LOUISIANA CRAWFISH FARMING: POND CONSTRUCTION

by

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SUMMARY:

Louisiana crawfish farming has increased greatly in recent years. This on-farm enterprise has created a big demand for Soil Conservation Service (SCS) technical assistance in pond design and construction. SCS's current design and construction standards and specifications are outlined.
Crawfish farming is a rapidly expanding industry in Louisiana. In 1980, the Soil Conservation Service (SCS) conducted an inventory of crawfish farmers, land in production, and types of ponds. It found that 22,380 water-impounded hectares (ha) were being used for crawfish production (Craft, 1982). Of these, 8607 ha were in a double-cropping system with rice, 5279 ha were open-water ponds with native vegetation, and 8494 ha were wooded ponds.

By the spring of 1983, the area of crawfish ponds in Louisiana had increased to over 37,000 ha, a 65-percent increase in just over 3 years. Open-water ponds constitute the largest portion of this increase.

Proper pond construction and maintenance are vital for successful crawfish-farming. Water quality can be improved and management of flooding, harvesting, drainage, and vegetation are better controlled in ponds that are properly designed to meet the farmer's needs. Before determining the size of operation, a farmer should consider labor available, cost feasibility, market demand, and harvesting method.

SITE SELECTION

Topography

Relatively flat land is most preferred and is essential to maximize the efficiency and feasibility of pond management. The slope of the land is a major factor in determining pond size, levee height, water depth, size and number of water-control structures, and construction costs. Precision land forming, land smoothing, and water leveling can be carried out to provide flatter and more uniform slopes. A 0.1-percent slope within borders of crawfish ponds has proven optimum to efficiently irrigate and manage the ponds and provide adequate drainage.

Soils

A complete soil analysis should be made in every pond during planning. The best soils for crawfish ponds are clays, silty clays, and sandy clays. These types of soils have slow permeability rates, which indicate good water-holding capacity. Loamy and sandy soils with high permeability rates should be avoided where possible.

Soil fertility is another factor that should be considered. Studies have shown that the composition of essential nutrients in the soil influences crawfish growth and production (de la Bretonne, Avault, 1971). Soils high in organic matter should be avoided because the rapid decay of organic matter during flooding can cause oxygen depletion.
In many parishes (counties), the SCS has published soil survey reports which contain useful data for existing or potential pond owners. In parishes where a soil survey has not been published, soil scientists at SCS area offices can provide information about the soils.

Other Considerations

Wooded ponds have proven less desirable than open-water or cleared ponds. If clearing of the entire pond is not feasible, open lanes or strips should be cleared to provide easier access to the pond for harvesting and to establish desired vegetation as an available food source. Some of the disadvantages of wooded ponds are:

1. Trees and brush cause difficulties in harvesting.
2. Water temperatures are lower in the winter because of shading, thereby retarding crawfish growth.
3. Oxygen levels are lower as a consequence of the decaying organic materials in wooded ponds.
4. Populations of predators, such as snakes, raccoons, and wading birds are higher in wooded ponds.
5. Initial cost of construction is higher because clearing for levees is needed.

Other site considerations are accessibility of the pond area, adequacy of water supply and drainage outlets, degree of over-bank flooding from nearby streams, potential for expansion, prior use of chemicals on the area, and federal permit requirements.

In locating potential sites, careful consideration should also be given to preserving natural areas, fish and wildlife habitat, woodland, and other environmental resources.

EMBANKMENT DESIGN

The area occupied by the base of the levee should be cleared of trees, stumps, brush, other vegetation, and debris. This material should be pushed outside the base of the levee and the surface should be scarified to provide proper contact between the excavated fill material and normal ground.

In soils with medium to high rates of permeability, a core trench will be required. It should extend to impervious material and be wide enough to accommodate construction equipment.

Water depths in crawfish ponds range from 0 cm to 122 cm (48"). The optimum depth recommended by specialists is 45 cm (18"). No more than 25 percent of the pond's surface area should be in water 91 cm
(36") or deeper.

The difference in elevation (freeboard) between the normal water surface elevation in the pond, when it is flooded, and the settled top of the levee should not be less than 30 cm (1.0'). Levee height should be sufficient to prevent seasonal floodwaters from entering the pond.

Fill settlement must be considered when determining levee height. The amount of settlement depends on soil type, moisture conditions, and type of equipment used in construction. In Louisiana SCS generally allows 20 to 30 percent for settlement of levees constructed with draglines (excavators) and 10 to 20 percent for those constructed with blade equipment (dozers, scrapers).

