AGGREGATES MANAGER
Your guide to profitable production
PULL-OUT GUIDE
by Mary Foster, Contributing Editor

OPERATIONS ILLUSTRATED

Lower Water Consumption at Your Plant

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Water Wisdom

The washing of aggregates can require thousands of gallons of water per minute — which add up to millions of gallons of water in a day. The good news is that, in today's aggregate plants, at least 90 percent of the process water is typically recycled. Where does the rest go? It's lost to the ground, the air (through evaporation), and with the aggregate product itself as it leaves the site. This water is ultimately consumed.

"Fresh makeup water — the water replacing water that can't be recovered in the process — has to come from ponds, lakes, or rivers; from the ground; or from a municipality," says Don Ruppert, product/processing engineer for Derrick Corp. "Wells and municipalities incur costs. And even if you have a ready supply of makeup water, it's usually regulated, and you're permitted only a certain number of gallons per day or month." Ruppert says these facts are motivators for producers to seek better ways of recapturing process water.

Alan Parks and Bill Bruck agree. Parks is vice president of Memphis Stone & Gravel Co. in Tennessee; Bruck is plant manager at several Valley Quarries plants in Pennsylvania. Both companies use settling ponds as part of their fresh water return after processing. But Parks and Bruck say there is a general trend toward reducing the size and number of settling ponds.

"The more water you can take out of the discharge, the more you increase the life of your ponds," Bruck says. "And if you can squeeze the water out of your fines so that they're stackable and you can load them onto a truck, it's also an advantage. Any time you can find a way to reduce water at discharge, you're ahead."

Where Valley Quarries' Mt. Cydonia Plant #2 uses a clarifier/thickener that settles out the ultrafines before sending them to a centrifuge, Parks says that Memphis Stone & Gravel mostly dewaters sand using screws, and recycles the wash plant water via a series of basins with the help of flocculants that settle the fines more quickly. Both companies utilize gravity to help the water channel through basins to ultimately reach a fresh water pond.

Valley Quarries has found markets for its fines. Memphis Stone is somewhat unique in that it can sell all of the gravel it mines, but the company produces an overabundance of sand at some sites, which it returns to the excavation for quicker reclamation.

"In general, land values will force our industry to look at technology as a way to reduce our footprint," says Parks. "And issues of water use will continue to become more stringent. We must look at our water use more carefully. Even operations with abundant supplies can't take their water for granted."

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1 Water use vs. water consumption

Water use for aggregate processing differs from water consumption in that consumed water is ultimately lost in the process. Water can be lost to spillage and overflow in the washing and settling stages, to evaporation and ground absorption in settling ponds and clean water basins, and to moisture in the aggregate product as it leaves the site. This lost water must be replaced at the producer's expense.

4 Improve fines recovery

Fine sand and silt material from the washing process traditionally goes to ponds where it settles to the bottom. Over time, the ponds must be cleaned or they are filled and replaced with a new pond in a different location on site. Clarifiers/thickening tanks settle fines with the help of flocculants. Hydrocyclones also separate fines. By dewatering and stacking these fines prior to the pond stage, the pond's lifecycle and associated costs improve.

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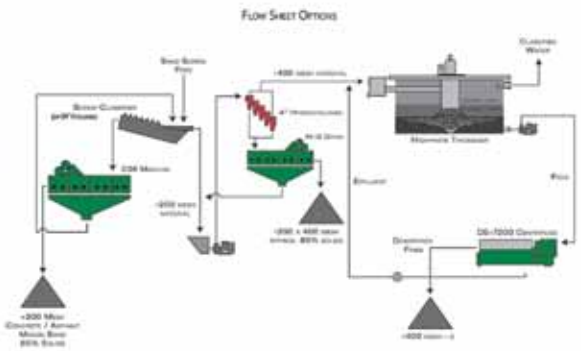
2 Define the makeup point

Fresh water comes from different sources depending on location, including municipalities, wells, lakes, and reservoirs — and water use is usually regulated. Because of cost and permitting, most washing operations recycle water to a degree, but producers should determine the makeup point at which the consumed water must be replaced. Advanced separation and recycling practices may further reduce the cost of water loss.

3 Separation and drying options



One key to reducing water needs for settling is to better separate and dry the -400 mesh ultrafines. Traditional equipment includes classifying tanks, sand screws, dewatering screens, and thickener/clarifiers. Captured water is reused. Further ultrafine wet separation and subsequent drying can be realized through hydrocyclones, filter presses, and centrifuges. With the latter equipment, producers can significantly cut back on, or even eliminate, settling ponds.

5 Further processing for saleable ultrafines

To remove as much water as possible from the separated ultrafines, install a belt or plate press or a centrifuge — the newest technology in dewatering fines. The outer bowl spins at a high rate. The thickener underflow enters as slurry and centrifugal energy sends fines to the wall and clear water to the center. A conveyor augers solids out the discharge end at 75-percent solids, from which they can be conveyed, stacked, and hauled for sale as a viable product.

6 Tweak the process

Operations can also conserve water by determining needs and tweaking equipment to meet, rather than exceed, water needs. A small reduction in gallons per minute adds up to large savings over a year. High-pressure, low-volume spray nozzles; flow restrictors on valves; and automatic shut-offs save water, as do routine inspections for leaks in water lines, spray systems, valves, and pumps. Metering can also help detect leaks, while maintaining minimum flow rates.

