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FACT SHEET

Pond design for freshwater crayfish

The following summary details current ideas on pond design used for aquaculture in South Australia. It also presents a discussion of the reasons behind the designs and the drawbacks and failures of other pond systems.

To produce freshwater crayfish or fish on a significant scale it is necessary to have multiple ponds with a number of special features. Expert advice in the construction of earthen dams and ponds is readily available from government agencies and consultants. Although some farmers may already own earthmoving equipment, it is desirable to employ a contractor who has a scraper, laser levelling equipment and pond building experience.

An adequate supply of good quality water and impervious clay soils are essential requirements when considering the site for pond. Both land and water supply must be available at relatively cheap prices.

Before any pond construction begins, it is worth investigating prior use of the farm site to ascertain whether the soil has been contaminated by agricultural chemical residues. A small scale pilot project should also be successfully conducted before committing finance to extensive pond construction. Design the farm so that these pilot ponds can be incorporated into future expansion. Pond construction is one of the biggest cost outlay for an aquaculture farm.

During initial planning of pond layout, a system of channels should be integrated so that each dam can be filled, drained, repaired or spelled as required, taking advantage of site topography and using gravity wherever possible.

Pond design

There is no strict formula for determining the optimal size for culture ponds. Since the early days of the industry when farmers used gully dam type impoundments, trial and error has led to the relatively small shallow ponds that are currently most popular in this state. These ponds are usually around 1,000 m^2 surface area with an average depth of 1m, square or rectangular in shape and parallel to prevailing winds to ensure good aeration. The corners are rounded and the bottom slopes gradually to a maximum depth of 2m in the sump area towards one end. The volume of water contained in such a pond can be more effectively managed than the larger and deeper gully dams previously used. Water quality manipulation, predator control and harvesting are also easier.

Advantages

There are a number of advantages to the type of pond described which has made it the most commonly constructed design. The most important feature is the gradual slope of the bottom which provides the following advantages:

- minimal erosion from wave action (as occurs in steep sided ponds with square corners),
- very little burrowing occurs (a common problem for yabbies in vertical banked ponds),
- waste material tends to gravitate to the sump area allowing the majority of the bottom to be relatively clean,

- vehicles and farm machinery can easily enter the drained ponds to remove waste, perform farm maintenance work or sow crops which will be gradually flooded to provide a food source,
- when draining water gravitates to the sump area, the remaining stock follow the falling level and can be retrieved by dab net from the small pool of water left in the sump.

Disadvantages

The only major disadvantage to using this pond design is the possible increase in stock taken by wading birds. The shallow waters created around the perimeters of these ponds are similar to those in which herons and other waders search tor prey in a natural environment. Some farmers have attempted to combat this problem by increasing the angle of bank slope at the water's edge to discourage waders and taken extra measures to stabilise against wave erosion by using rubble batter.

The only way to completely protect fish and yabbies from bird predation is to enclose the entire pond area with mesh. The benefits of installing predator nets are slowly being realised in the form of increased production levels in areas that have a history of serious bird problems.

Evaporation due to the shallowness of these ponds has also been a problem in some areas where an abundant water supply has not been available.

Construction costs

Some farmers may choose to construct their own ponds but it is generally recommended to engage the services of an earthmoving contractor who is experienced in pond construction and the use of laser levelling equipment. Prices quoted for building ponds will vary according to soil type, topography and location.

The usual method is to remove the topsoil and shape the pond in the clay below. If the topsoil is sandy it may then be used to cover the bottom (between 150 to 300 mm thick) of the completed pond to provide a suitable substrate for the planting of food crops. It also provides a firm surface to walk on immediately after the pond has been drained.

Yabbies are also less likely to burrow in a pond with a compacted sandy loam substrate. The surrounding banks should then be stabilised by planting a suitable prostrate grass. In areas that are prone to occasional flash flooding consideration should also be given to constructing diversion channels around the pond area to prevent collapse or erosion from wild water.

The crests of embankments should be wide enough to allow vehicle access.

In areas where the soil is unsuitable for water retention, ponds could be polylined, although the enterprise may not be profitable on such a site.

