runoff enters. Runoff can also be diverted away from the pond by means of earthen berms, diversions or grassed water-ways. A filter strip of unmowed grass and other low plants along the banks reduces nutrient inflow. Other aspects of erosion control are discussed in the section on landscaping below. If the pond is formed by a dam, an outlet structure that allows discharge from the bottom enables draw-off of nutrient-rich water that accumulates there in summer and winter.

As discussed, making pond depth 15 feet or more keeps much of the bed dark enough to reduce growth of rooted plants.

Submerged side slopes that extend 3 feet into the pond per foot of drop (a 3:1 slope) are sufficiently steep to reduce plant growth while not being so abrupt as to cause unreasonable danger to wading children. If the incline is of fine sand, it is likely to be unstable and slump if steeper than 3:1. Coarse sand, peat, or loam may be stable at a slope of 2 feet horizontal distance per foot of drop, and clay slopes of 1:1 may be stable. If your objectives are plant control and maximum amount of deep water, the steeper the side slopes the better, but a slippery clay incline of 3:1 or greater will be a great hazard to people or animals that might wade or stumble into the pond and be unable to keep their footing.

Surface Area

As a rule, the larger the pond, the more dependable its fish population will be. While trout ponds of only a quarter acre may support passable fishing if they have strong spring flow, most ponds don't provide satisfactory fishing unless they are a half acre or more—preferably much more.

Small ponds may need much more intensive care than large ones. The disadvantages of small ponds may be somewhat alleviated by making them very deep. Pond depth seems even more important to fish populations than pond surface area.

Landscaping and Erosion Control in the Pond's Surroundings

With a little planning, a fish pond and the area around it can be made very attractive. Decide whether you want a natural setting or a more lawn-like one. In a natural landscape, logs, stumps, rocks and uneven ground may be fitting. If much of the area is to be mowed, you may need to smooth the ground and eliminate obstacles during pond construction.

Plant cover should be established quickly on raw areas after construction to prevent erosion. Sod or a heavy stand of grasses and legumes is needed on areas of greatest slope and washing, such as berms, runoff diversion waterways, tops and slopes of dam embankments, emergency spillways, and bank slopes of the pond perimeter. The latter should be quickly vegetated back at least 20 feet from the water.

Deep-rooted plants such as alfalfa, sweet clover, shrubs and trees shouldn't be planted on earthen dams or fill embankments. Deep roots tend to weaken such structures and cause leaks. Some ponds need reinforcement, called "rip-rap," with stone of 8-10 inches (20-25 cm) diameter piled along the shoreline to protect against wave erosion, especially in the case of dam and fill embankments.

Mixed clumps of evergreens and deciduous trees, bordered by shrubs, provide food and cover for wildlife and give the pond surroundings a pleasing appearance. But trees and shrubs shouldn't be planted so near the pond that many leaves fall or blow into the water when shed. Leaves that get into the pond use up oxygen when they rot, and they create layers of litter on the pond bed, as well as furnishing nutrients for overgrowth of water plants. Keep such vegetation at least as far back from the water's edge as the greatest height the tree or shrub will reach—preferably much farther back than that. It isn't necessary to set evergreens so far back. Trees and shrubs on the shore area may also interfere with fishing.

Fence livestock away from the pond. They destroy vegetation of the pond-bank buffer strip, and their droppings overenrich the water. Grazing and trampling also weaken dams, embankments and spillways. If livestock watering is a purpose of the pond, pipe the water to an area where the animals won't harm the pond.

Excavated or Dug Ponds

Dug ponds are built mostly in rather level areas not suited for ponds formed by dams. Many parts of Michigan are favorable for dug ponds because they are fairly flat, the soils are soft and porous, and groundwater lies close beneath the soil surface. The pond is then fed by water slowly seeping in one side of the pit and out the other. Dug ponds can also be positioned so that springs upwell within the pond or flow into it from a short distance up-slope. Groundwater can be pumped into ponds from nearby wells. Sometimes windmills are used for this. Less desirably (see drawbacks in section on water supply), dug ponds can be catchment pits for overland runoff if soils are clay or other fine material that will hold water—or if clay or other sealants can be obtained to line the pond bed.

Groundwater seepage ponds are the most common in Michigan. They are generally located in sand or sand-gravel soils through which water easily percolates. Such ponds are possible even in many areas with rather non-sandy surface soils because water-bearing sands and gravels lie close beneath, and excavation reaches down into them.

The water level may fluctuate significantly in seepage ponds as the groundwater table rises and falls—higher in wet years and wet seasons, lower during drought. Plan excavation depth to be more than 15 feet below the lowest level that the groundwater table reaches in a very dry year. Consult an SCS engineer, or other field personnel, for such a determination. Make test borings to find the water table in late summer of a dry year.