Aquaculture Ponds (Acre) 397

DEFINITION

A water impoundment constructed and managed for farming of freshwater and saltwater organisms including fish, mollusks, crustaceans and aquatic plants.

PURPOSES

Provide a favorable aquatic environment for producing, growing, and harvesting aquaculture crops.

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to all impoundments that store water and are managed for aquaculture purposes.

This practice applies to embankment impoundments that do not exceed the requirements for Class (a) dams, as defined in conservation practice standard for Pond (378), having a product of storage times effective height of dam less than 3,000 acre-ft^2 and effective height of dam less than 35 feet.

CRITERIA

General Criteria

Aquaculture ponds shall be planned, designed, and installed to meet all federal, state, local and tribal laws and regulations.

All permits will be obtained prior to construction and stocking.

All measures implemented under this practice shall comply with Michigan's Generally Accepted Agricultural and Management Practices for the Care of Farm Animals. Aquaculture Facilities must be registered with the Michigan Department of Agriculture.

Prepare a thorough resource assessment to determine the feasibility of the project prior to design.

Soil conditions, climate, water resources, and topography shall be suitable for constructing a pond or reservoir.

Aquaculture ponds may be: (1) embankment ponds that intercept and store surface runoff water, or (2) off-channel impoundments or excavated ponds that are filled by pumping ground water, or diverting spring or stream flows.

The site must be protected from flooding, sedimentation, and non-sediment contamination.

Check the soils within the pond area, as well as those in the contributing drainage area, for residues of pesticides and other harmful chemicals if there is any possibility of contamination.

Lime acid soils to achieve a neutral condition or the desired pH level for best production.

When multiple ponds are installed, each pond shall be arranged so that it can be managed independently of the others to facilitate harvesting and the control of parasites and disease.

Federal and state threatened, endangered, candidate, rare, and other sensitive species shall be carefully considered in aquatic habitat improvement and included in the management plan. No plan shall have adverse effects on threatened or endangered species or species of concern. All ponds shall be designed to prevent the escape of harmful fish species to downstream and upstream waters.

A protective cover of vegetation shall be established on all exposed soil surfaces. If soil or climatic conditions preclude the use of vegetation, other protection methods shall be used.

Water Supply. Any available water source may be used if the quality and quantity are deemed adequate and in accordance with state regulatory agencies.

Use evaporation rates, stocking densities, and cultured species requirements in establishing specific incoming flow rates.

If water is pumped from rivers, streams or other sources where undesirable fish, pesticide residue, fish

disease, and parasites may be introduced, filters must be installed in the pumping system.

The minimum incoming water supply for trout is 200 gal/min/surface acre and 100 gal/min/surface acre for other species. However, evaporation rates, fish loading densities, and species requirements will be used in establishing specific rates. Flow shall be measured during periods of lowest flow. The pumping and pipeline facilities shall be located to best serve the pond, taking into account accessibility for maintenance and repair; protection from overflow and flood hazards; connections to power lines or fuel sources; and future expansion.

Water Quality. Water entering the pond shall be aerated to increase dissolved oxygen and dissipate harmful gases, if needed. The proposed water supply should meet the chemical criteria in Table 1. Supplemental aeration within the aquaculture pond shall be included, as necessary to maintain desired dissolved oxygen.

Table 1 – Water Quality Requirements

Dissolved Oxygen	Desirable Minimum	8 ppm 5 ppm
pH	Desirable Min/Max	6.5-8.5 6.0/9.5
Carbon Dioxide	Desirable Min/Max	2 ppm or less 0/3 ppm
Iron	Maximum	1 ppm
Alkalinity	Desirable Min/Max	100-120 ppm 20/200 ppm

Water temperature and water chemistry shall be suitable to meet the species requirements and the planned production level.

Incoming water shall be introduced as far away from outlet drain as practicable to prevent the rapid removal of fresh water from the pond.

Wastewater. Water released from the aquaculture impoundment shall receive adequate treatment to ensure that the State designated use of the receiving waters is not degraded.

