American Water Works Association

PRACTICAL IDEAS FOR WATER OPERATORS

Opflow

VOLUME 40, NO. 4 APRIL 2014

WATER REUSE
CALIFORNIA DROUGHT PROMPTS WATER-SAVING PRACTICES

WORKFORCE MANAGEMENT
Telematics Boosts Fleet Efficiency

WATER QUALITY
Biosensors Connect Nature and Technology

TRENCHLESS TECHNOLOGY
Pipe Bursting Helps City Meet Current and Future Needs

http://dx.doi.org/10.5991/OPF.2014.40.0023

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In the midst of one of the most severe droughts in centuries, resourceful operators at a North San Diego water reclamation plant manage increasingly precious effluent for community use. BY ANDY SEIDEL

CALIFORNIA DROUGHT PROMPTS WATER-SAVING PRACTICES

FOR DECADES, SAN DIEGO has struggled for water independence. In 1991, the region purchased about 95 percent of its water from the Los Angeles-based Metropolitan Water District (MWD). To become more independent, the San Diego County Water Authority (SDCWA) vowed to reduce imported water 30 percent by 2020. Today, with a state-declared drought that threatens to be the worst in history, San Diego water and wastewater utility operators face even more pressure to ensure beneficial use of every drop of water.

As a result of intermittent droughts (most recently 2008) and the apprehension caused by having to purchase water, most San Diego-area communities and utilities have carefully planned for water scarcity by drought proofing their communities through a combination of public education and creating local water sources. Notably, San Diego County's water use during 2007–2011 decreased 27 percent from conservation efforts alone. Olivenhain Municipal Water District (OMWD), located in northern San Diego County, embraced conservation and reuse, with 14 percent of water demand being met through use of reclaimed wastewater.

Barely visible to the surrounding neighborhood, with homes only 100 ft away, the OMWD 4S Ranch Water Reclamation Facility operates a 2-mgd-rated water reclamation plant that currently treats and delivers 1 mgd of recycled water to the community. In 2013, the plant reclaimed more than 327 mil gal of wastewater that ultimately was used for common-area watering by housing developments, schools, parks, and some of North San Diego County's most exclusive golf courses. This eliminated the need to use an increasingly stressed potable water source for irrigation purposes.

PHOTOGRAPHS: ANDY SEIDEL

Operators adjust the 4S Ranch Water Reclamation Facility's improved polymer activation equipment, which delivers a drier filter cake with less polymer.

The 4S Ranch Water Reclamation Facility benefits from five dedicated staff and several roving specialists from Olivenhain Municipal Water District.

OPERATIONAL EFFICIENCY

The 4S Ranch Water Reclamation Facility uses a simple, effective design to routinely produce effluent with a turbidity of less than 0.5 ntus. The process train comprises screening, oxidation ditch aerobic treatment, clarification, rapid sand filtration, and final ultraviolet disinfection. Aerobic digestion and sludge dewatering with belt filter presses complete the residual solids processing. Plant personnel also manage a 134-mil gal recycled water overflow reservoir, 15 sewage pump stations, and more than 60 miles of collection system pipe.

Without a sewer rate increase for more than five years, the 4S Ranch Water Reclamation Facility operations team is cautious regarding large capital improvements. Instead, the team focuses on operational and system improvements that have yielded strong performance in community relations and recycled water output.

Dedicated Operators. The operations team's efforts are well supported by managers who recognize the difference between wants and needs, according to Gabriel Hernandez, chief plant operator. Operators pay close attention to maintenance schedules and asset management to stay ahead of the operations curve. "Having dedicated operators who have time to learn the plant's operating characteristics and who can therefore anticipate problems is the key," said Hernandez.

Hernandez and his staff are also supported by an OMWD pump/motor technician and information technology personnel who supplement key project capabilities. In particular, the pump and motor technician ensures preventive maintenance of rotating equipment is carried out in a timely manner. With the right staffing, a program of consistent improvement and attention to detail characterizes the plant's operating ethic. For example, housekeeping in the plant is exceptional, which simply illustrates a systematic approach to taking care of basics and improving unit operations.

