Practical Aquaculture 5

By

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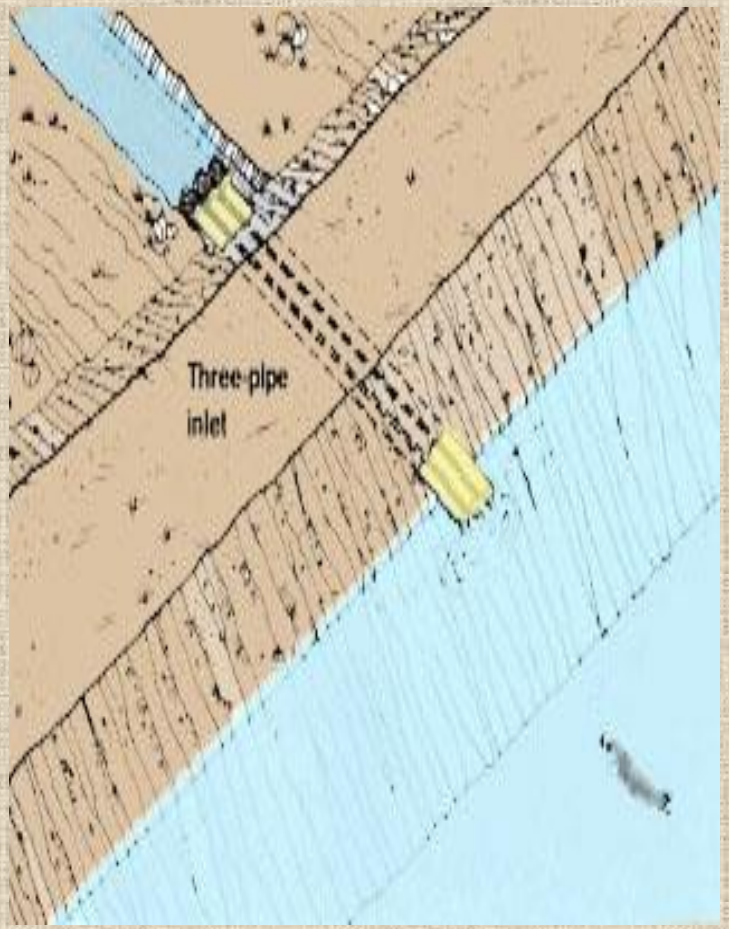
If the pipes you have are too small to provide the required water flow, you may have to use more than one pipe at each pond inlet. Usually, pipe inlets extend for about 0.60 to 1 m beyond the edge of the water surface of the pond when it is full, and they should be at least 10 cm above the final water level

Pipe	Inside diameter of pipe		
	Less than 10 cm	10-15 cm	Over 15 cm
Bamboo	yes	-	-
Galvanized iron	yes	-	-
Plastic	yes	yes	yes
Asbestos cement	-	-	yes
Concrete	-	-	yes



ESTIMATES OF WATER REQUIREMENTS

Water to fill the pond

Water losses by seepage

Water losses by evaporation

To determine how much water your pond will hold when it is full you need to calculate:
The surface area of the pond;
The average water depth in the pond;
The volume of water in the pond when full

How to calculate the surface area of the pond

If the pond has a **square** shape, multiply two sides (in meters, or m) or, if it has a **rectangular** shape, multiply the length (in m) by the width (in m) to find the surface area (in square meters or m2).

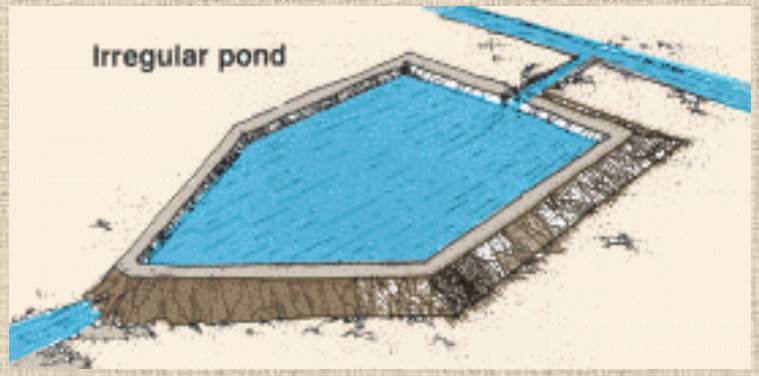
If you have a large pond you may want to convert the surface area from square metres to ares or hectares (ha).