Provisions shall be made for any needed treatment of water released downstream from the aquaculture impoundment structure.

If the wastewater from the pond is land applied, a Comprehensive Nutrient Management Plan (CNMP), a waste utilization plan and/or nutrient management plan shall be developed that meets the requirements of NRCS conservation practice standards Waste Utilization (633) and Nutrient Management (590), as appropriate.

Pond size and depth. The pond shall be constructed to the recommended size and depth for the species to be grown.

The water depths required for various species are as shown in Table 2. Aerators or circulators will allow ponds to support fish at shallower (8-10 foot) depths.

Table 2 – Water Depth to Minimize Winterkill

Species	Minimum Depth
Bass, Bluegill	12 ft (4m)
Minnows	10 ft (3.3m)
Trout	10 ft (3.3m)

Pipes and conduits. Pump discharge through levees shall be installed above expected high water level, and provisions shall be made to prevent pump and motor vibrations from being transmitted to discharge conduits.

Interior embankments constructed for division of water or to direct water flow for circulation shall have adequate cross section to ensure stability and function for their intended purpose.

Adequate provisions must be made to protect earth surfaces from turbulent water at pipe inlets and outlets.

Drains. All ponds shall have facilities for complete as well as partial drawdown. Turn-down pipes, quick-release valves, bottom-water release sleeves, pumps or other devices for water level control and pond management are to be included in the design and construction of the impoundment. Conduit design and seepage control shall meet or exceed the requirements specified in NRCS conservation practice standard Pond (378).

Pond bottom. Where organisms are harvested by seining, the pond bottom shall be smooth and free of all stumps, trees, roots, and other debris. Existing channels and depressions in the pond area shall be

filled and smoothed. The edges of the pond shall be deepened to provide at least 3 feet of water.

Where organisms are harvested by trapping, complete clearing and removal of trees, stumps, and other vegetation is not required.

The pond bottom shall be sloped to the outlet at a gradient of at least 0.2 foot per 100 feet.

Access and safety. Provisions shall be made for access to the site as well as access for operation and maintenance. Ramps shall be located as necessary to accommodate aeration and harvesting equipment. Ramps for equipment access shall have a slope of 4H:1V or flatter. *Ramps for vehicular access shall have a slope of 8H:1V or flatter*.

Appropriate safety features shall be made available nearby to aid people who may fall into the pond and devices installed to prevent such accidents.

Fences shall be installed as necessary to exclude livestock, unauthorized access and unwanted traffic.

Road surfaces, access ramps, and other areas used by people and vehicles shall be treated, if necessary, to maintain a stable surface under the anticipated load and to prevent sliding into the pond.

Dams and levees shall be crowned to provide drainage.

Design Criteria – Embankment Ponds

Earthfill dams and embankments around excavated ponds shall meet or exceed the requirements for embankments as specified in NRCS conservation practice standard Pond (378).

The minimum top width of the embankment shall be 14 feet, where it is to be used as a road for harvesting, feeding, and management purposes.

Design Criteria – Excavated Ponds

Excavated type ponds shall meet or exceed the requirements specified for NRCS conservation practice standard Pond (378).

Ponds established by excavating and constructing an embankment around their outer perimeter that excludes outside runoff shall have either an auxiliary spillway or a principal spillway pipe installed with sufficient capacity to remove a 10-year/24-hour direct rainfall amount in 48 hours or less. A minimum 8-inch diameter pipe shall be used.

Levee construction shall include the required embankment settlement to the minimum freeboard requirements. A minimum berm width of 10 feet shall be provided between the outside toe of levee and top of bank of outlet drainage ditch.

Additional Considerations for Ponds Used for Fee-Fishing

Management for Fish

1. Species Selection and Stocking Rates

a. Cold Water Ponds

Normal water temperature is cooler that 65°F (18°C) and surface water temperature rarely exceed 72°F (22°C). Rainbow trout are most suitable. Brook trout are suitable but often have a lower survival rate than rainbow. Brown trout are suitable and are tolerant to higher temperatures than brook trout but are more difficult to catch.