Classification of soils

Soils can be divided into four main groups: gravels, sands, silts, and clays. This division is based on particle size, gravels being the largest and clays the smallest. In Australia the size classification is:

- gravel, from 75 to 5mm
- sand, from 5 to 0.07mm
- silt, from 0.07 to 0.002mm
- clay, less than 0.002mm

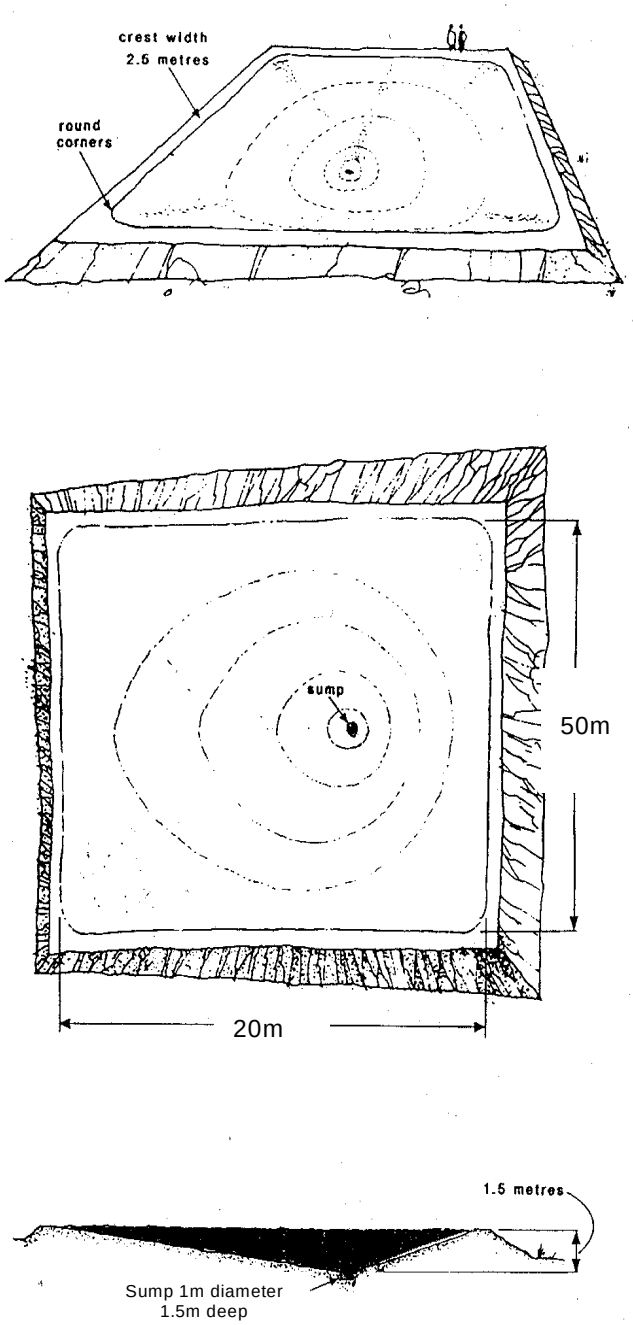
Gravels and sands can be readily identified by appearance and feel, but unfortunately silts and clays are indistinguishable when dry. While clay is one of the most useful soils in dam building, silt, when wet, is the most troublesome. It is inherently unstable in the presence of water and tends to become 'quick' when saturated. One simple test to distinguish clay from silt is to moisten the sample and feel it; clay should feel sticky. Then pinch a sample between the thumb and forefinger, if it is clay, it should be possible to form a flexible ribbon about 1.5mm thick and at least 40mm long. Another field assessment is the 'shine' test. A dry or slightly moist sample of soil is cut with a knife. A shiny cut surface indicates highly plastic clay while a dull surface suggests silt or clay of low plasticity.

Once the presence of clay is established, further tests are needed to find if it has good water-holding qualities. One is the 'bottle' test. The bottom of a 750ml plastic soft drink bottle is cut off. The bottle is inverted and one-third filled with the soil to be tested. Then fill the bottle with water; if no water seeps through the soil within 24 hours, it has good water-holding qualities.

