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REACHING THE UNREACHED: CHALLENGES FOR THE 21ST CENTURY

Gravity roughing filter for pre-treatment

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MOST OF THE Slow Sand Filters in Sri Lanka has maintenance problems due to lack of pre-treatment systems for reduction of turbidity and suspended solids in raw water. Horizontal flow Roughing Filters (HRFs) are the most common type of pre-treatment systems used for Slow Sand Filters. Usage of HRFs for large schemes has been limited due to high capital cost and operational problems in cleaning the filters. Therefore, the idea of gravity flow through a roughing filter media was tested by converting a Horizontal Flow Roughing Filter into a Gravity Flow Roughing Filter. The total depth of filter media was 1m and the smaller size of filter media was packed at the top of the filter and large size of filter media was packed at the bottom of the filter. Perforated pipes were fixed at the bottom for cleaning and removing filtered water. This filter was similar to upward flow filter with a shorter bed of filter media, but the direction of flow is downward. Gravity flow Roughing Filter (GRF) and an existing HRF were tested to check the suitability of a GRF for pre-treatment and to compare the performance of both filters. It was found that the reduction in Turbidity, Suspended Solids and Colour of GRF is 10-15 per cent less than the that of HRF, but the capacity of the GRF is 3-4 times higher than the HRF. The quality of filtered water is acceptable to a Slow Sand filter. Since most of the suspended solids are deposited on top of the filter, manual cleaning could be done easily. The sludge accumulated inside the filter could be removed through scour pipes.

Horizontal flow roughing filters are the most common type of pre-treatment systems used for slow sand filters in Sri Lanka. Capital investment for a 6-10m long HRF is very high and not economical for rural schemes where the cost recovery is very low. In an Earlier study done on HRFs (Jayalath et, al., 1994, 1995) it was found that within a short distance from the inlet, a considerable reduction in Turbidity and Colour could be achieved. Therefore as an alternative system, gravity flow though a short bed of filter media was tested at Udatenne Water Supply Scheme in Kandy, by converting an existing HRF into a Gravity flow Roughing Filter.

Method

The experimental filter was 10m in length, 3.6m in width and 1.4m in depth. Under drain pipes were fixed and three layers of pebbles were packed as shown in Figure 1. After allowing the filter to operate for two weeks at a rate of 0.75 - 1.0m/hr, raw water and filtered water were tested for Turbidity, Suspended Solids and Colour. A

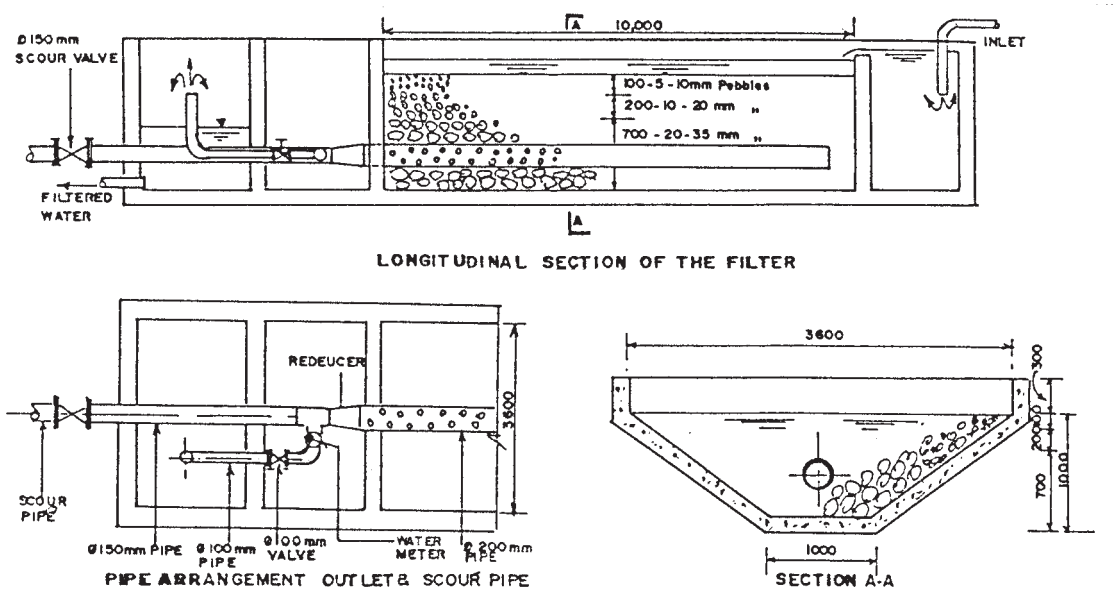

Figure 1. Schematic diagram of the gravity flow roughing filter

Table 1. Percentage reduction in turbidity suspended solids and colour

	GRF	*HRF*
Turbidity	40 - 85	50 - 90
SS	35 - 80	40 - 80
Colour	40 - 80	50 - 95
Capacity (m3/hr)	30	7 - 11

similar size HRF was also available at the site and that was also tested for same water quality parameters to compare the performance of the GRF and HRF.