Incremental Improvements. Recent projects have yielded incremental improvements. Installing variable frequency drives (VFDs) on oxidation ditch aerators reduces energy demand and maintenance by allowing operators to more easily optimize dissolved oxygen around 1–2 mg/L. The initial VFD installation resulted in a new motor sound that might have been noticed by the plant's neighbors. Temporary sound dampeners were installed until the motor sound could be addressed permanently to ensure relations with surrounding homeowners remained strong.

In addition, an ongoing water pump-seal project improves the plant's equipment maintenance profiles. When completed, the project will save more than 1 mil gal of water/year and reduce pump downtime.

Equipment. Ensuring equipment reliability is just as important as improving efficiencies. With homes located so close to the treatment facility as well as strict local air-quality permit requirements, operators outsource certain aspects of the plant's odor control system. For example, a third party monitors and maintains the chemical odor scrubbers, determines optimal intervals for media cleaning, and helps ensure compliance. The outside firm provides periodic hydrochloric acid cleaning of the scrubber media to remove partially oxidized sulfur and carbonates caused by hard-water conditions. Plant operators are also refurbishing the plant's mechanical diaphragm metering pumps, which have operated continuously for caustic and hypochlorite feed to the scrubbers for more than 10 years.

Processes. Operators also have developed a high degree of operating knowledge on other key processes, such as final filtration, which is accomplished by a shallow pulsed-bed sand filter. The tertiary polishing filter is critical for enabling the plant to meet California water-reuse standards. With a shallow 10 in. of filter bed, the filter can handle rapid changes in solids loading—if the filter cells have been properly maintained with sand addition, functioning level switches, and valve actuators.

Finding the right balance between managing the plant with available resources and looking for small improvements plant personnel can manage themselves is like walking a tightrope.

Operators examine the results of the 4S Ranch Water Reclamation Facility's successful digester rebuild project.

After a recent visit, a filter field-service technician remarked that proactive maintenance and operator attention keep the filters operating with a modest backwash rate of 1–2 times/cell/day (four filter cells total at a rate of 12 gpm/ft^2 of surface area), resulting in low effluent turbidity. The filters produce a quality and quantity of recycled water comparable to the most sophisticated and expensive membrane filtration plants at a fraction of the cost.

Dewatering. While juggling an upcoming clarifier rebuild and digester retrofit, the team of four full-time operators focuses on additional process improvements. In an ongoing dewatering project, operators are working with a demonstration polymer blending/activation unit that seems to cut polymer use at the belt filter presses by more than 20 percent. The current polymer mixing units use plant water pressure as a driving force for polymer activation. The demonstration unit uses external motive force with a multiple-zone mixing chamber to deliver high-shear force initially to the neat cationic polymer (break emulsion fisheyes), followed by a lower-shear zone that allows for optimal polymer relaxation and dispersion. Because polymer is one of the largest annual expenses in the plant, the project could produce significant savings in dollars and water.

Hypochlorite Mixing. Operators are considering a tank-mixing unit that promises to improve hypochlorite mixing for residual disinfection in OMWD's more than 50,000 ft of distribution piping. To reduce biofouling, the district strives for a residual distribution-system chlorine concentration of 0.5 ppm. Plant personnel are hopeful the demonstration mixer will more uniformly mix hypochlorite than the current flow-based system of metering disinfectant.

FINDING A BALANCE

Finding the right balance between managing the plant with available resources and looking for small improvements plant personnel can manage themselves is like walking a tightrope, according to Hernandez. The key is listening to outside experts and vendors with an open mind and filtering the information with a deep understanding of the plant. As they continue to contend with a record-setting drought, OMWD operators continue to walk that tightrope and endeavor to squeeze every drop of water from local, sustainable sources.

RESOURCES

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