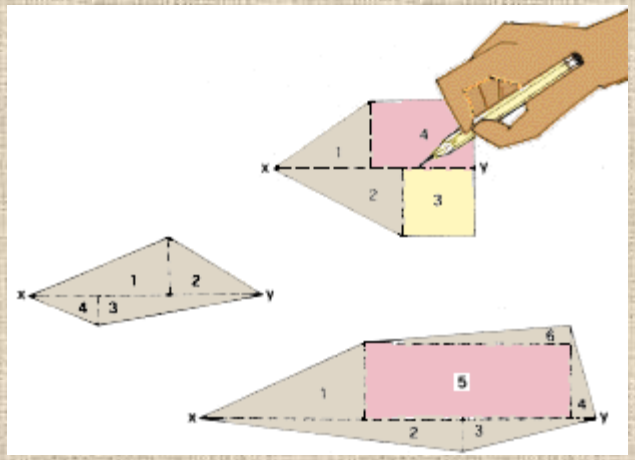
100 m2 = 1 are, 10000 m2 = 100 ares = 1 hectare (ha)

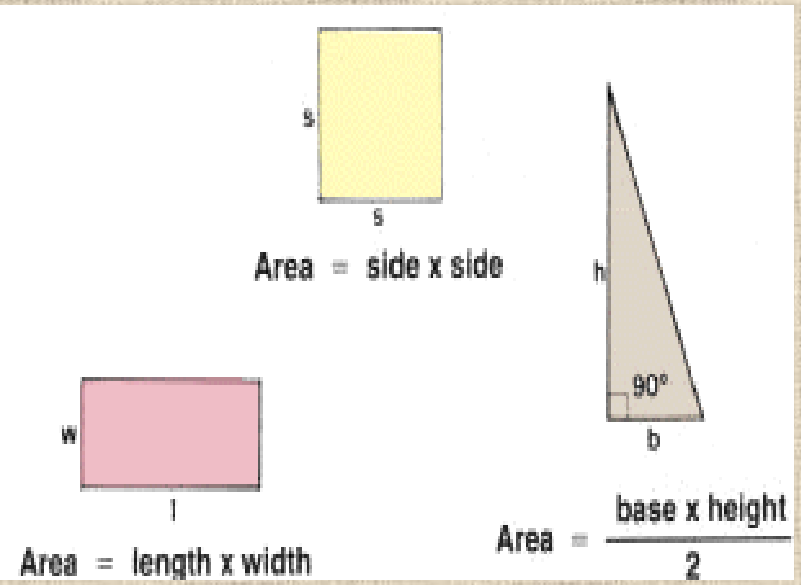
Examples

150 m2 = 1.50 ares
780 m2 = 7.80 ares
2 758 m2 = 27.58 ares
15 350 m2 = 153.50 ares = 1.5350 ha

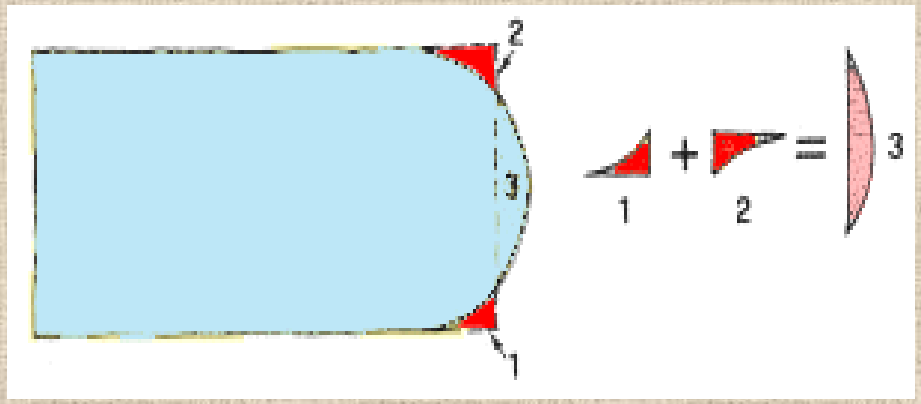
If the pond has an **irregular** shape but the sides are generally straight, you can find the surface area by dividing the pond into smaller areas that can be more easily calculated, and add these to find the total surface area.







