Online, Right on Time

To avoid service interruptions, Georgia's Cherokee County Water and Sewerage Authority carefully timed the expansion and upgrade of its water treatment facility.

By Gilbert R. Puffer

Georgia's Cherokee County Water and Sewerage Authority (CCWSA) faced a dilemma: It had to double the capacity of its Etowah River Water Treatment Facility (WTF), but it could not afford to interrupt service as it upgraded its only drinking water plant. To overcome this quandary, the CCWSA opted to construct essentially a new drinking water facility parallel to its existing WTF, scheduling its completion so that it would be available to help meet demand during peak summer months. After this demand subsided, the authority removed the existing plant from service to upgrade it, a process that is on track to be finished before this summer. Upon completion of the upgrade, the Etowah River WTF will enable the CCWSA to continue to meet its water needs while also positioning it to respond to new regulatory requirements or changing water quality conditions.

Located along the Etowah River in northeastern Cherokee County, the original WTF was constructed in 1986 and expanded to an 18-mgd facility in 1994. Since then, the county has experienced a population boom. "Like all metro Atlanta counties, Cherokee County is growing at a rapid rate," says Clint Blackwell, the manager of the Etowah River WTF. In fact, the county's population grew 57 percent between 1990 and 2000, and since then the growth has only continued. The need to keep pace with this development prompted the CCWSA to expand and upgrade the Etowah River WTF, which provides drinking water to more than 100,000 customers.

Recognizing the need to increase the facility's treatment capacity, the CCWSA hired the consulting engineering firm PBS&J (www.pbsj.com) to design the upgraded plant and administer the construction contract. Design work began in 2000, and the contractor—3D Enterprises Contracting Corporation—initiated construction in July 2004.

In keeping with the project's scheduling demands, a new 20-mgd water treatment facility began operating in June 2006, and the original plant was taken offline in October 2006 to be revamped. Since then, the new facility has met all of the county's water needs. Scheduled to be substantially complete this April, the refurbished plant will have a treatment capacity of 16 mgd. Final completion of the plant is scheduled for July. All told, the design and construction of the overall 36-mgd facility is expected to cost $31.4 million.

Although different in some respects, the new plant and its revamped counterpart will feature new chemical-mixing facilities, settling basins, and filtration systems. The overall WTF also will benefit from automated operations, a new high-service pumping facility, more advanced methods for handling sludge, and a safer approach to disinfection.

Two raw water intake units were added to the plant's existing intakes in the Etowah River. Comprising three 24-in. diameter slotted intake screens, intake No. 1 has a maximum capacity of four mgd per screen. Intake No. 2 consists of four 36-in. diameter slotted screens, each of which has a maximum capacity of 11.2 mgd. Both intakes have a maximum design velocity of 0.5 ft/s. Intake No. 1 was designed for a maximum headloss of 0.25 ft, compared to intake No. 2's maximum headloss of 1 ft.

The Etowah River WTF has two raw

The renovation of the facility's existing sedimentation basins includes adding inclined tube settlers.

The drinking water facility's eight new flocculation basins include flocculator baffles, a diffuser wall, a floating baffle, and a head baffle.

water pump stations. The existing Raw Water Pump Station No. 1 employs four vertical turbine pumps that have a maximum capacity of 17.4 mgd. To augment the plant's pumping capacity, two pumps were added to Raw Water Pump Station No. 2, such that it now boasts three 400-hp vertical turbine pumps. With one pump on standby, the station has a maximum capacity of 24.6 mgd.

Before it is pumped to a 11-MG presettling reservoir, the raw water receives potassium permanganate to facilitate settling. Upon leaving the reservoir, the raw water enters a rapid mix basin, which includes three mixers. Lime, chlorine, carbon, and potassium permanganate are added at the first mixer location. Lime, alum, chlorine, and carbon are added at the second mixer location, while alum is added at the third mixer location. A new building was constructed to house the chemicals and the equipment used to rapidly mix them into the raw water.

