Infrastructure Upgrades: Jumping From The 19th To The 21st Century

The billions of dollars allocated to water infrastructure upgrades in the stimulus bill provide the opportunity to implement small, point-of-entry filters or massive filtration systems to improve water quality and decrease environmental footprint.

BY JIM LAURIA

The U.S. government's stimulus package with more than $7 billion earmarked for water infrastructure upgrades represents an opportunity to start upgrading the nation's water infrastructure with new, more environmentally friendly technology. In many cases, we'll be updating systems and technology that date back more than 100 years, and we'll be jumping from the 19th to the 21st century.

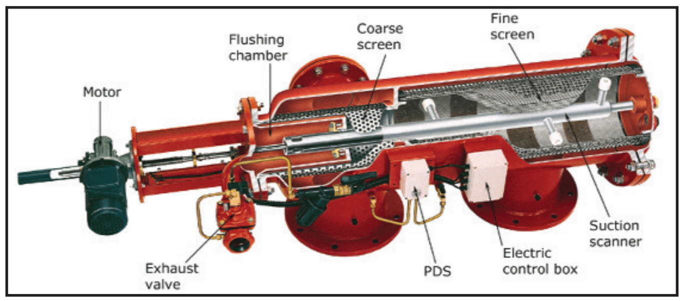
Our population demands water like never before. On the municipal level, we expect endless streams of fresh water for drinking, cooking, lawn and landscape, refreshing dips in the pool, and long, relaxing showers. The industrial sector demands ever-cleaner water for manufacturing, massive heating and cooling systems, and ingredients for food, beverages, and a host of other products. Farmers also need water to produce the food and fiber that sustains our nation and contributes billions of dollars to our economy. At the same time, demand is spiraling upwards, supply of quality water is dwindling, and concerns over environmental sustainability overlay nearly every decision a water manager makes.

Stimulus-driven upgrades and investment opportunities for cities and businesses offer a chance for the country to implement systems that reduce the environmental footprint of our water systems — lowering the energy, chemicals, backflush water, and physical space demanded by water treatment processes. In turn, we will be able to deliver cleaner water more efficiently and effectively than ever, conserve water, and reuse wastewater.

The upgrades can range from small, point-of-entry filters to massive filtration systems in desalination and wastewater treatment plants. At every step, we can improve water quality and decrease environmental footprint.

Point-Of-Entry Filtration

At the ground level of infrastructure improvements, we find a growing interest in point-of-entry filtration. The managers of hospitals, hotels, and high-rise buildings understand that



Amiad's automatic self-cleaning screen filters consume little water and energy.

their high-end properties are often connected to water delivery systems that date back a century or more. Even water from the cleanest reservoirs and best treatment systems in the nation suffers when passed through pipes choked with 100 years of scale, rust, sediment, and other debris.

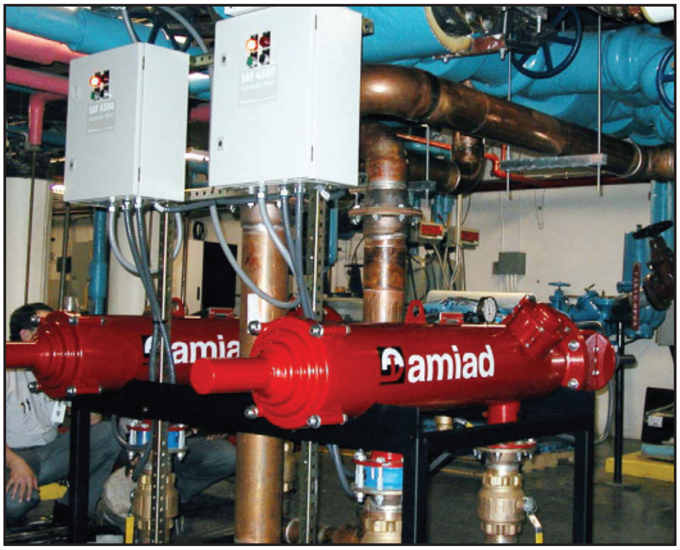
As the infrastructure is upgraded and digging begins on shovel-ready projects, that debris will be in a near-constant state of disturbance. Protecting drinking water and heating, ventilating, and air conditioning systems from infrastructure churn-out will be critical — and low-maintenance point-of-entry filtration will become a mainstay for many buildings.