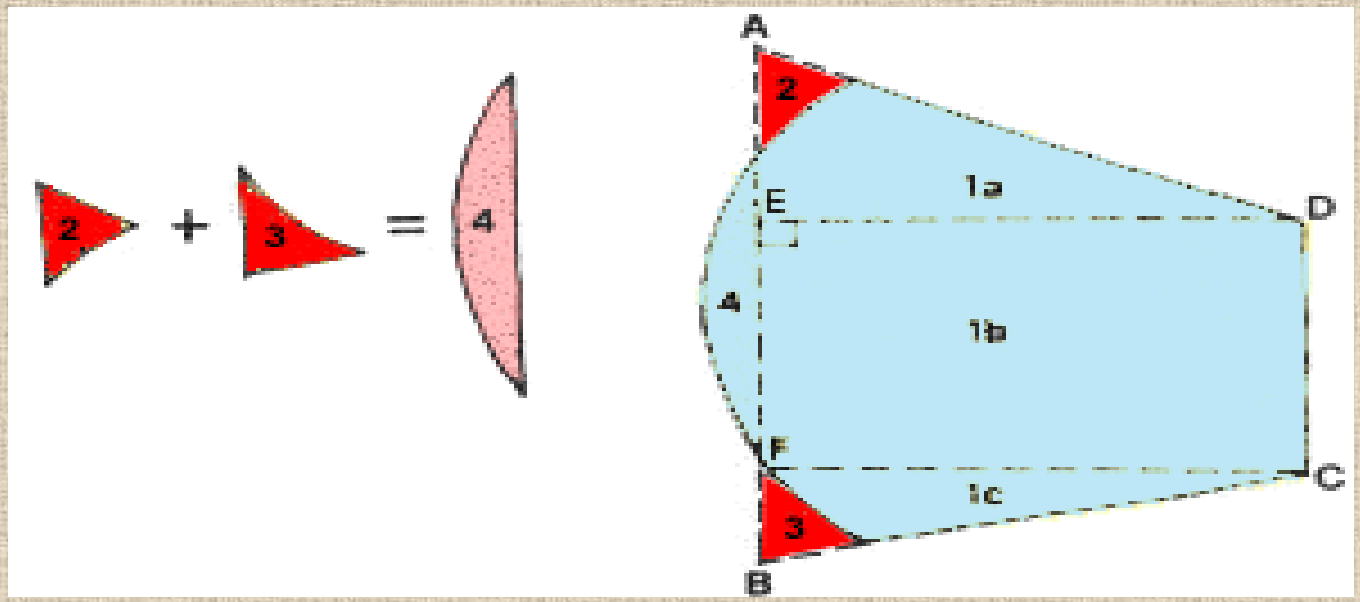
If the pond has an irregular shape with a **curving side**, you may need to approximate the curved part to find the surface area.



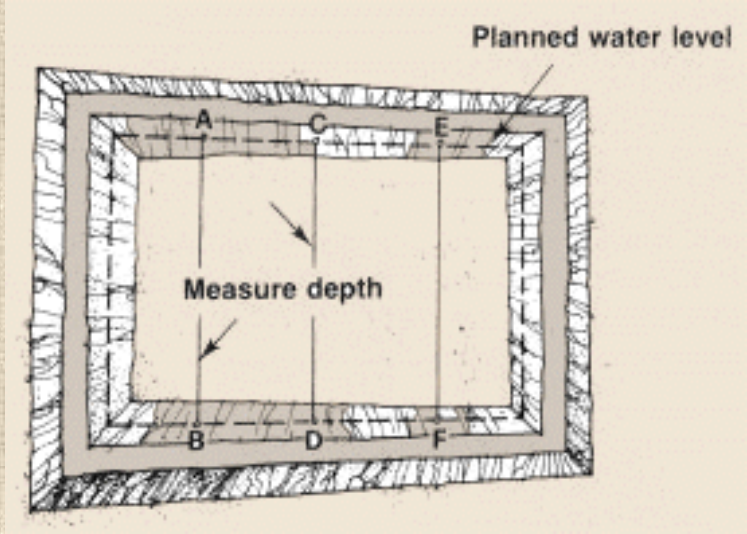
Examples

The parts outside the pond and the part inside the pond are about equal; assume1+2=3:
you can calculate the surface area by multiplying the length by the width.

