waterlines

Technical Brief No.47: Improving pond water

Wherever possible, a community should avoid the health risks which result from using contaminated pond water, by using an alternative, good-quality source. (Groundwater or rainwater sources will usually produce water of much better quality.) If a pond is the *only* source of water, the implementation of some of the ideas in this Technical Brief should improve the quality of the water. It is not easy to find a sustainable way to produce good-quality potable water from ponds, but any improvement in the quality of pond water is worth the effort.

This Brief concentrates on the removal of suspended matter and pathogenic organisms. It does not address the removal of chemical contaminants because of the complexities involved.

Health risks

The consumption of untreated pond water is a health risk. Like all surface water sources, it is likely to contain one or more of the following contaminants:

- **Pathogens** (disease-causing organisms, many of which come from faeces) such as bacteria, viruses, protozoa, and guinea-worm larvae. If *schistosome cercaria* are present, they can penetrate the skin of anyone entering the water causing bilharzia.
- **Harmful chemicals**
  Agricultural — pesticides, herbicides, fertilizers
  Industrial — heavy metals (e.g. chromium)
- **Other contaminants**
  These affect the appearance and taste of the water and make filtration difficult:

  Algae may release poisonous toxins when they die. Their growth is promoted by the presence of fertilizer or other sources of phosphates or nitrates in the water.

  Suspended solids — fine particles of soil, particularly clays, to which bacteria and viruses often become attached. If these particles can be removed (e.g. by settlement), so can many of the pathogens.

Reducing contamination

Contaminants come from many sources (Figure 1). It is easier to prevent them entering the pond than to remove them from the water. To be successful, the following methods of reducing contamination need wide support from the community, and participatory health education:

○ Restricting activities around the pond

Whenever possible, fence off the catchment area draining into the pond and prevent polluting activities from taking place within the catchment area.

○ Restricting activities in the pond

Faecal pathogens enter the water:

- when faeces are deposited in the water;
- when people wash themselves or their clothes; and
- on the feet of people and animals.

Keeping people and animals out of the pond will improve the water quality. It will also prevent the spread of guinea-worm disease.

Some communities may be able to devote one pond to bathing and watering livestock, and leave another pond protected from these activities so that the water quality is maintained.