For levees with a settled height of 91 cm (3.0') or less, minimum design requirements are 1\(\frac{1}{2}:1\) front and back slopes and a 122 cm (4.0') minimum top width. For levees with a settled height between 91 cm (3.0') and 183 cm (6.0), minimum design requirements are 2:1 front and back slopes and a 183 cm (6.0') minimum top width. For perimeter levees, however, a top width sufficient to allow vehicular traffic should be considered to provide access to monitor the pond and to facilitate harvest and repair of levees and pumps. On perimeter levees, 3:1 slopes front and back are recommended to facilitate maintenance, reduce rodent damage, and sustain any possible seepage.

Figure 1 illustrates a cross-sectional design of a typical crawfish pond levee in Louisiana.

The berm located between the toe of the levee and the top slope edge of the borrow should not be less than 183 cm (6.0'). Levees that are constructed by blade equipment such as bulldozers do not require a berm if the slope of the borrow adjacent to the levee is not steeper than the front slope of the levee. Most borrow areas are located inside the pond to facilitate drainage and increase the pond size. However, provisions must be made to drain or rotenone the borrow area yearly to remove unwanted fish.

Levees should be protected from erosion by vegetation. Seeding may be used to provide protection until voluntary cover to establish and provide adequate protection.

PUMPING REQUIREMENTS

A well (ground water) or pump (surface water) should be located at the highest elevation of the pond to minimize pumping time, evaporation, seepage losses, maintenance costs and allow gravity flow through the pond. Gravity flow in conjunction with interior levees and/or properly placed outlet drains, creates better water circulation and distribution.
The output capacity of a well or pump should be compatible with the size of the pond. It is generally recommended that this capacity be such that a pond could be completely flushed within a 3.5-day period. Pumping rates required for flushing and the required flooding time at various pumping rates are discussed in Lawson et al. (1983) and Craft (1980).

A technique for estimating the discharge capacity from a full-flowing pipe in a horizontal or nonvertical position is illustrated in Figure 2. A technique for estimating the discharge capacity from vertical pipes is shown in Figure 3.

If the farmer has the option of using either groundwater or surface water there are several factors to consider in making the decision. The dependability of the water source, saltwater intrusion, economic feasibility, possible pollutants, and accessibility are some of the most important factors. Groundwater is the preferred water source in Louisiana (Craft, 1982), although the initial cost of installation of the well and yearly pumping costs are disadvantages.

**AERATION**

Water quality is of the utmost importance in achieving maximum potential production in a crawfish pond. Information on this subject is available from universities and local, state, and federal agencies. Some criteria are discussed in Lawson et al. (1983).

One very important consideration is dissolved oxygen (DO) content in the water supplying the ponds. There are several methods by which the DO level can be increased either at the well (pump) discharge or inside the pond. The aim is to break up water into fine particles to increase the DO levels to as near 100% saturation as possible.

One very effective method is to place hardware cloth or expanded metal below the discharge pipe. One type of splash box developed by a crawfish farmer in St. Martin Parish is shown in Appendix A. The box also traps fish when surface water is being pumped. Another aerator, which is used extensively in Mississippi and Alabama in catfish ponds, is the paddle-wheel aerator (Appendix B). Currently, it is the most effective aerator for rapidly increasing dissolved oxygen content. Some advantages are that it is mobile, easy to operate, durable, relatively inexpensive, and provides a large amount of oxygenation per unit.

A series of internal baffle levees can be used to distribute aerated water to eliminate any "dead" (low DO level) areas which may exist in a pond. These levees are normally much smaller than the perimeter levees, and their tops are at or just above the pond water level.
SCS recommends using water control structures in crawfish ponds to maintain a constant water level, carry off surplus water originating from heavy rains or additional pumping and to control erosion. Careful consideration should be given to the placement of these structures. They should be located at a maximum distance from the pump or well discharge to provide for better water circulation and oxygen distribution throughout the pond.

Crawfish ponds need to be drained slowly to encourage crawfish to burrow before predators gain access to them. The drawdown rate should be approximately 3.8 cm (1.5") per day with the ponds completely drained in 15 to 20 days. The capacity of the drainage structures, has to be adequate to: (1) remove surface water rapidly enough to prevent damage to crops if the pond is part of a double-cropping system and (2) handle pump discharge rates during flushing operations.