The parts outside the pond and the part inside the pond are about equal; assume 2+3 = 4;
the total surface is then = ADE+FCB+EDCF =
1a+1b+1c

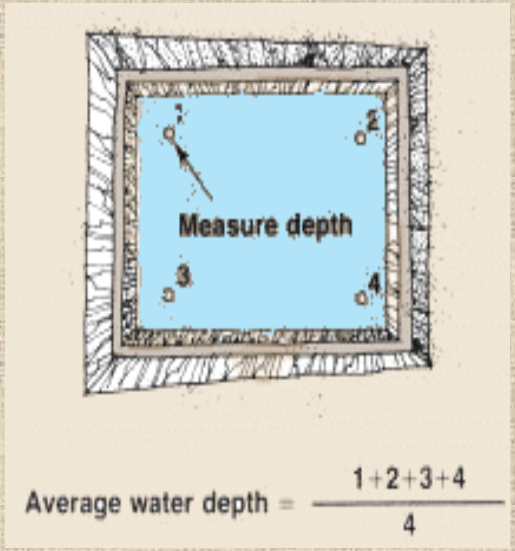


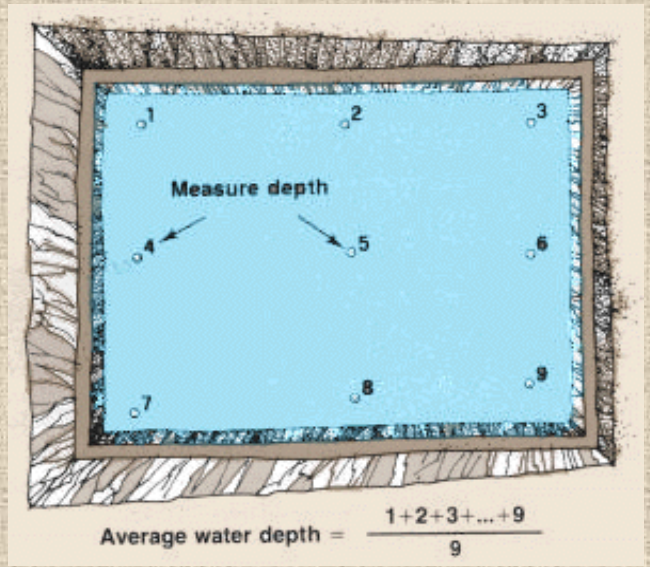
How to calculate the average water depth of the pond when it is empty

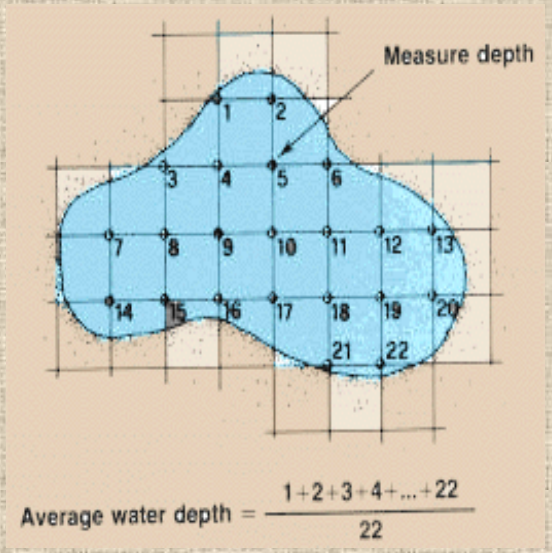


Surface area (m^2)		Average water depth (m)		Water volume (m^3)
235	x	1.0	=	235
450	x	1.2	=	540
2500	x	1.5	=	3750