Table 4 provides guidance in determining initial stocking rates for ponds of medium fertility. Use lower stocking rates for less fertile waters and higher rates for fertile waters. A simple test for alkalinity will give an indication of fertility. Consider the medium fertility range of 40-120 mg/l of $CaCO_3$ alkalinity. Trout normally do not reproduce in ponds, so restocking should be planned at 2-3 year intervals, depending upon growth and harvest rates. If adult trout are present, do not restock with small fingerlings.

Commercial fish production, hatcheries, or raceways require more detailed analysis to determine stocking rates and a fisheries biologist should be consulted.

b. Warm Water Ponds

Historically, largemouth bass and bluegill have been the most popular fish to stock in warm water ponds. In light of management problems, bluegills should only be stocked when population controls are planned. Hybrid sunfish are being used with success and are available commercially. Forage fish such as golden shiners or fathead minnows, when stocked with

largemouth bass or channel catfish, will result in earlier development of catchable-size fish. Other warm water species including channel catfish, yellow perch and redear sunfish may be stocked. Northern pike, muskellunge, walleye, crappies, and bullhead are not recommended in ponds less than 2 acres in size. It is illegal to stock grass carp or White Amur in Michigan.

Table 4 provides guidance in determining initial stocking rates according to pond size. Largemouth bass and bluegill, if properly managed, should not require restocking since reproduction will replenish harvest. Channel catfish may successfully reproduce if provided secure nesting sites such as nail kegs, drain tiles, milk cans, or hollow logs. Hybrid sunfish require restocking but do not restock with small fingerlings if adult bass or channel catfish are present.

2. Supplement Feeding

Natural food supplies in the pond will sustain the fishery stocked at the rates shown in Table 4. With intensive management and supplemental feeding, higher fish populations and harvestable yields can be produced. If supplemental feed is desired, it should be provided at the same time and from the same place every day during the growing season. The optimum growing season for trout can be considered to be the period when water temperatures range from 50°-65°F (10°-18°)C while for channel catfish and sunfish the optimum growing season can be considered that period when water temperatures are above 60°F (15°C). Hybrid sunfish respond well to supplemental feeding. Only offer the amount of food that can be consumed in 15 minutes. Excess food will be harmful to water quality.

3. Fish Population Control

Maintenance of a “balanced” fish population requires careful management. Managing the harvest is most important in warm water ponds stocked with several species of fish. Aquatic plant control described in another section is a prerequisite to fish population control.

a. Cold Water Ponds

In trout ponds harvest 25 to 50 fish/ac/yr. Records must be kept of fish removed. Natural mortality should be accounted for in that 20 to 50 percent of the fish may die annually after reaching 8 inches in length.

b. Warm Water Ponds

Maintaining a “balanced” population of largemouth bass and bluegill is difficult but possible. Overharvest of bass is a leading cause of stunted panfish populations. Bass must not be fished until they have had a successful spawn, generally occurring the second or third year after stocking. Then in fertile pond, harvest no more than 35 lbs/ac/yr. of bass and in less fertile ponds no more than 25 lbs/ac/yr.

Manage the bass harvest to sustain a “balanced” population consisting of individuals in all year classes. It takes 4 to 5 pounds of forage fish to produce 1 pound of bass. A “balanced” bass population will serve as a check on the panfish or forage fish.

Bluegill and channel catfish may be harvested as soon as they are considered big enough to eat. A good pond should yield 200-300 fish/ac/yr. Channel catfish and hybrid sunfish will require periodic restocking, depending upon the rate of harvest. In some ponds, particularly unmanaged ponds, total fish eradication and restocking may be necessary. Completely draining the pond for two weeks is recommended. Fish toxicants are approved for use in Michigan but a permit for their use is required for ponds with multi-owners or with outlets in Michigan from the Michigan Department of Environmental Quality.

