

Pre-filtration

Roughing pre-filters reduce the quantity of suspended matter in water prior to other treatment processes. They are most commonly used with slow sand filtration (covered in Fact Sheet 2.12). Roughing pre-filters also contribute to the removal of microorganisms from water during treatment.

In a typical roughing pre-filter, water passes slowly through packs of gravel of different sizes where suspended matter is trapped. Flow through the gravel may be horizontal, vertical upflow or vertical downflow. The upflow configuration is the most efficient and facilitates hydraulic cleaning. The accumulated material trapped in the filter must be removed periodically by cleaning. Cleaning is often achieved by rapidly draining down the filter through a fast-opening gate, so that the particles are re-suspended from the gravel and leave the filter in the wastewater. In practice, it is often found that the gravel needs to be dug out of the filter periodically, washed and replaced.

Roughing pre-filters, like coagulation-flocculation clarification, are used to remove suspended matter from the water. Roughing pre-filters have the advantage that no chemicals or dosing equipment are required, and operation and maintenance requirements are lower and more simple.

Roughing pre-filters are especially useful in small and medium-sized water supply systems where they are often combined with slow sand filters. Pre-treating water before slow sand filtration minimizes clogging of the slow sand filters by suspended matter and therefore helps ensure their optimum performance.

Sanitary inspections of roughing pre-filters

Sanitary inspections of roughing pre-filters should be conducted regularly to ensure that they are functioning properly and that an adequate water supply is maintained (see Fact Sheet 2.1). The key points and observations to make during a sanitary inspection of a roughing pre-filter are :

- The turbidity of the water leaving the pre-filter should be less than 10 TU. There should be a 70-90 per cent reduction in turbidity between the water at the outlet and the raw water.
- The flow rate through the filter should be controlled in the range of 0.5-1 metre per hour.
- The regularity and effectiveness of cleaning should be checked. The latter is done by analysing a sample of gravel from the filter immediately after cleaning to measure the silt content.

- The filter and filtrate should be protected from birds and animals.
- The pre-filter must not have any cracks that allow water in the filter to leak out or surface water enter the filter.

Configuration

Efficient gravel pre-filters have the following requirements :

- Several sections (usually three) each filled with a different size of gravel.
- For a three section gravel pre-filter the sizes of gravel used are :

First section	16-30 millimetres
Second section	8-16 millimetres
Third section	4-8 millimetres
- The largest size of gravel is used at the raw water inlet, and gravel size gets smaller towards the outlet of the filter (see Figure 1).
- Water flow in pre-filters may be horizontal (see Figure 1), vertical upflow (see Figure 2) or vertical downflow. The vertical upflow configuration is now preferred.

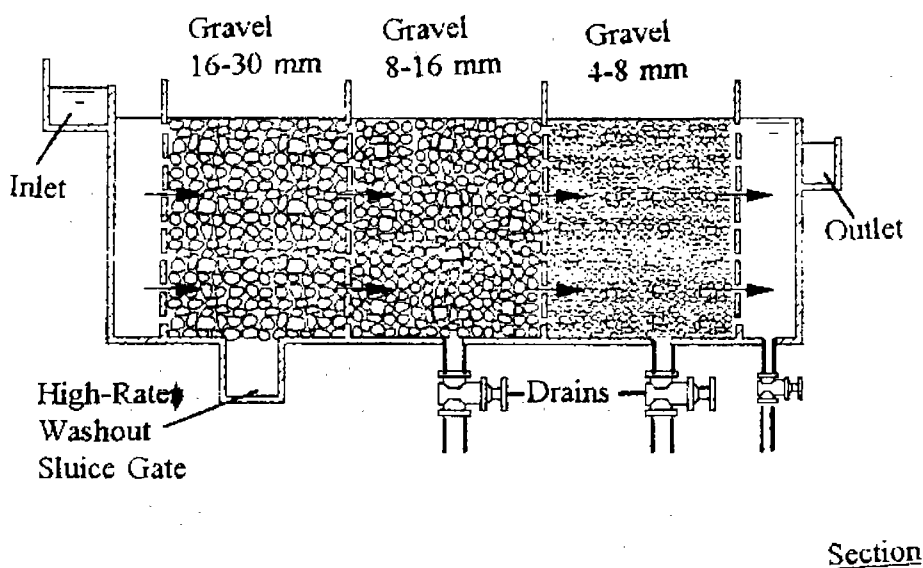


Figure 1. Horizontal gravel pre-filter

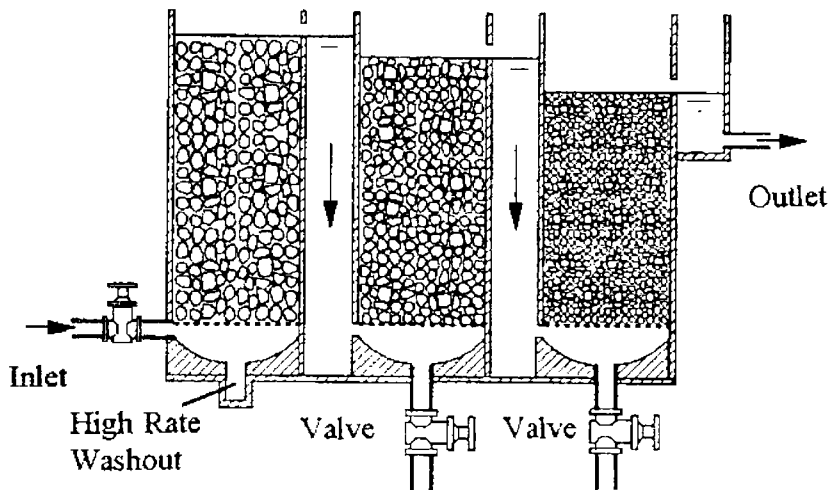


Figure 2. Upflow gravel pre-filter

Operation and maintenance

The operation and maintenance of roughing pre-filters is relatively straightforward.

- **Turbidity** : check and keep a log of the turbidity of the water entering and leaving the pre-filters. Water leaving the filter should have a turbidity of less than 10 TU (see Fact Sheet 2.33). If turbidity is above this value, the filter may need cleaning or the flow rate may be too high.
- **Flow rate** : the flow rate of the raw water through the gravel pre-filters must be controlled, for example using a V-notch and weir at the inlet. For horizontal flow pre-filtering, flow rates should be between 0.4 and 1.0 m/hour. Check and adjust the flow rate of the gravel pre-filters using the V-notch at the inlet (see Fact Sheet 2.9). Keep a log of flow rates.
- **Cleaning** : the gravel pre-filters should have sloping floors and a channel leading to rapid opening wash-out gates to allow hydraulic cleaning of the filters. Close the outlet valve or gate and allow the filter to fill with water. Next, open the wash-out gates, causing the filter to drain rapidly carrying much of the sediment with the wash-out water. Close the wash-out gates and allow the gravel pre-filters to fill again.