How to calculate the average water depth of the pond when it is full

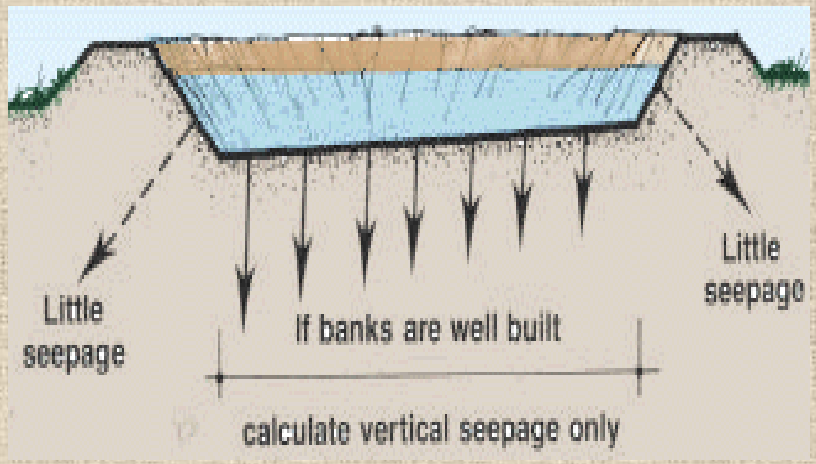


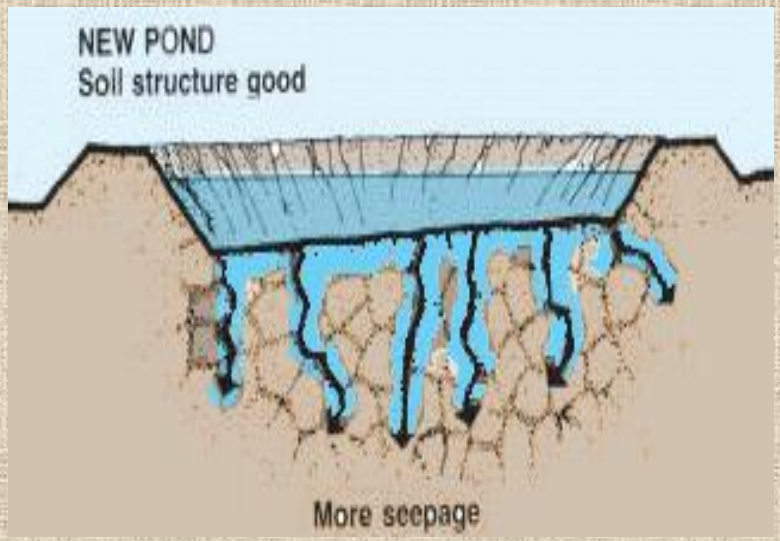


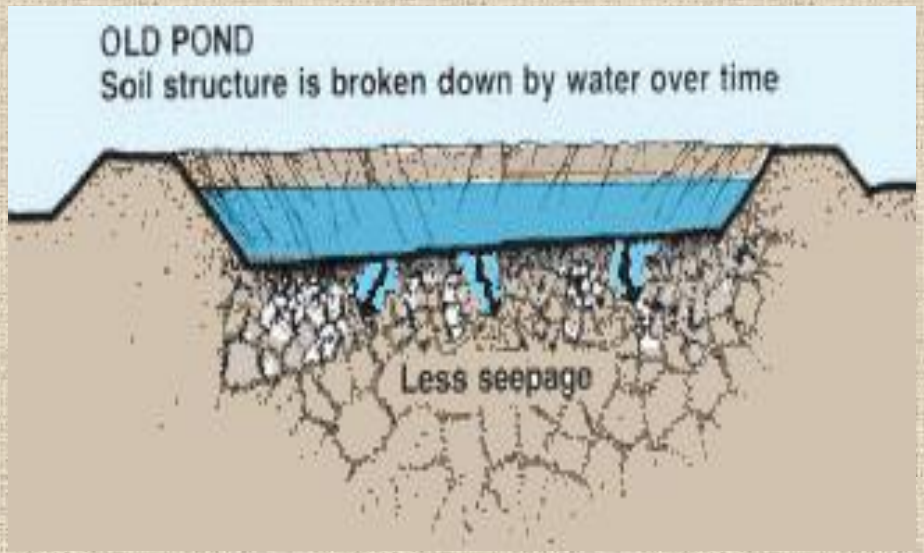


Water losses by seepage

Water that is lost vertically through the bottom of the pond, horizontally through the dikes by infiltration, and through the drainage system of the pond is called **seepage water**.







the rate of seepage losses in millimeters per day (mm/day) from various soil types (in the natural state) needed to calculate pond seepage losses over a period of time.