After undergoing rapid mixing, the raw water enters a splitter box, where it receives polymer before being directed to one of 16 flocculation basins, eight of which were constructed as part of the plant's recent expansion. Nearly 28 ft long and roughly 31 ft wide, the basins include flocculator baffles, a diffuser wall, a floating baffle, and a head baffle.

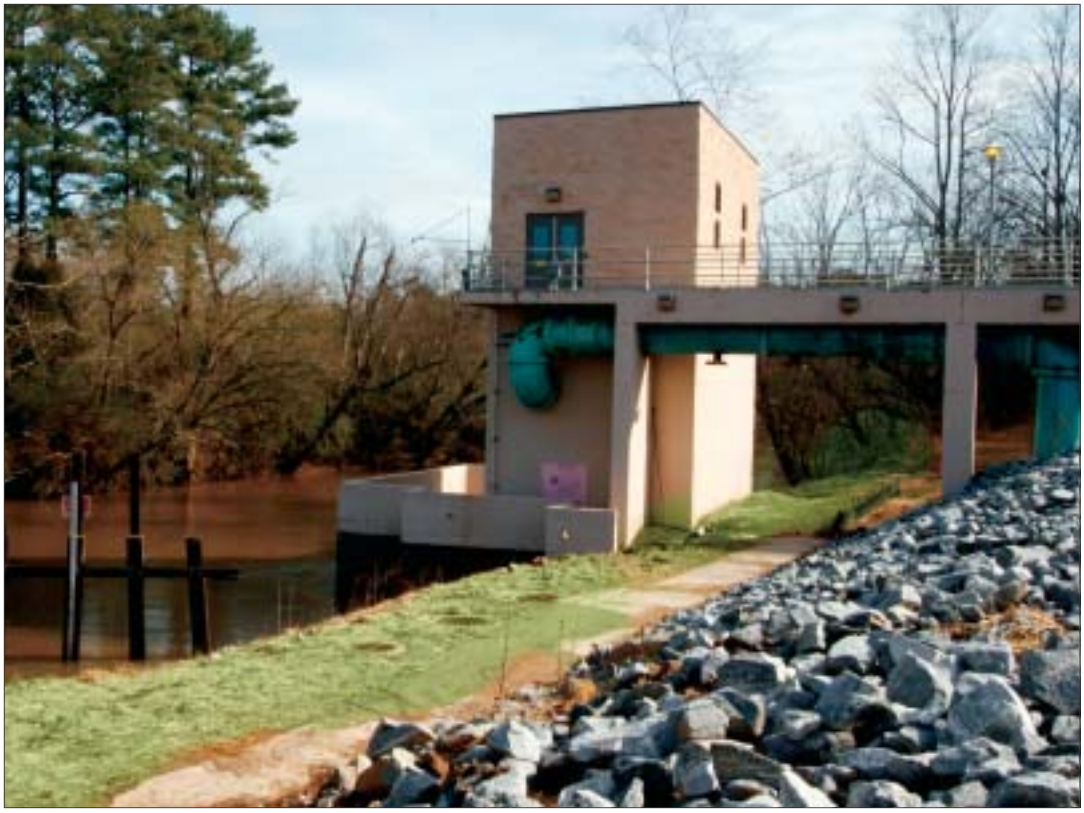
Each flocculation basin has a corresponding settling basin, all of which are nearly 83 ft long and about 31 ft wide. Inclined tube settlers were added to the eight existing settling basins to increase their effectiveness. Tube settlers also were used in the eight newly constructed settling basins. Designed with a hydraulic loading rate of 2.1 gal/min·ft^2, the tube settlers offer certain advantages, among them lower turbidity in effluent leaving the basins, longer filter runs, higher flows, and improved solids removal.

After leaving the settling basins, the treated water enters one of 30 deep-bed filters, which cleanse flows of contaminants using three media—garnet sand, filter sand, and anthracite—supported on a bed of gravel. Part of the original facility, filters 1 through 16 measure 11.5 by 11.5 ft, each having a capacity of 1.049 mgd. Newly constructed filters 17 through 30 measure 14 by 14 ft and have a capacity of 1.453 mgd each. Each filter is designed to operate at a maximum rate of 5.15 gal/min·ft^2. No pumping is required to backwash the filters, which occurs at a maximum rate of 24 gal/min·ft^2.

