well stocked ponds with supplemental feeding normally support a good phytoplankton bloom without fertilization.

a) Stocking

Stock 1,500 to 2,000 channel catfish fingerlings and 1,000 fathead minnows per acre between October 15 and March 1st. Add 50 to 100 bass fingerlings per acre during the following April or May.

b) Feeding

If stocked prior to March 1st, feed 1 percent of body width either on alternate days or when the water 3 feet below the surface is above 54˚ F. Begin daily feeding using pelleted catfish feed by March 1st and continue through October or until water cools to 54 ˚ F or below. Start feeding at a rate of 3 pounds per acre. Increase to a maximum of 25 to 30 pounds per acre per day in September and October of the first year. Feed 10 to 15 pounds per acre per day during the second year. Reduce feed gradually as fish stock is depleted through harvest.

c) Fishing

Start fishing for catfish when they reach harvestable size ≈ ½ lb.) Four inch fingerlings stocked at 3,000 per acre in February and fed correctly reach an average size of 0.7 lbs by

October (8-inch fingerlings should reach that size by August.)

d) Restocking

Ponds must be drained periodically and restocked every 2 or 3 years. With heavy fishing pressure (e.g., 50% or more of the fish caught during the first year), it may be best to drain the pond in November or December, harvest the remaining fish, and restock by March 1st. If fishing pressure is lighter, ponds may provide good fishing for several years before draining and restocking.

D. Cage Culture for Fingerling Production

Cage culture offers an excellent opportunity for growing small fingerlings to a larger size for stocking in ponds with established bass-bream populations. Cages may vary in size or construction, but a convenient size is about 3 ft (height) x 3 ft (width) x 4 ft. (length). Cages may be constructed of plastic netting, hardware cloth, or welded wire on a suitable frame. The metal wires will need to be plastic coated to slow corrosion and to keep the fish from scraping themselves as they swim against it. Float cages in ponds and allow for one foot or more of water beneath the cage. If more than one cage is placed in the pond, they should be placed at least 3 feet apart to permit adequate circulation. Anchor securely. The major problems associated with commercial cage culture have been:

1. Oxygen depletion.
2. Growth of filamentous algae or other organisms on cage sides which block transfer of water through the cages
3. Increased likelihood of disease and parasitic problems.
4. Theft of fish either by man or wildlife such as alligators, raccoons, etc.

The first three aforementioned items are closely correlated with high fish densities; these problems can be alleviated by production of fewer numbers and pounds. Periodic clearing of cages will likely be needed with heavy fish poundage. To reduce theft by humans, the cages should be placed in a well supervised area and have solid, padlocked tops.

The following information is based on work with channel catfish only.

a) Stocking

Stock 6 to 12 fingerlings per cubic foot depending on the cage size. At densities less than 4 per cubic foot, the catfish have been found to fight and try to stake out territories. Stock a total of no more than 2,000 fingerlings per acre. Mesh size of the cage will determine size of fingerlings to be stocked; five-inch fish or larger can be stocked in 1/2" mesh or a 1/2" x 1" mesh. Two-inch to four-inch fish will require a 1/4" mesh. If fish are to be held past the 8" length, they should be transferred to cages of 3/4" or 1" mesh, since the heavy nutrient load results in the smaller mesh fouling more frequently with organic growth. Stocking during fall or winter is preferable to enable growth prior to onset of summer heat.

b) Feeding

The fish must be fed a nutritionally complete (not all fish foods are “complete”), floating fish food 6 to 7 days a week whenever water temperature is above 54 ˚ F. Feed 3 to 6 percent of the total estimated fish weight per feeding. A sample of fish should be removed from cages and weighed at 1 to 3 week intervals, so that total weight can be computed and feed amounts adjusted appropriately. Avoid feeding over 35 pounds of fed per acre.

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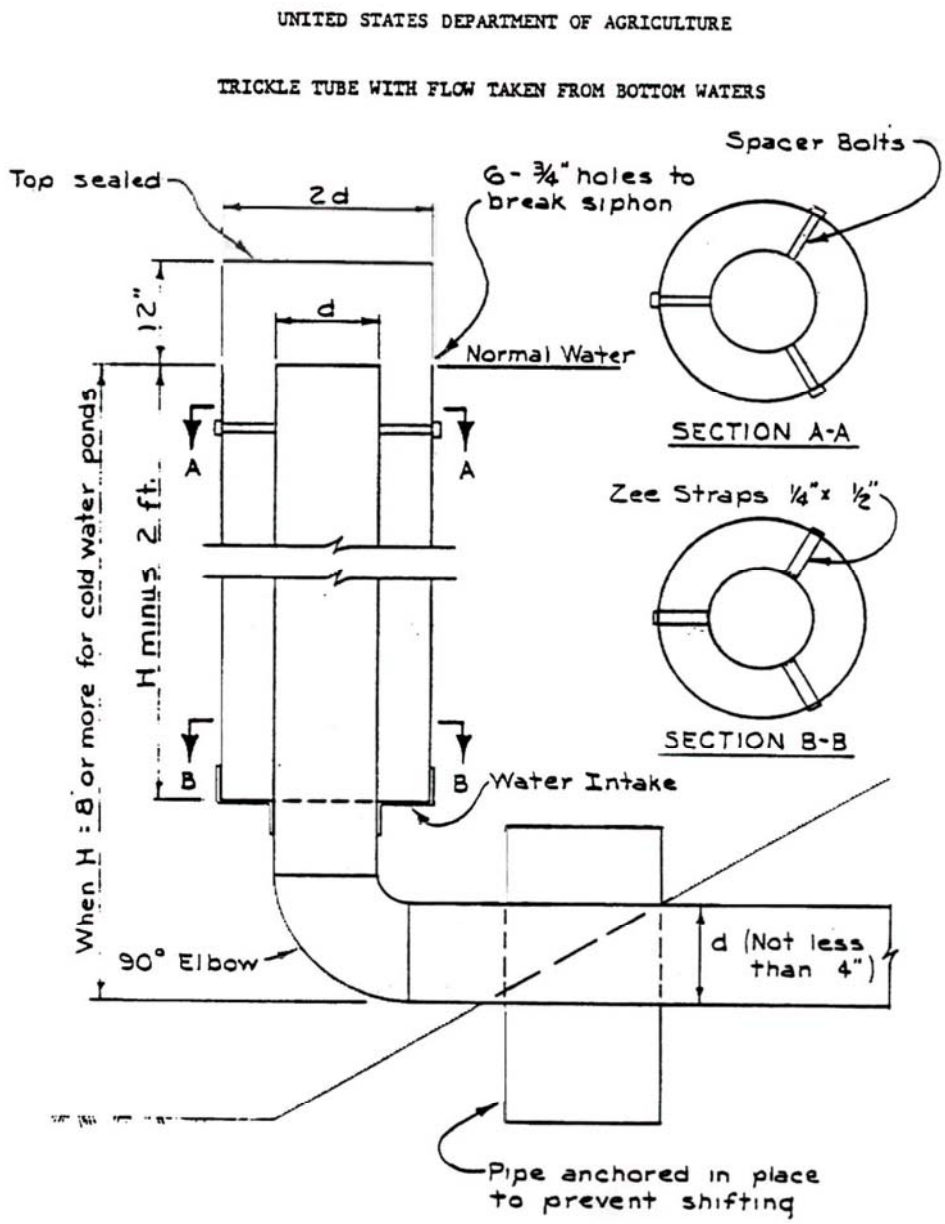
Figure 1. Trickle Tube with Bottom Flow.