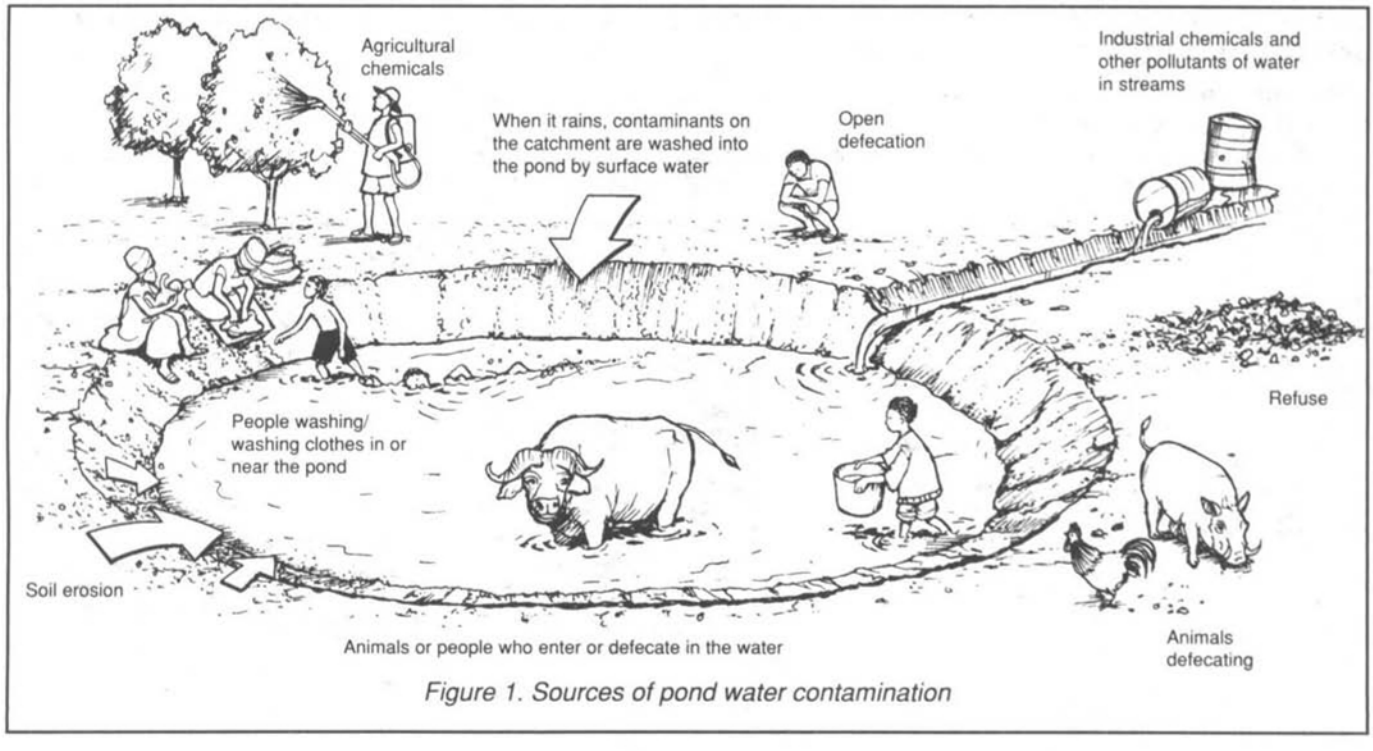

Figure 1. Sources of pond water contamination

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Collecting water without entering the pond

People can only be discouraged from entering the pond if alternative methods for collecting water are provided:

Platforms, steps or ramps (Figure 2) can be used to bring people close enough to the water for them to bend down and fill a bucket, but contamination deposited on these structures can enter the pond, especially when it rains. If the pond level varies considerably, platforms will need to have floating sections to keep the access close to the water. Alternatively, people can draw water by bucket and rope. **Bank-mounted devices**, (Figure 3) which keep people well away from the water are ideal, but if a handpump is to be used it must be sustainable. Spilt water should not be allowed to flow back directly into the pond, and is best disposed of into a soakaway.