The concept has been proven across the country.

A pair of automatic self-cleaning screen filters protects a Virginia hospital where maintenance budgets suffered whenever work on the city water system suspended scale and silt, clogging costly cartridge filters, fouling machinery throughout the hospital, and causing service interruptions of the facility's water supply.

Each filter's 10-micron, stainless steel, weave-wire screen effectively filters out sediment from city pipes, even during periods of extremely high turbidity.

When solids collecting on the screen create a pressure differential between the clean and dirty streams, an outlet valve opens to outside pressure. Water rushes to the outlet



These automatic self-cleaning filters protected a Virginia hospital's water system from sediment churned up when firefighters turned on nearby hydrants to douse a car fire. Such point-of-entry systems will become even more important as communities nationwide start their stimulus-funded infrastructure improvements.

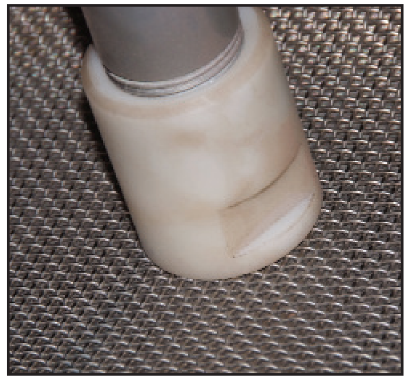
valve at 50 feet per second through suction nozzles, which focus the force of the back-flush water to pull filter cake off the screen. The nozzles are arrayed on a scanner, which rotates in a spiral pattern to ensure the entire screen is cleaned during the 20-second back-flush cycle. The efficiency of the focused back-flush system ensures that little power is consumed — just enough to operate a small motor to turn the scanner — and less than 1% of the flow is used for back flush.

The hospital's automatic self-cleaning filters underwent a trial by fire — literally — when a three-car fire in the hospital parking garage required firefighters to open several hydrants, stirring up tremendous amounts of sediment in the city system. Though they were forced to back flush almost constantly for three hours after the hydrants were opened, the screen filters protected the hospital's expensive cartridge filter system. In fact, the maintenance manager found that the cartridge system showed no change after the fire.

One grand Midwestern hotel installed a similar automatic self-cleaning screen filter system after poor water quality from aging water mains led to the loss of thousands of dollars in missed bookings and refunds to disgruntled guests. The filter was installed at the water main's point of entry.

Drinking Water Systems

Follow those old pipes back to their source today and you'll find many drinking water treatment plants using technology, such as sand media filters — a technology firmly rooted in the sand tanks at the very first municipal water treatment plant in Paisley, Scotland, in 1804.



Amiad's suction scanner focuses backwash suction through a square centimeter of screen at a time.

Today's growing population and ever-growing demand for clean water — compounded by concerns fueled by outbreaks of waterborne pathogens, such as *Giardia* and *Cryptosporidium* — are pushing water purification technologies to higher levels of efficacy. Ultrafiltration, membrane systems, and ultraviolet (UV) purification are all gaining ground, while chlorination continues to treat billions of additional gallons.

Many drinking water treatment plant designers have realized that multistage filtration is the most efficient way to ensure that downstream purification systems work at optimal efficiency. Removing suspended solids reduces tie-up of chemicals, such as chlorine or flocculants. It reduces the load borne by downstream cartridge filters, which can lead to significant decreases in the cost of replacing the cartridges. It dramatically improves the efficiency of membranes and reduces the need for chemical cleaning of membrane systems. It also minimizes the chance of casting protective shadows in UV systems that could allow some pathogens to get through the process.

Perhaps just as important, in a world where consumers are increasingly aware of how much wastewater goes down the drain, minimizing back-flush water is both environmentally and politically correct. A significant factor driving the growth of automatic self-cleaning screen filtration systems is that they generate just one-fourth of the back-flush water that sand media systems do — and often even less.