CONSIDERATIONS

General

The owner/operator's objectives should dictate the level of development and management to be planned. The plan should be based on the limitations and potentials of available natural resources. Information on adapted commercial aquatic species is available from Michigan State University-Extension.

Ponds from 2 to 20 acres are desirable for commercial production and 1/2 to 10 acres for hatchery and fingerling ponds.

Consider the potential effects of installation and operation of this practice on the cultural, archeological, historic, and economic resources.

Easy access to the site is available or can be constructed and maintained for the public if fee fishing is planned.

The visual design should be carefully considered in areas of high public visibility and those associated with recreation.

Only purchase fish from a source free of disease and parasites. Many fish diseases are extremely contagious and extreme care is required to limit disease transmission.

Measures to avoid depredation by birds or other animals should be considered in the design.

Measures to avoid damage to flexible membrane liners should be considered in the design, as appropriate.

Supplemental aeration in collection facilities should be considered in the design.

Measures to avoid aquatic nuisance or aquatic invasive species should be included in the design.

Consider soil properties (texture, salinity, Ksat, etc) effects on potential for earth moving, compaction, shrink swell if drained and refilled, underlying sandy strata and other unsuitable materials that should not be excavated or redistributed to prevent undesired effects on aquatic and wildlife.

Consider keeping detailed records of stocking rates, feeding rates, and harvest rates to determine the effects on fish species composition, population levels and growth rates.

PLANS AND SPECIFICATIONS

Plans and specifications for installing aquaculture ponds must conform to requirements of this standard and must describe requirements for applying the practice and achieving its intended purpose.

Support data documentation requirements are as follows:

- Inventory and Evaluation records
  - Assistance notes or special reports
- Stocking plan
- Fish management plan
- Survey notes, where applicable
  - Design survey
  - Construction layout survey
  - Construction check survey
- Design records
  - Physical date, functional requirements, and site constraints, where applicable
  - Soils/subsurface investigation report, where applicable
- Design and quantity calculations
- Construction drawings/specifications with:
  - Location map
  - "Designed by" and "Checked by" names or initials
  - Approval signature
  - Job Class designation
  - Initials from preconstruction conference
  - As-built notes
- Construction inspection records
  - Assistance notes or separate inspection records
  - Construction approval signature
- Record of any variances approved, where applicable
- Record of approvals of in-field changes affecting function and/or job class, where applicable

OPERATION AND MAINTENANCE

An Operation and Maintenance (O&M) plan shall be developed for this practice. The O&M plan shall be consistent with the purposes of the practice, its intended life, safety requirements, and the criteria for the design.

REFERENCES

1. Managing Michigan Ponds for Sport Fishing, Extension Bulletin E-1554.

2. Generally Accepted Agricultural and Management Practices for Care of Farm Animals, Michigan Department of Agriculture.

3. Wisconsin Commercial Fish Pond Standard, Wisconsin Field Office Technical Guide.

4. Fish Stocking Combinations for Farm Ponds. SIU Fisheries Bulletin No 4, Fisheries Research Laboratory, Southern Illinois University, Carbondale, Illinois.

Table 4 – Fish Stocking

Species	Size-inches	No./Ac	Dates
COLD-WATER PONDS			
Trout	2 - 4	125 - 200	April - May
Trout	4 - 6	90 - 150	September - October
Trout	6 - 10	80 - 130	April - June
WARM-WATER PONDS			
Largemouth or Smallmouth Bass alone	2 - 4 6 - 10 12	100 25 - 50 6 - 8	July - August April - October October or May
Bass with minnows	2 - 3	500 adult minnows, then after minnows spawn, stock bass as above	April - May July - August
Largemouth Bass with bluegills-sunfish hybrid	1 - 2	Stock bass as above and 500 fingerling hybrids	July - August
Channel Catfish with minnows	2 - 3 2 - 4	500 adult minnows, then, after minnows spawn, 100 fingerling catfish	April - May July - August
Largemouth Bass Bluegill Channel Catfish (Pond >0.75 acre)	5 - 6 1 - 2 2 - 4	100 500 100	July - August