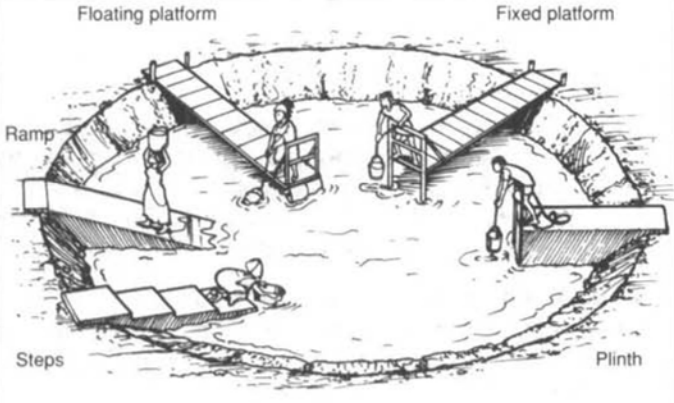


Figure 2. Allowing people near the water

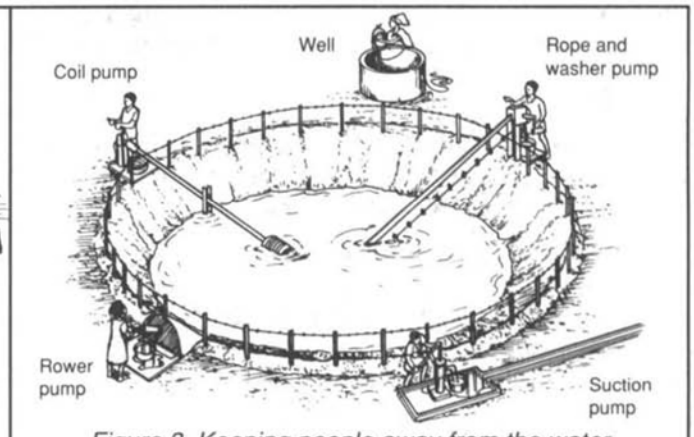


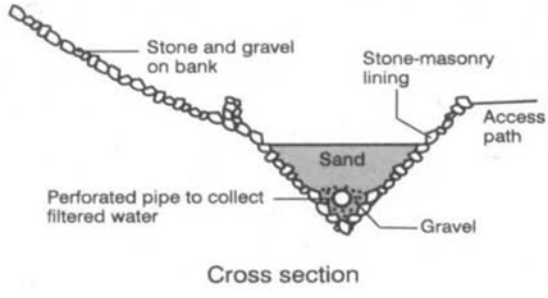
Figure 3. Keeping people away from the water

Drawing strained or filtered water

The water near the surface of a pond, and away from its edges, usually contains less suspended solids than anywhere else in the pond. There are some advantages, therefore, in using a **floating intake pipe** (Method 1). A coarse strainer (such as a **perforated pipe**) will keep out amphibians and plants. A floating **strainer box** has a larger surface area which may permit the use of a finer strainer (such as woven mesh) to exclude the smaller water creatures. Both types will need to be cleaned periodically, although the strainer box is, to some extent, self-cleaning, since debris is likely to fall off the mesh when water is not flowing into the box (especially if the surface water is disturbed by wind).

Instead of drawing water straight from the pond, it is much better to collect it after it has passed through existing sandy soil (Method 2), or through sand **filters constructed in/on the bed or bank** of the pond (Method 3). Over a period of time, filters in/on the bed are likely to become blocked due to the accumulation of settled suspended solids in and on the filter. Bed filters can only be renovated if the pond is drained to allow their partial or complete reconstruction. It is possible to construct a sloping sand filter down the side of the bank to the pond (Figure 4), but this is rare. With such a filter some of the filter media can be cleaned or replaced when the water level in the pond drops substantially at some stage.

Man-made filters on the banks (such as horizontal roughing filters and slow sand filters) **or at home** (Methods 4 and 5) can be used to improve the quality of the pond water considerably, and good, well-maintained designs can remove all faecal bacteria, and most viruses. Such filters can be drained down to allow for the regular cleaning of the sand or gravel, or for it to be replaced. A well-trained, dedicated caretaker is needed to supervise the proper running and cleaning of such filters.



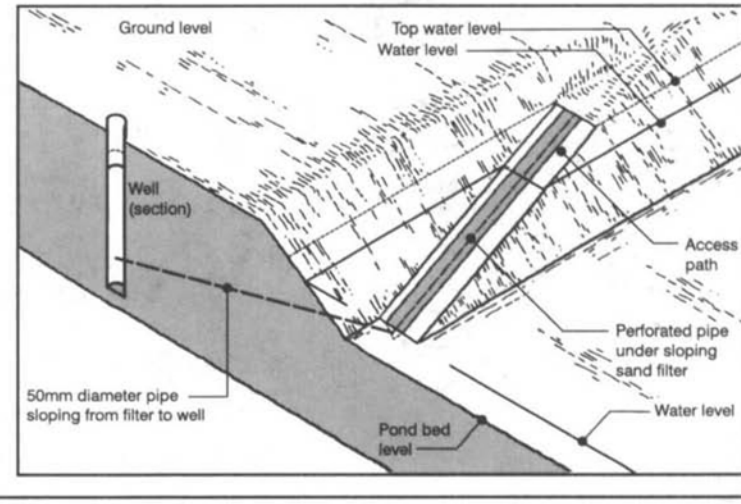
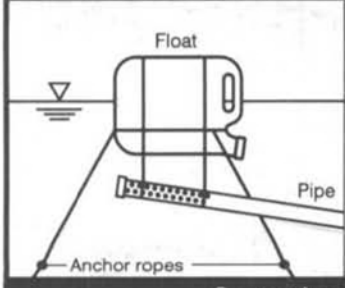