After filtration, the water enters one of four clearwells in which lime is added to adjust pH and a sodium hypochlorite solution is added for disinfection. Although clearwells 1 and 2 operate in sequence, clearwells 3 and 4 operate in parallel. However, effluent from all the clearwells is combined in a mixing chamber in which fluoride and phosphate are added.

The finished water is conveyed through the distribution system via a new high-service pumping facility that includes six 800-hp vertical turbine pumps, each of which is rated at about nine mgd. When the plant is operating at maximum capacity, five pumps will be in service, and one pump will remain in standby mode. To accommodate future growth, the

To avoid service interruptions while expanding the treatment capacity of its Etowah River Water Treatment Plant, the Cherokee County Water and Sewerage Authority built a new drinking water facility, shown at left in this photo, parallel to its existing facility, shown at right, which is being upgraded.



To augment the plant's pumping capacity, two pumps were added to Raw Water Pump Station No. 2.

facility has room for two more pumps.

The facility's methods for handling solids also will be revamped. Currently, solids generated at the Etowah River WTF are pumped to a sludge pond until they can be manually removed and disposed. Once the overall upgrade is complete, solids will be conveyed to a gravity thickener, from which decant will be returned to the treatment process. Meanwhile, the thickened sludge will be pumped to a centrifuge, where it will be dewatered to about 23 percent solids and then removed for disposal.

Primarily for safety considerations, the CCWSA opted to discontinue its use of gaseous chlorine to disinfect drinking water at the plant. "Sodium hypochlorite is much safer to handle and store and is just as effective as chlorine gas," Blackwell says. Therefore, the CCWSA is constructing a system to generate sodium hypochlorite onsite. To be completed as part of the upgrades to the existing facility, the new onsite generation process will use salt to create brine, which then will be passed through electrolytic cells to create sodium hypochlorite at 0.8 percent solution. The disinfectant will be stored in tanks and dispensed as needed by metering pumps. In the meantime, however, the CCWSA is purchasing bulk (12 percent) sodium hypochlorite and diluting it to 0.8 percent before using it to disinfect the treated drinking water.

Although sodium hypochlorite is all that is currently needed in terms of disinfection, the design for the upgraded facility includes provisions to enable the use of ultraviolet (UV) light for disinfection in the future if necessary. To this end, a pipe gallery consisting of two 54-in. diameter headers with four 24-in. diameter pipes between them was constructed ahead of the high-service pumping station. If future regulations or water quality conditions require it, UV units then can be installed in the pipes without having to modify or disrupt existing treatment processes.

Among the most significant changes to the facility, a new supervisory control and data acquisition (SCADA) system has converted the plant from a manually operated facility to a mostly automated approach. By automating such processes as metering chemicals to various treatment steps, filter backwashing, and pumping, the SCADA system simplifies plant operations. The new system "allows operations personnel more control and information of the entire treatment process," Blackwell says. Be-cause of the higher level of automation, maintenance procedures at the plant will be "less labor intensive as well as easier to diagnose," Black-well says.

To assist operations and maintenance (O&M) staff at the Etowah River WTF, PBS&J developed an O&M manual for the entire facility. Rather than having to rely solely on separate manuals provided by vendors of the various equipment used at the facility, O&M staff can turn to the overall manual for a general overview. However, the O&M manual references the individual manuals in the event that additional information is required. The manual "already has proven to be an important part of the plant's operation," Blackwell says. "Several of our standard operating procedures were derived from the O&M manual."

Although critically necessary, the expansion and upgrade of the Etowah River WTF have created their share of obstacles for the facility's staff. "The most difficult challenge we have had to face has been operating the existing plant during the construction of the new facility," Blackwell says. Despite these challenges, the CCWSA has continued to meet the water demands of its customers without interruption while simultaneously taking the necessary steps to ensure that it will continue to be able to do so in the future. GE

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