Pond Design and Construction

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Introduction

For many years farmers and ranchers have been building ponds for livestock water and for irrigation. By 1980 more than 2.1 million ponds had been built in the United States by land users on privately owned land. More will be needed in the future.

The demand for water has increased tremendously in recent years, and ponds are one of the most reliable and economical sources of water. Ponds are now serving a variety of purposes, including water for livestock and for irrigation, fish production, field and orchard spraying, fire protection, energy conservation, wildlife habitat, recreation, erosion control, and landscape improvement.

This course describes embankment and excavated ponds and outlines the requirements for building each. The information comes from the field experience and observation of land users, engineers, conservationists, and other specialists.

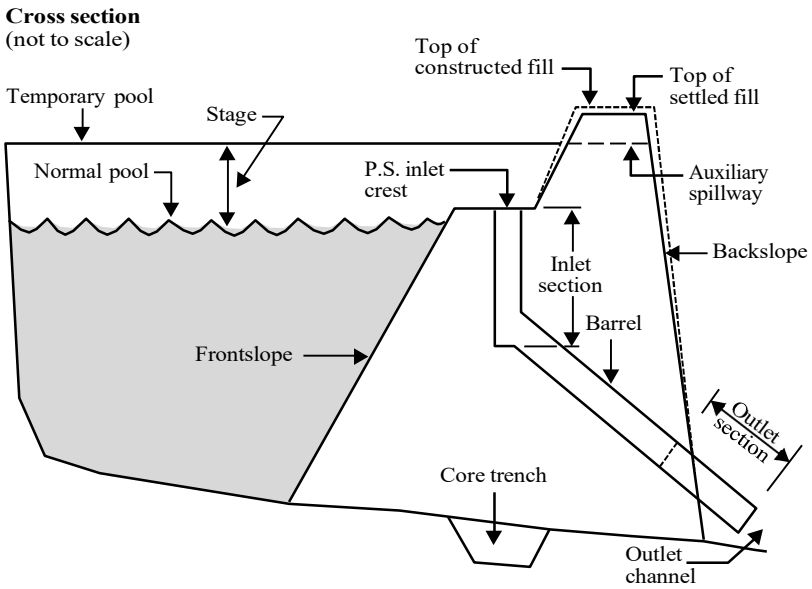
An embankment pond (fig. 1) is made by building an embankment or dam across a stream or watercourse where the stream valley is depressed enough to permit storing 5 feet or more of water. The land slope may range from gentle to steep.

An excavated pond is made by digging a pit or dugout in a nearly level area. Because the water capacity is obtained almost entirely by digging, excavated ponds are used where only a small supply of water is needed. Some ponds are built in gently to moderately sloping areas and the capacity is obtained both by excavating and by building a dam.

The criteria and recommendations are for dams that are less than 35 feet high and located where failure of the structure will not result in loss of life; in damage to homes, commercial or industrial buildings, main highways, or railroads; or in interrupted use of public utilities.

Local information is essential, and land users are encouraged to consult with specialists experienced in planning and building ponds.

Figure 1 Typical embankment and reservoir



Water needs

Livestock

Clean water and ample forage are equally essential for livestock to be finished out in a marketable condition. If stockwater provisions in pasture and range areas are inadequate, grazing will be concentrated near the water and other areas will be undergrazed. This can contribute to serious livestock losses and instability in the livestock industry.

Watering places must also be properly distributed in relation to the available forage. Areas of abundant forage may be underused if water is not accessible to livestock grazing on any part of that area (fig. 2).

Providing enough watering places in pastures encourages more uniform grazing, facilitates pasture improvement practices, retards erosion, and enables farmers to make profitable use of soil-conserving crops and erodible, steep areas unfit for cultivation.

An understanding of stockwater requirements helps in planning a pond large enough to meet the needs of the stock using the surrounding grazing area. The average daily consumption of water by different kinds of livestock shown here is a guide for estimating water needs.

Kind of livestock	Gallons per head per day
Beef cattle and horses	12 to 15
Dairy cows (drinking only)	15
Dairy cows (drinking and barn needs)	35
Hogs	4
Sheep	2

The amount of water consumed at one pond depends on the average daily consumption per animal, number of livestock served, and period over which they are served.

Figure 2 This pond supplies water to a stockwater trough used by cattle in nearby grazing area

Irrigation

Farm ponds are now an important source of irrigation water (fig. 3), particularly in the East, which does not have the organized irrigation enterprises of the West. Before World War II irrigation was not considered necessary in the humid East. Now many farmers in the East are irrigating their crops.

Water requirements for irrigation are greater than those for any other purpose discussed in this handbook. The area irrigated from a farm pond is limited by the amount of water available throughout the growing season. Pond capacity must be adequate to meet crop requirements and to overcome unavoidable water losses. For example, a 3-inch application of water on l acre requires 81,462 gallons. Consequently, irrigation from farm ponds generally is limited to high-value crops on small acreages, usually less than 50 acres.

The required storage capacity of a pond used for irrigation depends on these interrelated factors: water requirements of the crops to be irrigated, effective rainfall expected during the growing season, application efficiency of the irrigation method, losses due to evaporation and seepage, and the expected inflow to the pond. Your local NRCS conservationist can help you estimate the required capacity of your irrigation pond.

Fish production

Many land users are finding that fish production is profitable. A properly built and managed pond can yield from l00 to 300 pounds of fish annually for each acre of water surface. A good fish pond can also provide recreation (fig. 4) and can be an added source of income should you wish to open it to people in the community for a fee.

Ponds that have a surface area of a quarter acre to several acres can be managed for good fish production. Ponds of less than 2 acres are popular because they are less difficult to manage than larger ones. A minimum depth of 8 feet over an area of approximately 1,000 square feet is needed for best management.

Figure 3 Water is pumped out of this pond for irrigation

Field and orchard spraying

You may wish to provide water for applying pesticides to your field and orchard crops. Generally, the amount of water needed for spraying is small, but it must be available when needed. About l00 gallons per acre for each application is enough for most field crops. Orchards, however, may require 1,000 gallons or more per acre for each spraying.

Provide a means of conveying water from the pond to the spray tank. In an embankment pond, place a pipe through the dam and a flexible hose at the downstream end to fill the spray tank by gravity. In an excavated pond, a small pump is needed to fill the tank.

Fire protection

A dependable water supply is needed for fighting fire. If your pond is located close to your house, barn, or other buildings, provide a centrifugal pump with a power unit and a hose long enough to reach all sides of all the buildings. Also provide for one or more dry hydrants (figs. 5 and 6).

Although water-storage requirements for fire protection are not large, the withdrawal rate for fire fighting is high. A satisfactory fire stream should be at least 250 gallons per minute with pressure at the nozzle of at least 50 pounds per square inch. Fire nozzles generally are l inch to 1-1/2 inches in diameter. Use good quality rubber-lined firehoses, 2-1/2 to 3 inches in diameter. Preferably, the hose should be no more than 600 feet long.

A typical firehose line consists of 500 feet of 3-inch hose and a 1-1/8 inch smooth nozzle. A centrifugal pump operating at 63 pounds per square inch provides a stream of 265 gallons per minute with a nozzle pressure of 50 pounds per square inch. Such a stream running for 5 hours requires 1/4 acre-foot of water. If you live in an area protected by a rural fire fighting organization, provide enough storage to operate several such streams. One acre-foot of storage is enough for four streams.

Your local dealer in pumps, engines, and similar equipment can furnish the information you need about pump size, capacity, and engine horsepower.

Figure 4 A pond stocked with fish can provide recreation as well as profit

Purchase this course to see the remainder of the technical materials.