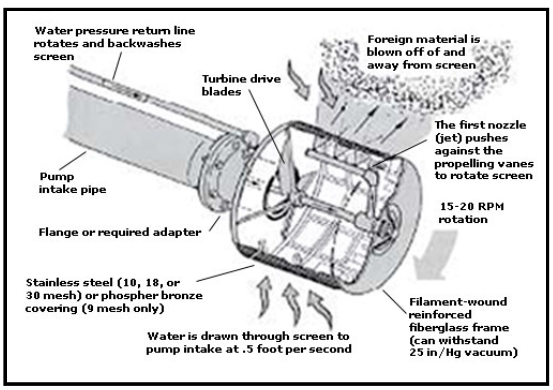
# Sand vs. Sand Filters:
# A Case For Reduced Backwashing

Sand media filtration is a respected and proven methodology for removing algae, fine silt and organic matter from pumped water for drip irrigation and micro-spray irrigation systems. By their nature, sand filters not only effectively remove these fine solids, but also (not-so-effectively) remove larger particle matter, too. Solids such as +200 mesh sand and stringy organic matter are even more easily removed from the water stream via a sand filter. Unfortunately, such particle matter/debris are not-so-easily removed from a sand filter. Instead, consider the logic of applying two or more filter techniques to solve the overall contaminant problem, rather than depending on one filter to do all the work … which often results in overwhelming a filter or causing it to fail.

Stringy organic material can build-up quickly on a sand media bed surface, causing high pressure loss in a short period of time. Problematic also is the occurrence of such material being able to foul the dispersion plates at the inlet to a sand filter, when such debris interweaves or gets impacted onto the plates, vanes and/or coarse screening of a sand filter's dispersion devices. Pre-filtering at the water source, before the debris gets to the pump, is an intelligent alternative, relying upon alternative technology designed for the removal of such debris. Self-cleaning pump intake screens, for example, can keep such larger debris from not only fouling a sand filter, but also damaging a pump.

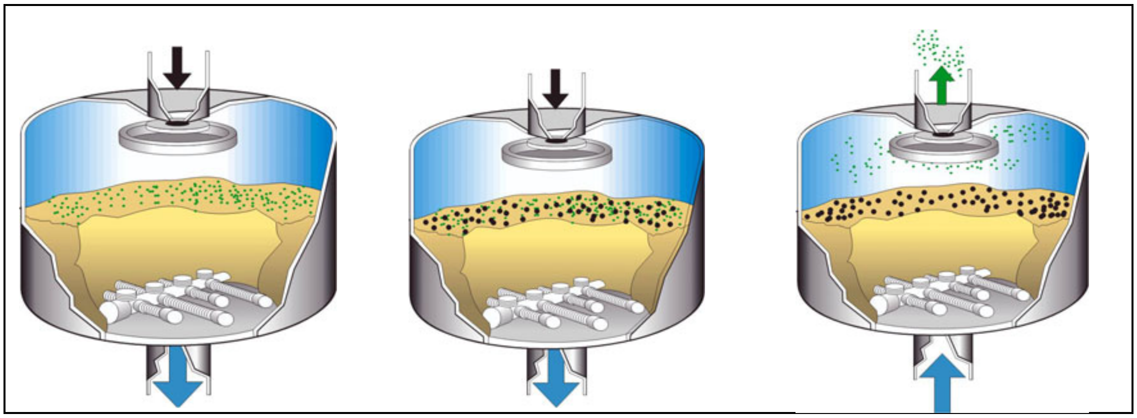



*How a Self-Cleaning Intake Screen Works*

More subtle, but more prevalent, is the fouling of a sand media filter by allowing or relying on a sand filter to remove larger sand particle matter. This problem almost always begins with the common indicator of a rapid-to-continuous pressure loss. What happens after that can be even more detrimental to the performance and ability of the sand filter to function as desired.

## Excessive backwashing.

Designed to respond to a pressure differential, a sand filter will read high pressure loss and trigger a backwashing cycle to rid the media bed of the unwanted debris. However, if the unwanted debris includes heavy sand particles, backwashing may not relieve the full measure of pressure loss caused by the intrusive sand. Backwashing, by design, is set to allow a reversing flow of water to remove debris trapped on the media bed's surface layer (typically the top 2-3 inches) without blowing any substantial amount of the media sand itself via the backwash process. The result, if heavy sand is present, is a residual leftover of intrusive sand that prevents the sand filter from cleansing itself to a desirable low pressure differential. Backwashing in such scenarios becomes more and more repetitive at shorter operating cycles as the intrusive sand builds-up a new layer on the sand media bed surface, triggering backwash cycles more frequently. At times, if left unchecked, the backwashing can become nearly continuous as the sand filter responds (as programmed by the automatic controller) to the pressure differential setting of the system. Significant water can be lost in such instances.



