Aquaculture Engineering

B.Voc. Industrial Aquaculture and Fisheries

Semester – VI

Dr. Mukti Chanda

Land Area Measurement:

Different states of India have different units of measurement. The measurement area in Bengal is as follows.

Measurements of area in terms of bigha

16 Chhatank = 1 Kaththa = 2.5 Decimal, 1 Decimal = 435.6 Or 436 Sq.ft., 1 Chhatak = 45 Sq.ft.

1 Katha (কাঠা) = 720 sq ft (66.89 sq m).

1 Bigha (বিঘা) = 20 katha (কাঠা) (14,400 sq ft or 1,337.8 sq m) = 33 Decimal

1 Acre (একর) = 3 bigha (বিঘা) 60.5 katha (কাঠা) (4,840 sq yd or 43,560 sq ft), = 100 Decimal = 4046.86 m^2.

1 hector = 7.5 bigha (বিঘা) = 151.25 katha (কাঠা). = 247.0 Decimal = 10000 m^2

Practical size and depth of nursery, rearing and stocking ponds (Sahoo, 1984)

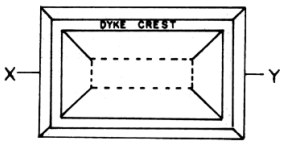
Pond type	**Size (ha)**	**Depth* (m)**	
		Irrigated command/water logged areas	**Rainfed+/non-irrigated areas**
Nursery pond	0.02 – 0.06	1.0 – 1.5	1.5 – 2.0
Rearing pond	0.06 – 0.10	1.5 – 2.0	2.0 – 2.5
Stocking pond	0.25 – 1.0	2.0 – 2.5	2.5 – 3.5

* Excluding the freeboard

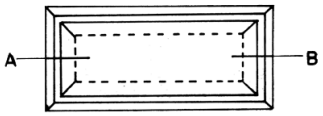
+ May vary depending on impermeable strata at pond bottom

Dyke

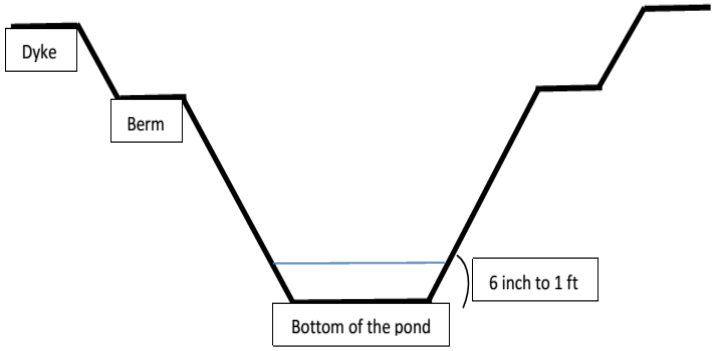
The dyke should be properly designed so that it can hold maximum water in the pond and withstand the hydraulic pressure. The slope of the dyke usually depends on the type of soil. Suitable side slopes for different soil types are given in following Table.

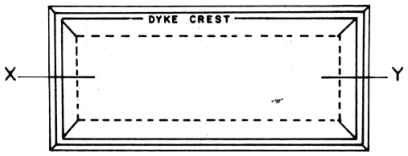


PLAN OF A NURSERY POND (0·02ha)



PLAN OF A REARING POND (0·1ha)





PLAN OF A STOCKING POND (0·4ha)

Suitable slopes for different soils (Sahoo)	
Soil type	**Soil (horizontal:vertical)**
Clay	1:1 to 2:1
Clay loam	1.5:1 to 2:1
Sandy loam	2:1 to 2.5:1
Sandy	3:1

The Evaluation of important soil types and their usability in aquaculture –

Soil type	Suitability	Explanation
Sandy soils	Unsuitable	Permeability too high
Silty soil	Unsuitable	Permeability too high
Clayey soils		
1:1 Clays	Marginal	Larger-grained, less cohesive, and more permeable than other clays. Use of very hard source water may even increase permeability through flocculation of soil particles.
Mixed Clays	Good	Permeability is low, shear strength is moderate, and resistance to piping is high. Stickiness and plasticity are adequate.
2:1 Clays	Excellent	Practically impermeable; High swelling, plasticity, and cohesiveness make these clays excellent binders and sealants, especially when combined with suitable amounts of other components to add stability; less suitable, however, when clay percentage is very high (say over 60%) due to difficulty of construction and poor stability.
Organic soils		
Peats	Marginal	Unsuitable as an above-ground construction material because permeability is high and shear strength is low. Can be used for excavated ponds where water table is high and can be used to fill and refill ponds by seepage.
Mucks	Unsuitable	Permeability is high and shear strength is very low.

Different soil class types –

Soil class	Definition
Sandy	Mineral soils[1] with not less than 70-85% SAND[2], but less than 50% of the sand is FINE[2] or VERY FINE SAND[2], and the quantity [% SILT[2] + (2 X %CLAY[2])] is less than 30 (same definition as *Soil Taxonomy*).
Coarse-Loamy	Mineral soils with less than 18% CLAY that are not SANDY (includes Coarse-loamy and Fine-silty classes in *Soil Taxonomy*).
Fine-Loamy	Mineral soils with 18-34+% (< 35%) CLAY (includes Fine-loamy and Fine-silty classes of *Soil Taxonomy*).
Kaolinitic	Mineral soils with 35% or more CLAY, and in which 1:1 clay minerals make up 50% or more of the clay fraction (probably includes *Halloysitic* class as well).
Montmorillonitic	Mineral soils with 35% or more CLAY, and in which 2:1 clay minerals make up 50% or more of the clay fraction (probably includes *Vermiculitic* and other classes as well).
Mixed clayey	Mineral soils with 35% or more CLAY, and in which no one clay mineral makes up 50% or more of the clay fraction. (Mixed clayey soils of *Soil Taxonomy*)
Organic	Soils containing 12% or more organic carbon (O.C.)(20% or more organic matter (O.M.)) when the mineral fraction has no clay, or 18% or more O.C. (30% or more O.M.) when the mineral fraction has 60% or more clay, or a proportional amount of organic carbon (or O.M.) when the clay content is between 0 and 60% ("Peat" soils; Includes at least the Fibric and Hemic suborders of the Histosols in *Soil Taxonomy*, and may include other subgroups).

[1] *Mineral* soils are those not meet the criteria for *Organic* soils.
[2] Definitions of sand, silt, clay, and subgroups of sand are according to the USDA soil textural classes, as reported in *Soil Taxonomy*.

Different types of soil with clay-silt percentage