Desalination Plants

Desalination is a mushrooming sector of the water industry. According to the American Membrane Technology Association, desalination accounted for $2 billion of the $9 billion spent on membranes in the United States during 2008. That's no surprise, as cities around the world — from Tel Aviv to Los Angeles — are looking to the sea to augment dwindling freshwater supplies. Farther inland, communities are forced to treat brackish water to sustain the community — whether because of saltwater intrusions into their aquifers or because they must draw on mineral-rich groundwater. Whatever the reason, the technology exists to effectively remove dissolved solids from water. Continued improvements in both desalination technology and prefiltration design will help augment effectiveness with increased efficiency.

The water utility in one growing Southwestern city found itself struggling to keep up with municipal demand by treating brackish groundwater. The original 1-micron cartridge filter was plugged rapidly with suspended solids pumped up with the groundwater. The particles also caused regular fouling of the costly membranes that the cartridge system failed to protect. Adding an automatic self-cleaning filter before the cartridge filter protected the membranes and boosted recovery from 70% to 85% — a significant jump.

Seawater desalination plants around the world are also benefiting from automatic self-cleaning filters. For instance, in Cyprus, a large seawater desalination plant uses a beach well as a massive sand filter, then runs the water through five huge automatic self-cleaning screen filters for secondary filtration.

The next stop is a set of automatic self-cleaning microfiber filters, which use tightly wound fibers to provide filtration down to the 3-micron level. When a pressure differential is reached across the filter, a high-pressure stream of water is directed through the fibers, bounces off a deflector plate, and draws solids off of the cartridge and through an outlet valve.

Adding the microfiber filter as a final polish before the reverse osmosis membranes protects the membranes without requiring costly replacement cartridges or the interruption of opening the cartridge systems in the first place.

Every little bit of such efficiency helps. According to *The World's Water 2006-2007*, membrane replacement represents 5% of the cost of operating a desalination plant, labor accounts for 4%, and consumables (such as filter cartridges, media, coagulants, etc.) use 3%. Prefiltration systems that protect membranes from fouling, reduce cleaning cycles, and require minimal labor for operation and maintenance can dramatically cut operating and capital costs. Each improvement makes desalination more cost-effective.

Wastewater Treatment

The stimulus bill includes nearly $1.4 billion for rural water projects, including wastewater treatment. These projects will be vital to not only protecting the environment but also in recycling wastewater for productive use. Also, because treating wastewater is as little as half the cost of desalinating seawater, we are likely to increasingly see wastewater as a valuable resource, at least for agricultural and industrial use and perhaps someday for toilet-to-tap programs.

It's a reality around the world. Currently, Israel reuses approximately 75% of its wastewater for irrigation, making it by far the world leader in wastewater recycling. (The No. 2 wastewater recycler, Spain, reuses 12% of its treated water.)

Wastewater treatment for reuse involves many of the same technologies as drinking water treatment from prefiltration to membranes, UV disinfection, and chlorination. As a result, the process demands the same level of prefiltration technology and efficiency as drinking water does. Downstream, where sophisticated drip and microsprinkler irrigation systems can put that treated wastewater to work growing crops, additional on-farm filtration is necessary to prevent suspended solids from plugging tiny emitters.

Amiad's AMF microfiber filter automatically self-cleans, so there is no cartridge replacement.

Conclusion

Clearly, filtration is a vital piece of every step of the water cycle — and a tool to help take 19th century technologies — from sand media filters to flood irrigation systems — into the future.

Moving these technologies forward is vital from a practical and political standpoint. The builders of much of our infrastructure probably would not believe the demand it is serving today. They would surely be surprised at the drive to reduce the environmental footprint of our water systems. They would be dazzled by our ability to create fresh, clean water from the sea or sewer. They would be inspired at the scope of opportunities that lie before us as we revitalize our economy and our utilities. And they would certainly embrace the outstanding tools that we now have at our disposal. ■

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