General comments

On a well-designed farm the pond complex should be constructed in a way that each dam is independent of the others and can be filled or drained as required with a water supply channel separate from a drainage channel. It must be possible to fill and drain ponds quickly to avoid stock loss.

If ponds are built on a slope, an outlet pipe from the sump could be installed at the time of construction for gravity drainage through the wall. Yabbies have a natural tendency to burrow around and along hard objects like drain pipes which leads to serious structural damage. The majority of farmers choose to drain ponds using pumps fitted with large fine mesh sieves to prevent the freshwater crayfish or fish from being drawn into the suction pipe.



Features of a typical yabbie pond. Some farmers have varied this design by placing the sump closer to a corner or end to improve pump accessibility. Measurements are meant as a guide only.

It is also an advantage if some level of turbidity can be maintained as this encourages movement and feeding activity and reduces predation from birds. Several farmers have experimented in increasing production by placing refuges or shelters (usually car tyres, seedling pots or corrugated material) for crayfish in ponds. Others have incorporated aeration, constant flow systems and artificial foods to achieve similar results. It is debatable whether any increase in production in crayfish production resulting from these variations in farming techniques

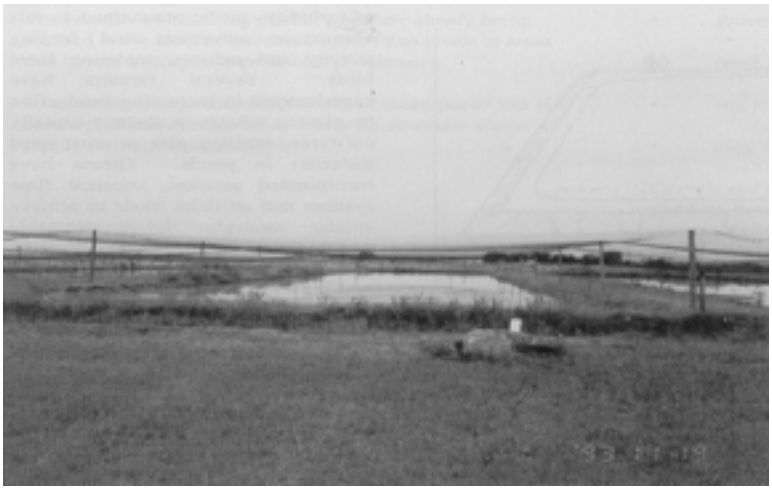
warrants the additional labour or financial outlay, although this does depend on the stocking levels, species cultured, and intensity of the system.

If you are unsure of the previous land use of the property the soil at pond sites should be analysed for pesticides before the ponds are built. Freshwater crayfish and fish are extremely susceptible to agricultural chemical residues in soil which may lead to future mass mortalities. Soil samples for testing should be collected from several locations within the proposed pond site.

As part of general farm management procedure, farmers using a network of these ponds usually drain each at least once after 12 months of continuous use. This is done so that the pond may be dried, waste material removed and minor maintenance carried out. Remaining stock, which usually includes for crayfish aquaculture, a large amount of juveniles (from in-pond breeding), soft shelled, berried and damaged freshwater crayfish, is then sorted and relocated into other ponds or sold. The water from the pond being drained is shifted into another that has been dried and prepared for restocking. Thus the farm is operated on a cyclic system where minimal water is dumped or wasted.

Pond almost completely drained. Note that the bottom in this pond was firm enough to follow the falling water level into the sump by tractor with the pump attached.

There are often several means of completing tasks to achieve the required result and the appropriateness of each depends on the individual situation. The pond system described may not suit every site; thus a variation in construction costs for different areas is likely. Site selection and costs will continue to be the main considerations and must be carefully weighed against the expected income.



Pond covered by bird netting supported by pine poles.

Although the ponds of the design described are the most commonly constructed at present, farmers should maintain contact with changing trends within the industry that may be advantageous to production in the future.

Further reading

Anon (1989) *"An Introduction To Yabbie Farming."* Primary Industries SA (Fisheries) Publication.

Mills B J (1989). *"Australian freshwater crayfish."* Freshwater Crayfish Aquaculture Research and Management, Tasmania.

Nelson K D (1985) *"Design and construction of small earth dams."* Inkata Press, Victoria.

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