Natural soil type	Seepage losses (mm/day)
Sand	25.00 - 250
Sandy loam	13.00 - 76
Loam	8.00 - 20
Clayey loam	2.50 - 15
Loamy clay	0.25 - 5
Clay	1.25 - 10

Example

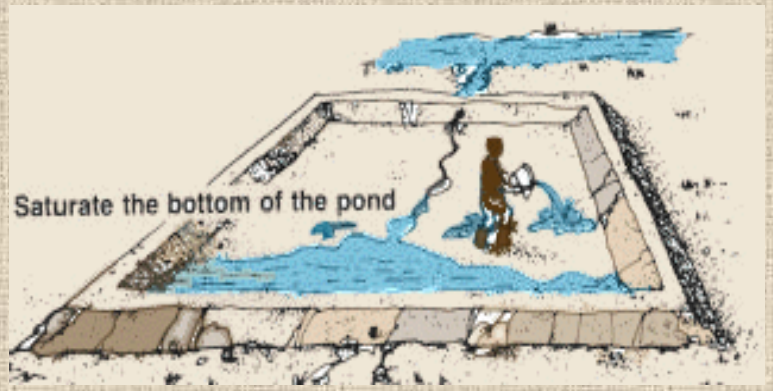
Your pond has a surface area of 1 500 m2. The soil of the pond is loam. You want to find the amount of water needed to compensate for seepage losses during 6 months.

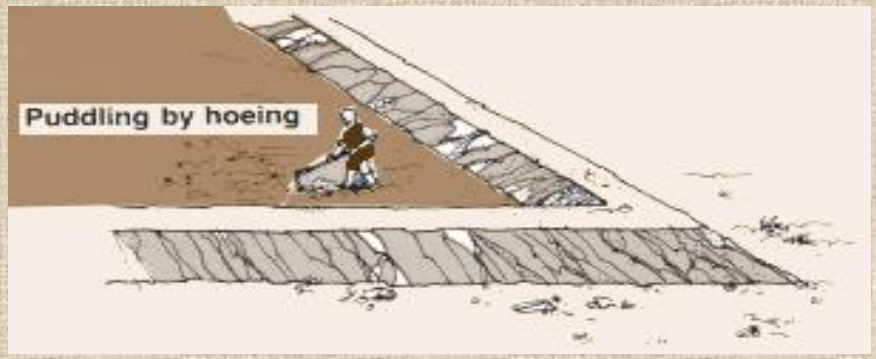
Seepage losses from loam in one day will average 14 mm (from 8 to 20 mm/day) or 0.014 m/day (seepage) x 1 500 m2(pond area) = 21 m3/day.

Seepage losses for 6 months (180 days):

180 (days) x 21 m3/ day = 3 780 m3.

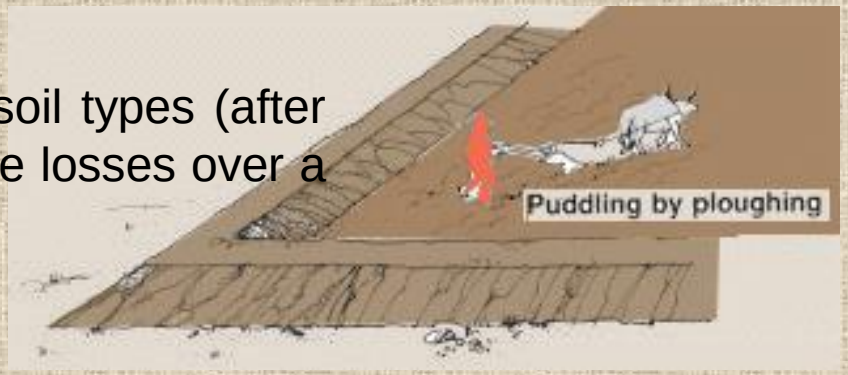
Reducing seepage water losses by ***puddle***





To calculate the amount of water needed for puddling multiply the pond area (in m^2) by 0.3 m.

the rate of seepage losses from various soil types (after puddling) needed to calculate pond seepage losses over a period of time.

