Figure 10. Leopold dual lateral air-water underdrain system
Figure 3-19 Essential parts of a rapid sand filter. The minimum total depth is 8½ ft, 12 ft preferred.

Rate of filtration = \[
\frac{7.48\text{ minutes for water in filter to fall 1 ft}}{\text{fill filter with water, shut off influent, open drain}}
\]
Backwash time = 10 to 15 min minimum, until water entering trough is clear
Normal wash-water usage = 2 to 2.5\% or less of water filtered
Sand expansion = 40 to 50\% = 33.6 to 36 in. for 24-in. sand bed
= 25 to 35\% for dual media, anthracite and sand

Rate of backwash = \[
\frac{7.48\text{ minutes for water in filter to rise 1 ft}}{\text{lower water level to sand, slowly open backwash valve, 20 to 25 gpm/ft}^2\text{ minimum (32 to 40 in. rise/min)}}
\]
Orifice area = 0.25 to 0.30\% of filter area
Lateral area = 2 × orifice area
Manifold area = 1.5 to 2 × total area of laterals
Figure 220. Facility layout for 10-mgd water treatment plant.