OUR EXPERTS

Alan Parks is vice president of Memphis Stone and Gravel Co. in Memphis, Tenn. He is a member of the Grassroots Task Force, Government Affairs Division for NSSGA and is a past chairperson of NSSGA's Young Leaders Council. Martin has a bachelor's degree in geoscience, a master's degree in mining engineering from the University of Missouri-Rolla.

Bill Bruck graduated from Penn State University with a bachelor's degree in geological science. He worked in coal strip mining then worked for consulting firms in geology, hydrogeology, and mining. In 1997, Bruck joined Valley Quarries, a division of New Enterprise Stone and Lime, as a geologist and manager of Mt. Cydonia Sand.

Don Ruppert is a senior product/process engineer for Derrick Corp., based in Buffalo, N.Y., and manages the Aggregate Division for the company. He has designed and developed several key components that have become standard within the industry. Ruppert is a member of the NSSGA, OSSGA, and SME.

Voices of Experience

Alan Parks

"We don't currently utilize a lot of the newest equipment that's available, but we're moving in that direction," says Alan Parks, vice president of Memphis, Tenn.-based Memphis Stone & Gravel Co. "Our next generation of plants should incorporate more of the newer technology for water conservation." He adds that while the Southeast is not under the same water use constraints that other areas in the United States experience, conserving water simply makes good business sense.

Memphis Stone & Gravel's plant production requirements total about 400,000 gallons of water per hour, or 4,000,000 gallons for a 10-hour day, according to the company's operations manager Ed Ragsdale, who says that during the driest weeks of the year, when evaporation depletes recycled water supplies, water wells provide about 60,000 gallons per hour. "But we only run our wells about three or four weeks out of the year. During the fall, winter, and spring, we don't operate the wells, and our plants' needs are fully met by recycled water," Parks notes.

The company's pits use sand screws to dewater the sand to 5- to 6-percent moisture. Parks says the overflow water and fines from the washing process move to a series of basins, where flocculants are added. "The flocculants provide quicker turnaround to clean up the water for reuse and have helped to cut down on our water storage needs," he says. "In addition, we've seen that we have empirically enhanced the compaction of our settled solids, which have preserved our basin lives significantly. We haven't had to clean out a pond since 2004."

Bill Bruck

According to Bill Bruck, plant manager for several Valley Quarries operations in Pennsylvania, many settling ponds are 10 percent suspended solids and 90 percent water. "But if you can take 40 to 50 percent of the water out of those solids, you'll be able to reduce the size of your ponds," he says.

Valley Quarries' Mt. Cydonia #2 Plant uses state-of-the-art equipment to remove as much water as possible from the product and the fines. "We use approximately 2,800 gallons of water per minute — or 168,000 gallons per hour — at Mt. Cydonia #2," Bruck says. "Aside from about 2,500 gallons per hour that goes out with the product, the rest of the water circulates back to the plant."

Bruck says Mt. Cydonia #2's primary ASTM C33 washed concrete sand product creates a silty clay waste that pumps 10-percent solids to a series of small hydrocylones paired with a high-frequency dewatering screen. The plant dewaters the -200 fines to create a product Valley Quarries calls "fine sand," which is marketed for cattle bedding. The -325 waste material goes to a clarifier, from which the thickened underflow material pumps to a centrifuge that squeezes the fines to 70-percent solids. At that point, they can be loaded on a truck. "All of the water in this process is returned to the system," Bruck says, noting the site recirculates 95 percent of its water.

In addition, Bruck says the ASTM C33 sand coming off the belt is typically at 22-percent moisture. "We allow it to drain off and we sell it at 6- to 8-percent moisture," he notes. "The water that drains from the product is channeled back to the system. We also capture all of our stormwater to use in the process."

Dan Ruppert

"If you look at consumption within the standard flow sheet, there's probably 15-percent consumption in making the product, and then 3- to 5-percent consumption from spills and evaporation," says Don Ruppert, product/processing engineer for Buffalo, N.Y.-based Derrick Corp. "Even as you recycle water, you still lose some to the ground and evaporation. And as it's lost, you have to add water to the process. That's the defining point for the makeup water."

Ruppert says that in the past, most producers used screws and/or tank-style classifiers. Next came the function of high-capacity dewatering screens. Producers learned how to close the loop and utilize ponds and tanks to thicken solids and dewater those solids, returning recycled water to the process. "Most of the time, the solids going to the pond are still 10- to 20-percent water volume, which has to be replaced," he says. "But if you can take the underflow from the thickener and use a centrifuge to dewater those solids, you're going to reduce the ultimate amount of makeup water necessary."

In some cases, by removing and recycling water from the ultrafines — with a centrifuge, belt press, or plate press — producers can eliminate the need for settling ponds. And they will have a dry, stackable fine product that can be sold. "There are now more than 100 proven viable uses for dewatered fines," Ruppert says.

Ruppert says he feels the industry will move away from screws and tank classifiers, using cyclones and dewatering screens instead. "The significance of this technology is that you're using less water and you get a cleaner, dryer product in the end," he says.