To help to improve water quality and increase DO levels in a pond, a farmer can alter or position the intake of an overflow structure so that excess water removed will come from the bottom of the pond where oxygen levels are the lowest.

Many different types of water control structures are being used in crawfish ponds. Some are obtained from local manufacturers; others are homemade structures. Structures should be built of good quality material and with the durability to last many years. All metal structures should be suitably protected from rust and corrosion. Farmers in southern Louisiana have installed cathodic protection on new metallic structures with the help of SCS. This practice, if applicable, can add many years to the life of metal structures at a nominal cost.

The two types of water control structures most commonly used in crawfish ponds in Louisiana are: (1) the weir-type flashboard riser with a corrugated metal or aluminum horizontal barrel (Appendix C); and (2) the plastic L-shaped drop inlet type made of 552 kPa (80 psi) rated polyvinyl chloride (PVC) pipe (Appendix D). Both structures are multi-purpose; they allow the farmer to maintain any desired water level in the pond, provide adequate drainage when the field is used for off-season or rotational crops, and control erosion at drainage outlets.

MAINTENANCE CONSIDERATIONS

A dependable all-weather road to the pond site is desirable to facilitate repairs, harvest, and management. Provisions for access for maintenance should always be included in the design of a crawfish pond.

During the off-season, farmers should provide required maintenance to power units, wells, pumps, structures, and levees to ensure their reliability during the flooding and harvesting season. Levees should be maintained to the required shape and height. The vegetation on all embankments must be cut periodically to inhibit rodents from
burrowing in the levees and control water snakes. Constant surveillance of all levees for leaks or breaks is a must in keeping pumping and fuel costs to a minimum.
REFERENCES


Figure 1. Typical levee cross-section and water control structure for crawfish ponds in Louisiana.
Figure 2. Estimating discharge flow from pipes flowing full in horizontal or nonvertical positions, (USDA-SCS, 1982)
Figure 3. Estimating discharge flow from pipes in a vertical position, (USDA-SCS, 1982)

\[ Q = 5.68 \cdot C \cdot D^2 \sqrt{H} \]

- \( Q \): Discharge in g.p.m.
- \( D \): Inside Diameter of pipe in inches
- \( H \): Jet height in inches
- \( C \): Coefficient of discharge, varies from 0.93 to 0.96 for pipes 8 to 18 in. in diameter.

"HEAD: IN INCHES"
AERATING SPLASHING DEVICE

4" x 4" x 8' Treated Timbers *
2" x 4" x 56" Treated Boards
2" x 4" x 8' " "
1" x 12" x 4' " "
1" x 12" x 8' " "
2" x 4" x 8' " "
2" x 4" x 56" " "
Top Screen
1" Expanded Metal - 4' x 8' sheet
Bottom Screen
3/4" Expanded Metal - 4' x 8' sheet
*Wolmanized or comparably treated
APPENDIX B

3/8" PILLOW BLOCK

A = 2" PIPE
B = 3" PIPE

CLAMP - DO NOT WELD TO HOUSING

3/4" PIPE

NOTE: PADDLES SHOULD BE LEVEL WITH RESPECT TO WATER SURFACE.

Design courtesy of the Georgia Cooperative Extension Service
APPENDIX D

ANTI VORTEX BAFFLE (OPTIONAL)

RISER DETAILS

Minimum Concrete Required for Anti-Suction

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<tr>
<th>&quot;Da&quot; Riser Dia. Inches</th>
<th>Volume Cubic Feet</th>
<th>No. 8 Lb. Bags</th>
<th>Rebars Inch Dia.</th>
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<td>4</td>
<td>1/6</td>
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<tr>
<td>15</td>
<td>1.8</td>
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<tr>
<td>24</td>
<td>3.1</td>
<td>7</td>
<td>3/8</td>
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2/ To be furnished by the manufacturer

SECTION ON C
TYPICAL INSTALLATION

WATER CONTROL STRUCTURE
PLASTIC WEIR DROP

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

<table>
<thead>
<tr>
<th>Type of Pipe</th>
<th>Size</th>
<th>Rice Runoff = 1.5&quot;</th>
<th>Improved Palover</th>
<th>Soybeans and Row Crops Runoff = 2&quot;</th>
<th>Sugar Cane Runoff = 4&quot;</th>
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<tr>
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<tr>
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