

12.15 EFFICIENCY EQUATIONS FOR STONE-MEDIA TRICKLING FILTERS

The BOD load on a trickling filter is calculated using the raw BOD in the primary effluent applied to the filter, without regard to the BOD in the recirculated flow. BOD loadings are expressed in terms of pounds of BOD applied per unit of volume per day. Common values are 25–45 lb/1000 ft³/day (400–720 g/m³·d) for single-stage filters and 45–65 lb/1000 ft³/day (720–1040 g/m³·d) for two-stage filters based on the total media volume of both filters.

The hydraulic load is computed from the raw-wastewater flow plus recirculated flow. Hydraulic loadings are expressed in terms of average flow in gpm applied per square foot of surface area per day. Recirculation flow is required to maintain an open, well-aerated bed by preventing excessive accumulation of biological growth in the voids and impeding the passage of water and air. The minimum recommended hydraulic loading is 0.16 gpm/ft² (9.4 m³/m²·d). The maximum recommended is 0.48 gpm/ft² (28 m³/m²·d). Above this, the flushing action is excessive and contact time of the wastewater with the filter media becomes too short. The recirculation ratio for this range of hydraulic loadings is usually between 0.5 and 3.0.

Trickling filters have a bed depth of 5–7 ft (1.5–2.1 m) for most efficient BOD removal per unit volume of stone or slag media. In the early development of filters, they were constructed as deep as 8 ft and as shallow as 3 ft. Experience showed that two 3-ft-deep filters in series were no more efficient than one 6-ft-deep filter, and that the filter media below 6 ft in a bed did not result in significant increased BOD removal.

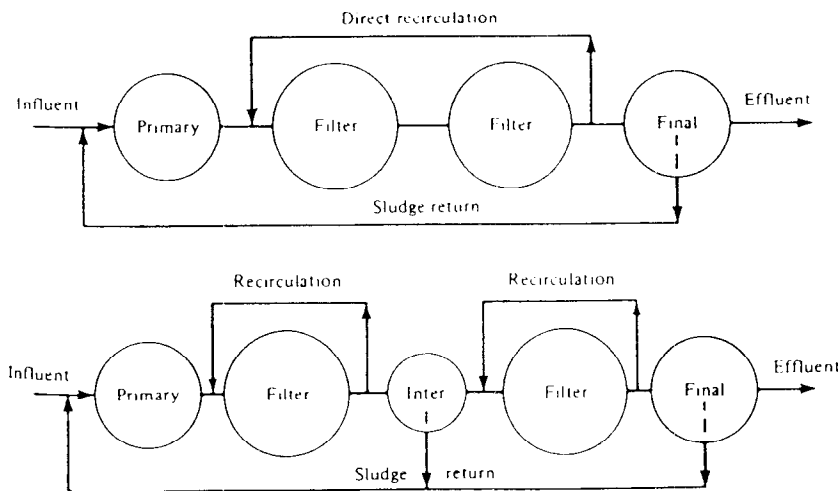


Figure 12.23 Typical recirculation patterns for two-stage trickling filter plants without and with intermediate sedimentation.