

How Water Works

ILLUSTRATED PROCESSES, EQUIPMENT, AND TECHNOLOGY

Effective Filtration Relies on the Right Media Mix

Filtration plays an important role in removing naturally occurring and treatment-induced particles in water treatment plants. It usually isn't necessary to filter groundwater, because most suspended material is removed as water percolates through the soil. However, because surface water is subject to runoff and other sources of contamination, filtration is necessary to remove the suspended material for aesthetic and public health reasons.

High-rate filters—dual-media and multimedia filters—can operate at rates up to four times higher than rapid sand filters. As illustrated here, high-rate filters use a combination of filter media, not just sand. In operation, the top, coarse layer removes most of the suspended particles. Particles that pass through this layer are removed by finer media below. As a result, most of the filter bed is used, allowing for longer filter runs and higher filtration rates than a conventional sand filter.

1-3. In dual-media and multimedia filters, the coarsest material has the lowest specific gravity (material weight relative to water weight), so it tends to stay at the top. The heaviest material is the finest, and it stays near the bottom. A common combination is coarse anthracite (coal) at the top (1), fine silica sand in the center (2), and gravel at the bottom (3) to prevent sand from entering the underdrains. Garnet sand is used as an additional layer in multimedia filters. Some mixing of the layers occurs, but the media maintain their approximate respective positions in the filter bed after backwashing. The types of filter media used depend on many factors, including general raw-water quality, water quality variations, and chemical treatment used.

4. Filter tanks are generally rectangular and constructed of concrete. To minimize piping and ease access, several filter tanks are usually constructed side-by-side on each side of a pipe gallery.
5. Influent water is introduced over the filter surface.
6. Filters typically require a trough placed over the filter media to collect backwash water and carry it to waste.
7. Porous plates, perforated bricks, and other systems can be used for the filter bottom.
8. A system of underdrain piping collects the filtered water.
9. A clearwell stores filter effluent water under the filter or elsewhere.

ILLUSTRATION: RON KNOWLTON, KNOWLTON MULTIMEDIA

Some illustration elements exaggerated for emphasis.

Editor's Note: Additional How Water Works images and related products are available at www.awwa.org/howwaterworks.