Results and discussion

According to the Table 1, the percentage reduction in Turbidity, SS, Colour is about 10-15 per cent lower than the that of HRF, but the capacity of the GRF is 3-4 times higher than the HRF.

According to Figures 2 and 3 water quality parameters of the filtered water of both filters are similar and suitable for a Slow Sand Filter (SSF). Hence the GRF is also act as a similar protective system like HRF for a SSF. However GRF can be cleaned at the top without removing the filter media which is not possible in a HRF.

Conclusion

Gravity flow roughing filter is also a similar pre-treatment system like horizontal flow roughing filter with a higher capacity. Hence this is a more appropriate and economical system in rural water supply schemes.

References

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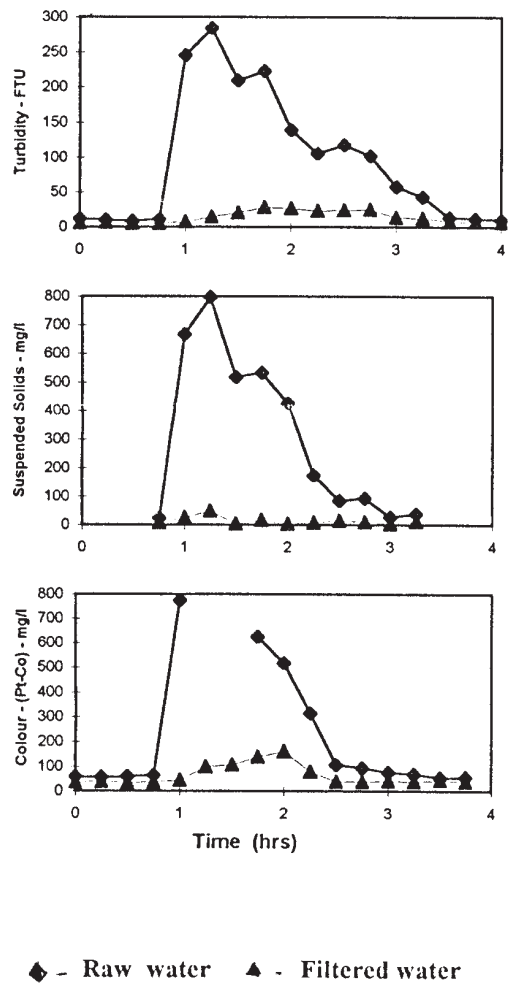

Figure 2. Behaviour of the GRF during a rainy weather

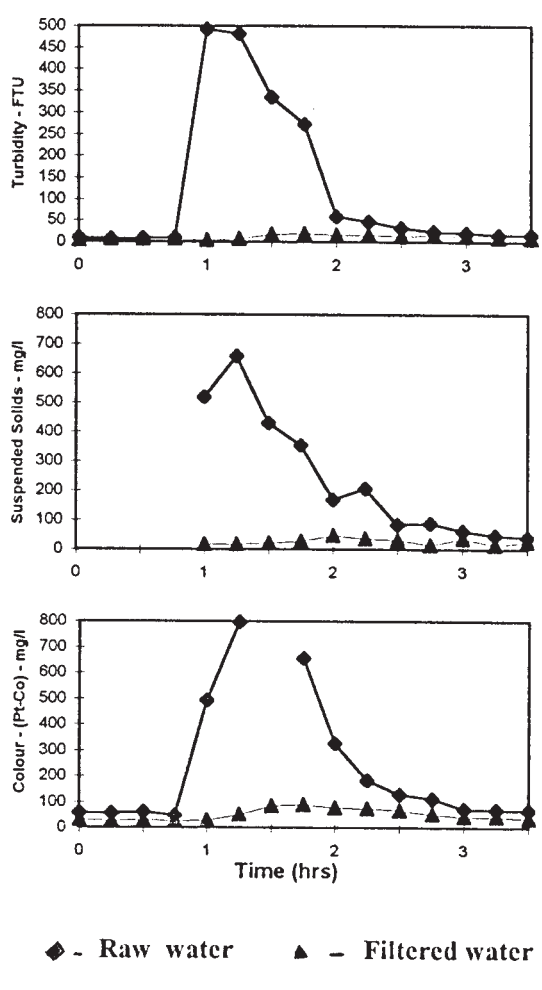

Figure 3. Behaviour of the HRF during a rainy weather