*Fine sand & organics (far left) are easily captured by the sand media. Larger/heavier particle matter (middle) also are easily trapped by the sand media. Backwashing, however, has limited influence (far right) on the heavier/larger particle matter, causing residual build-up and greater pressure loss issues.*

**EXAMPLE:** A three-tank media filter system, operating at 650 gpm with water drawn from a sandy river water source, was backwashing 860 gallons of water per backwash cycle. This system had gotten to the point that it was backwashing at a frequency of every 15 minutes, resulting in a loss of 3,440 gallons of water every hour. A sand separator was installed to pre-filter the water and remove the heavier sand particles, resulting in a reduced backwashing rate of only every four hours (the equivalent of only 215 gallons of water per hour). The savings, a 94% reduction in water loss, amounted to a volume of one acre-foot of water every week. And that doesn't include the savings in reduced pumping costs, just to provide that water for backwashing the filter system.

**Ineffective backwashing.** In the example above, the filter system was not able to rid itself of the cause of excessive pressure loss. In another common scenario, the sand filter can quickly become so fouled with fine sand (50-250 mesh size) that backwashing cannot produce the flow necessary to clean itself. Each tank quickly builds-up a formidable and deep layer of fine sand and, when the filter system switches to its backwash mode, the water cannot effectively pass through any of the filter tanks, providing inadequate flow & pressure to properly backwash the fine sand from the media bed's surface. Unchecked, the fine sand remains on the media bed surface of each tank and more fine sand is pumped into the filter system, adding further build-up until backwashing becomes not only highly repetitive, but likely near continuous.

**EXAMPLE:** A six-tank media filter system is operating at 1,200 gpm, drawing from a water well with both sand and silt problems. With pump start-up being a particularly vulnerable time to draw sand from the well, the media bed of each tank quickly became loaded with sand & silt. Backwashing immediately became continuous and the system had to be either shutdown or bypassed in order to deliver water to the field. Manual cleaning of the sand bed surface provided no relief, as each start-up delivered more problematic sand & silt to rapidly trigger a backwash cycle, which could not be performed effectively, due to the increasing build-up across all the filter tanks. A sand separator was installed to protect the sand filter from the coarse-to-fine sand particles, allowing only the much finer silt to pass into the sand filter system. With a much lighter and less voluminous layer of build-up, the sand filters were able to deliver the backwash water volume and pressure necessary to effectively flush the lighter debris from the filter tanks and restore the system to a much lower operating pressure loss differential.

**Migration of organics deep into the media sand.** This problem can come from either over-pumping beyond the limit of the sand filter's recommended flow range, and/or from a combination of very fine organics and a media sand that is too coarse for the contaminant to be removed. The result is that the fine organics are driven deep into the media sand, clogging the interspacial open areas of the media sand deeper in the tanks than the recommended top 2-3 inches of the media bed. This clogging not only restricts the free flow of water through the filter system, but also makes it extremely difficult to backwash the more deeply-imbedded debris from the filter tanks in the typically allotted time frame for backwashing (usually 90-180 seconds). Build-up increases until backwashing becomes overly frequent. This condition can be difficult to detect, as backwashing appears to flow from dirty-to-clean in the typical backwash duration, but it is the debris that resides deeper in the filter tanks that is causing the greater amount of pressure loss. Even "super-flushing" has its limitations, ultimately resulting in the need to replace the sand … and it typically should be replaced with a finer media sand to trap the contaminants in the upper layer of the sand media bed. At times, adding more filter tanks and reducing the flow per tank, can also improve the operating conditions, especially if the water has a greater than average load of organic debris.

## Pre-Filtering Tips

When pre-filtering can help reduce backwashing, there are three important guidelines to understand. And, it's important to understand the capabilities and limitations of a filter to contribute to reduced pressure loss.

**Selective efficiency.** Don't select a filter that can equally remove the same particle matter as the sand filter. The goal of pre-filtration is to remove debris that the prime filter (the sand filter) cannot remove and cannot handle. Fine screens or discs will demand greater servicing routines and may offset the benefits of pre-filtration.  Also, organics can become problematic to filters better suited for the removal of sand & silt.  A sand separator, which removes only sand and not organics, allows the lighter contaminants to pass into the sand filter, which is better suited for that kind of contaminant removal.

**Load management.** Consider the water source and the range of contaminants in the water source.  Reduce the volume and the burden on the sand media bed.  The pre-filter need not address all of a given contaminant, but rather the greater volume or greater sizes only.

**Pressure loss.** Filters that trap debris and add pressure loss to a water system can limit the overall system's efficiency and ability to perform.  With most drip/micro systems already operating at low pressures, adding pre-filters that add more pressure loss may be problematic.  Better yet, consider pre-filters that offer a predictable and/or fixed pressure loss.  Sand separators, for example, operate at a pressure loss dictated only by flow rate, not by contaminant build-up; that pressure loss could be built into the system's design without concern for fluctuations.

*Reduced backwashing not only improves the operating efficiency of a sand media filter system, but also reduces servicing & maintenance routines and reduces significant water loss.  All of these issues translate to reduced operating costs and improved environmental conditions.  With the understanding that drip & micro-spray systems save water and money, it makes even greater sense that minimizing a sand filter's backwashing routines will save even more water and money.*