

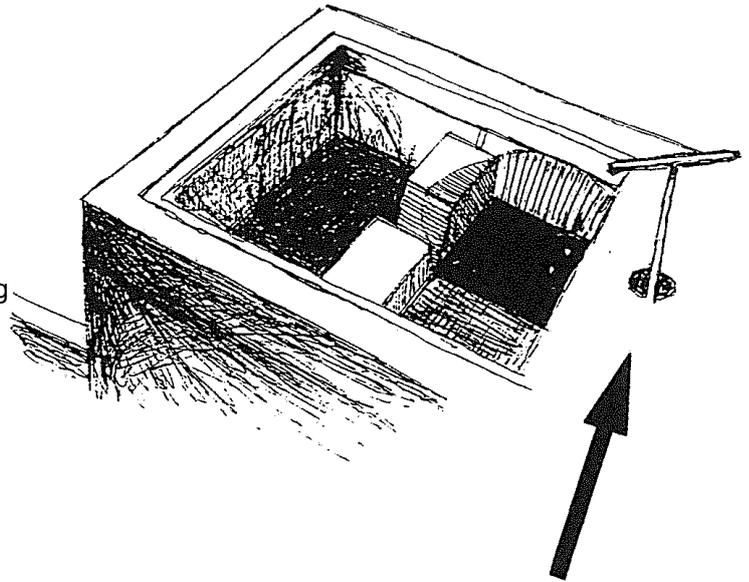
# 21. Slow sand filters (2)

## Operation and maintenance

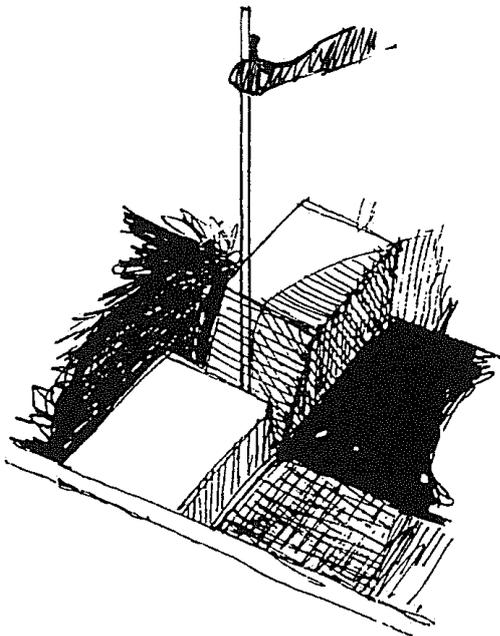
The effectiveness of slow sand filters depends very much on the style of operation and maintenance. A major advantage of this process is the limited number of tasks which must be performed, **but these must be carried out correctly.** (For design notes, refer to *Technical Brief No. 15.*)

## Daily tasks

1. Ensure the depth of water in the reservoir above the sand is near the maximum. The level must be just at or very slightly below the overflow. **This level should not be allowed to fall.**
2. Adjust the treatment rate and the design flow by slightly opening the control valve (or slightly closing it if it was previously incorrectly set). The control valve is the outlet valve between the filter outlet and the final weir.



*Adjust the outlet valve*



*Dip the water flow*

The correct flow rate can be accurately judged by dipping the depth of water flowing over the final weir, or by checking the water depth over the V-notch weir set on the outlet weir.

3. Observe the quality of the source water and of the filtered water. It is also helpful to check for any odour in both source and filtered water.
4. Note, in the records, the flow rate, condition of source and filtered waters and any unusual occurrences. Unusual occurrences might include unseasonal weather conditions, development of algae in the filter, rising *schmutzdecke* (filter-skin) or the illness of any of the operators.

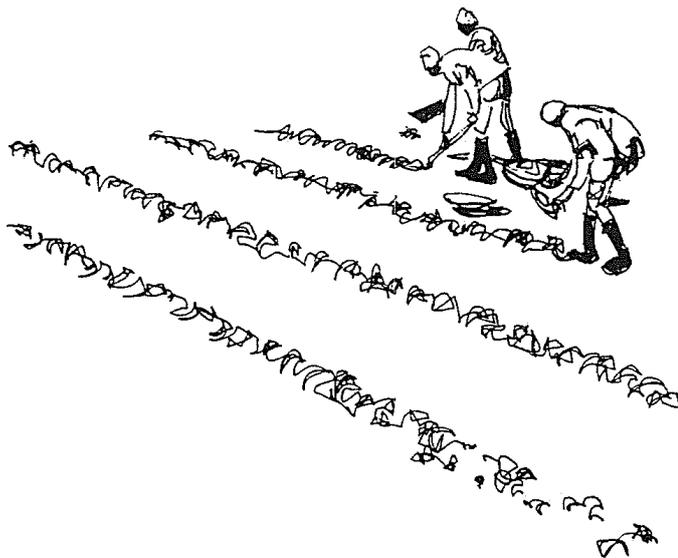
## Slow sand filters (2)

### Scraping the filter

Scraping becomes necessary when, with the maximum head of water available above the sand and the outlet valve fully open, it is not possible to obtain the design flow.

(When scraping the filter, it is essential to take measures to control the personal habits of the workers. There should be no spitting, urinating or defecating. Tools should be disinfected.)