Figure 4: Sloping sand filter on a bank

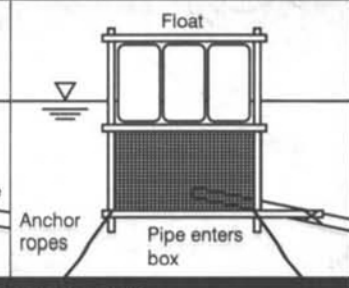
Methods 1 and 2: STRAINING AND NATURAL FILTRATION

Method 1. Floating strainer

1a. Perforated pipe

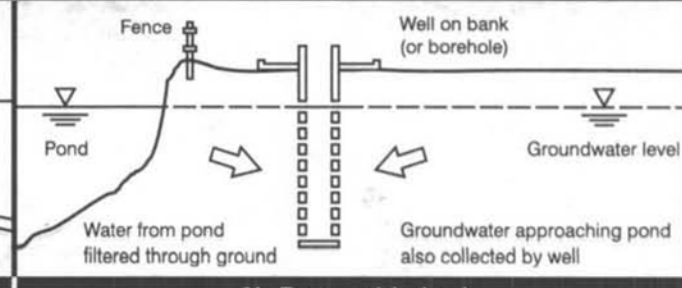


1b. Strainer box

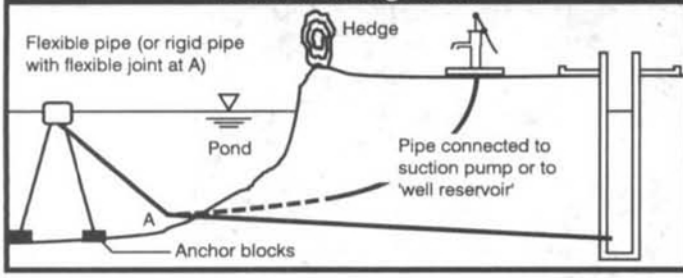


Method 2. Filtration by existing strata

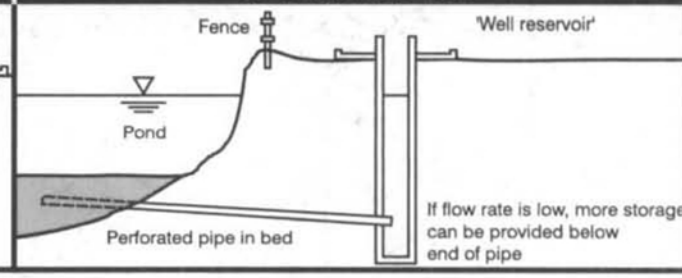
2a Permeable banks



General arrangement



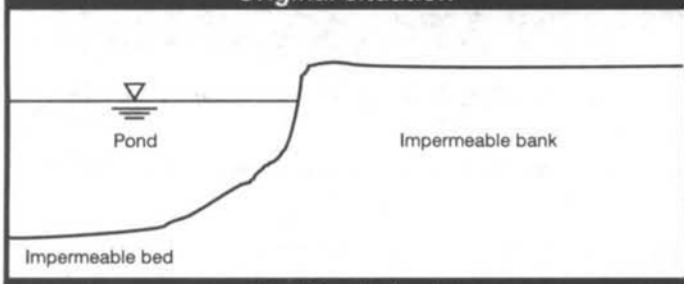
2b Permeable bed



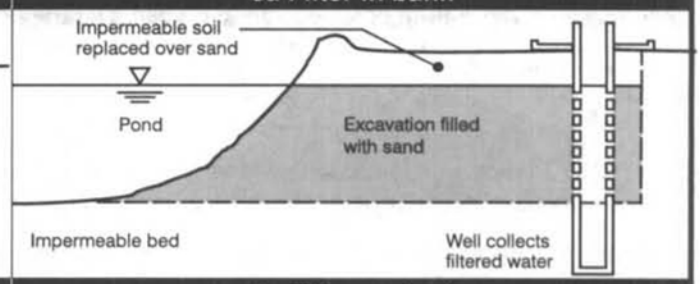
Methods 3, 4 and 5: FILTRATION THROUGH MAN-MADE FILTERS