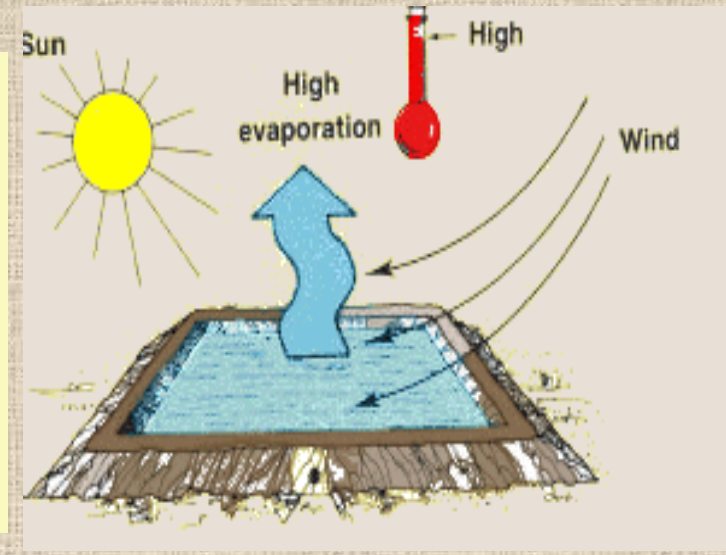


Puddled soil type	Seepage losses (mm/day)
Sandy loam	3-6
Loam	2-3
Clayey loam	1-2
Loamy clay	about 1
Clay	about 1

To calculate the total water required both for puddling and to compensate for seepage losses for 6 months thereafter, add the two values.

Water losses by evaporation

The water that is lost to the air from the surface of the pond is called **evaporation**. The amount of water lost by evaporation depends largely on local climate conditions. High air temperatures, low humidity, strong winds and sunshine will increase evaporation.
Low air temperatures, high humidity, rainfall and cloud cover will decrease evaporation.



Evaporation rates

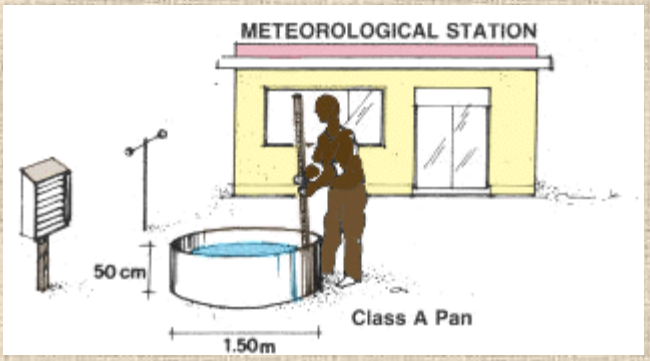
You will need to know your local **evaporation rate** in order to calculate the amount of water lost from the surface of a pond by evaporation. Evaporation rates, which are provided by meteorological stations, are found by measuring and recording water losses by evaporation over many years.

Evaporation rates are usually expressed as the water depth lost in millimeters over a period of time, e.g., 2 mm/day, 14 mm/week or 60 mm/month.

How to calculate water losses by evaporation

Class A Pan

measure daily water losses from a standard-size container called a **Class A Pan**.



Penman Formula

Note: water evaporates faster from a Class A Pan than from a large water surface such as a pond. When using Class A Pan evaporation rates you must multiply by a **correction factor** of 0.75 to better approximate evaporation losses

Month	Evaporation rate (mm)
April	56
May	63
June	68
July	75
August	84
September	79

Example

The water surface area of your pond is 2 500 m2 and you plan to grow fish from April to September.

Total evaporation for these months is 56+63+68+75+84+79 = 425 mm.

The corrected total evaporation is 425 mm x 0.75 = 318.75 or 319 mm (omit this step if you are using evaporation rates calculated by the Penman Formula). The corrected total evaporation expressed in meters is

319 mm ÷ 1 000 = 0.319 m. The total amount of water you will lose from your pond by evaporation from April to September is 2500 m2 x 0.319 m = 769.5 or 770 m3.