1. Commence the scraping (or filter cleaning) operations by closing the inlet valve at the end of the day and allowing the filter to drain overnight.
2. Early next morning, run off any remaining water by opening the drain valve at the sand surface.
3. Continue to drain surface water through the filter until the level of water is about 100mm below the sand surface.



Gather the *schmutzdecke* into ridges

4. Swab down the walls of the filter box and remove any attached algae. (See above.)
5. Begin scraping by using broad-bladed shovels or hoes to gather the *schmutzdecke* and any dirty sand into long ridges. The removal of a 25mm depth is usually sufficient. (See left.)
6. Remove the ridges of dirty sand and *schmutzdecke* from the filter. (See right.)
7. Smooth out the surface of the sand. Adjust the level of the sand surface drain and of the final weir if necessary and possible.
8. **Refill the filter from the bottom** until there is a depth of 150-200mm of water above the sand then stop filling from the bottom and resume filling in the normal manner.



Swab down the filter walls

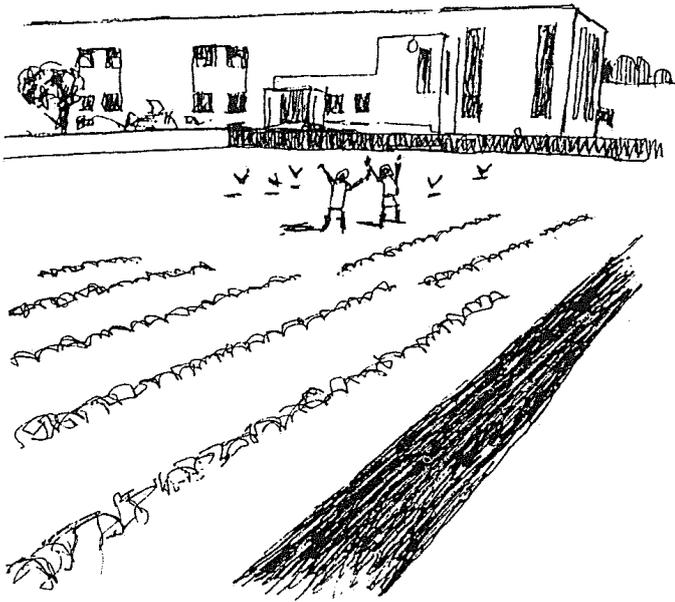


Carry away dirty sand

### Do's of slow sand filter operation

#### During filter cleaning:

- **Do** make sure that the cleaning operation is carried out quickly — one day is usually sufficient.
- **Do** make sure that there is a bath tray of clean water for all the personnel involved to walk through each time they enter the filter. Footwear should be provided.



*Scare birds away from the filter*

- **Do** refill the empty filter from the bottom.

#### Don'ts of slow sand filter operation:

- **Don't** dig up the whole of the sand bed during cleaning.
- **Don't** allow the level of the water in the reservoir to fall.
- **Don't** operate at varying rates.
- **Don't** allow people who are unwell to enter the empty filter during cleaning.
- **Don't** clean more than one filter at a time.
- **Don't** allow birds to foul exposed sand during cleaning.



*Walk through a bath tray of water*

- **Do** control the personal habits of workers in the filter. No spitting, urinating or defecating.
- **Do** make sure that all birds are continually scared away from the exposed sand.

# Slow sand filters (2)

## General points

The following notes relate to *Technical Brief No.15, Slow Sand Filter Design*, and are intended to clarify design points.

### 1. The Gravel Layer

Instead of four layers of graded gravel illustrated, it is possible to use only a three-layer gravel system:

Top layer: 100mm depth of 1-1.5mm gravel

Middle layer: 100mm depth of 4-6mm gravel

Bottom layer: 100mm depth of 16-23mm gravel

### 2. The Uniformity Coefficient

The Uniformity Coefficient is the mesh size of a sieve in mm which retains 90% of the sand divided by the mesh size of a sieve in mm which retains 40% of the sand.

### 3. Inlet and outlet control

- (i) The function of the inlet control system is to maintain a constant head of water above the sand.
- (ii) The function of the outlet control system is to regulate the flow of water to the design rate.

### 4. Removal of viruses

A minimum depth of sand of 600mm is recommended to ensure the complete removal of viruses.

#### References:

Poynter, S.F.B. and Slade, J.S., *The removal of viruses by slow sand filtration*, Prog. Water Technol., 9,75, 1977.

Windle-Taylor, E., *The removal of viruses by slow sand filtration*, Rep. Results Bact. Chem. Biol.

Exam: Land. Waters, 44,52, 1969-70.

### 5. Eliminating wall effects

In order to eliminate wall effects it is necessary either to roughen the walls at the sand level during construction or ensure that the drainage system ends at least 600mm from the walls. It is preferable to take both precautions.

### 6. Inlet flow control

Inlet flow control by butterfly valve is advantageous if possible. It is not essential.

#### For further information:

Ellis, K.V., *Slow Sand Filtration*. CRC Critical Reviews in Environmental Control, 15, 4, 315-354, 1985.

Huisman, L. and Wood, W.E., *Slow Sand Filtration*, WHO, Geneva, 1974.

*Slow Sand Filtration for Community Water Supply in Developing Countries: A Design and Construction Manual*.

IRC Technical Paper Series No.11, 1978.

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