Method 3. Filter in bed or bank

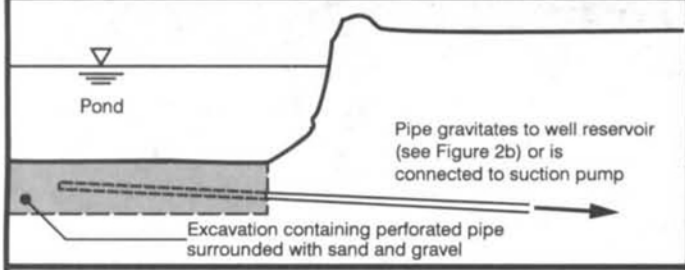
Original situation



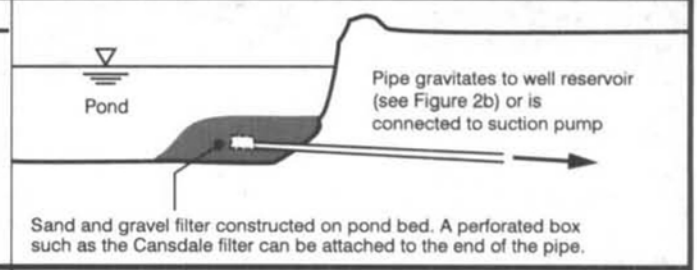
3a Filter in bank



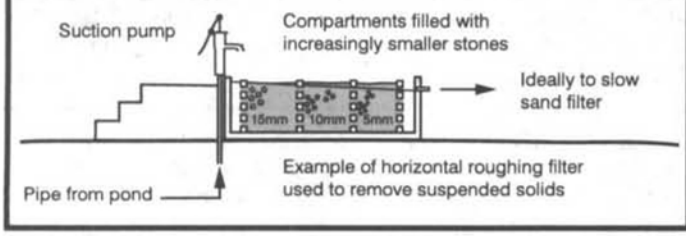
3b Filter in bed



3c Filter on bed

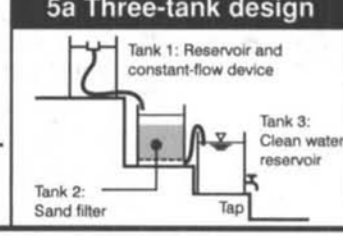


Method 4. Filter on bank

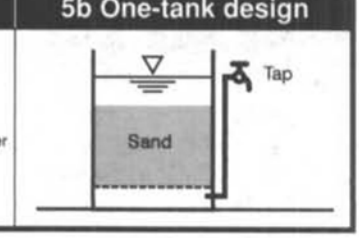


Method 5. Filter at home

5a Three-tank design



5b One-tank design



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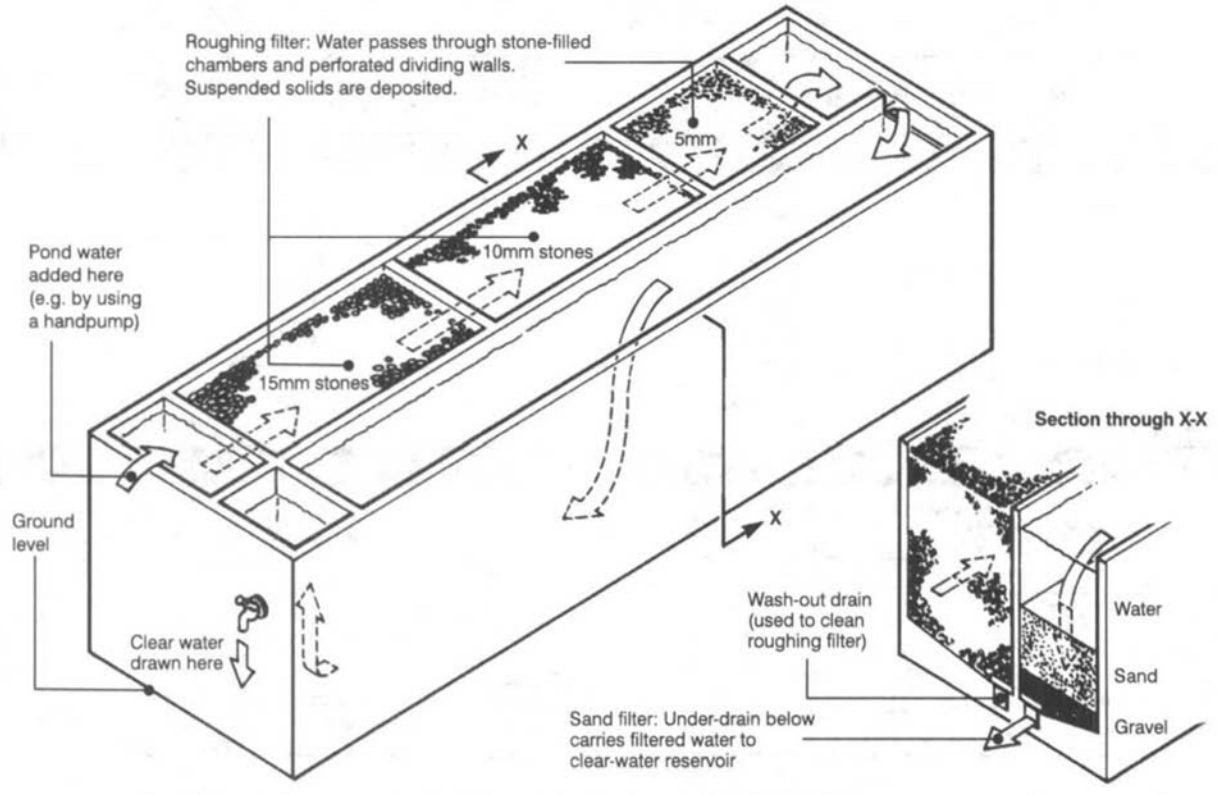

Figure 5. Pond water filter used in India

Other methods of water purification

Other small-scale water purification methods include **settlement and/or storage** for at least 48 hours (see 'three-pot system' reference below), **boiling**, **chlorination** and **solar disinfection**.

Further information:

AIIHPH (1993), *Proceedings of the Workshop on Sanitary Protection and Upgradation of Traditional Surface Water Sources for Domestic Consumption*, All India Institute of Hygiene and Public Health, Calcutta.

IRC (1988), *Community Self-Improvements in Water Supply and Sanitation*, Training Series No. 5, International Water and Sanitation Centre (IRC), The Hague, The Netherlands.

References below to articles in *Waterlines* are given by issue number (e.g. 3:4), Technical Brief number (e.g. TB 35), or page numbers (e.g. pp 15-18).

Handpumps (general)	13:1, TB 41	Household filters	3:1, TB 1; 5:5, pp 29-31; IRC (1988) pp 11-1 - 11-5
Using off-set handpumps	2:4, pp 25-26		
Rower pump	11:3, TB 35	Boiling water	5:1, pp 2-5; IRC (1988) pp 11-10
Rope and washer pump	11:3, TB 35		
Coil pump	8:2, pp 20-22	Solar disinfection	IRC (1988) pp 11-11
Horizontal roughing filters	8:1, pp 27-29		12:4
Slow sand filters	6:3, TB 15; 8:1, TB 21	Three-pot system	IRC (1988) pp 10-13
		Chemical treatment	IRC (1988) pp 11-6 to 11-9
Cansdale filter	1:1, pp 11-13		14:2, TB 46

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