Plant Renovation Brings Daytona Beach to Forefront of Water Reclamation

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Imagine having to accommodate 500,000 visitors for special events on a regular basis several times a year. That's what The City of Daytona Beach faces every year.

The permanent annual population of the community is approximately 70,000; however, special events like Bike Week and Speed Week, including the Daytona 500, bring hundreds of thousands of visitors to the area, literally flooding Daytona Beach with massive crowds, sometimes for weeks on end, that dramatically impact traffic, housing, water, and wastes. As one of the tourist capitals of the world, Daytona Beach must maintain an infrastructure capable of handling such dramatic flow demands.

To make certain that its infrastructure meets the challenges, the city has expanded its wastewater treatment plants and renovated them with the latest and best technology. In 1997, the city commissioned McKim & Creed to plan, design, and oversee construction of the Westside Regional WTP expansion, which increased capacity from 10 to 15 MGD and upgraded the plant to full advanced waste treatment standards. Westside serves as the major source of reuse effluent for the city-wide reuse distribution system, DRIP (Daytona Reuse-water Implementation Program).

During the Westside Regional plant expansion, the city contracted McKim & Creed to also expand and upgrade the Bethune Point WTP, which serves the eastern zone of the city. The Bethune Point expansion and upgrade resulted in the facility becoming the largest ultraviolet (UV) disinfection system in Florida, the first public reuse system in Florida with UV disinfection to receive permitting for unrestricted public access, and the largest UV system in the U.S. to use an uninterrupted power supply to ensure the plant is always 100 percent operational.

Bethune Point History

When it was built in the 1940s, the Bethune Point plant was the first contact stabilization plant in Florida. In 1993, Daytona Beach upgraded the facility to advanced treatment, using an A2O process and a de-nitrification filter.

Originally, the majority of the effluent from the Bethune Point plant was discharged directly into the Halifax River, with small volumes reused in the local downtown area. During the Westside Regional Plant expansion, the city realized the need to balance capacity citywide, and to improve the ability to reuse effluent from the Bethune Point plant.

The plant had suffered from some ongoing problems. The process relied on denitrifying biological filters for nitrogen removal, and disinfection following the filters often contributed to effluent violations during chlorination and de-chlorination. McKim & Creed was tasked with renovating the existing process to eliminate the disinfection upsets and the resulting chlorine residual and pH violations during discharge.

The site is heavily congested and sits on the west bank of the Halifax River. The city needed a 30% increase in capacity, which had to be completed within the existing structures without any major new construction, while the plant remained in service.

Efficient disinfection for the facility had long been a challenge. Problems with chlorine residual, filter backwash, and effluent pH had over the years led to effluent violations. The state requires high-level disinfection with no detectable fecal coliform for any reuse effluent. One of the prerequisites of the project was to increase the availability of Bethune Point effluent within the city's distribution system, DRIP. To achieve that, the continuing problems with spurious fecal growth, chlorine residual, and effluent pH upsets had to be controlled.

SFR Funding Puts Project on Fast Track

In the late spring of 1998, as design on the Westside Regional facility was nearing completion, the city authorized McKim & Creed to begin work to expand and renovate the Bethune Point Plant. Improvements to the plant were scheduled to come online as soon as possible after Westside Regional was activated.

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Since both Westside and Bethune Point were funded with SRF dollars, the plans and specifications had to be completed in concurrence with the SRF funding group and were due by June 1998. From April to June, McKim & Creed worked to complete the necessary funding documents within the limited schedule. By September 1998, the plans had been completed, reviewed, and accepted by the state, and the project was fully funded.

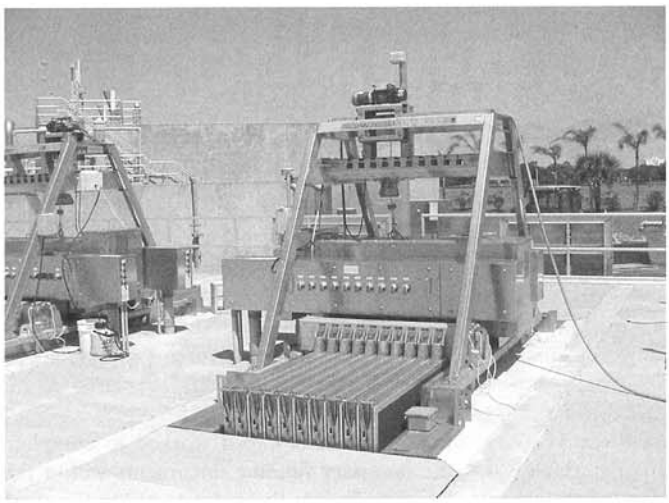
Expansion Features Process Conversion, UV Disinfection

McKim & Creed staff, along with city staff, studied the existing system in detail and determined that by changing the processes the city could improve plant capacity and process performance.

The existing A2O process and accompanying de-nitrification filter were converted to a five-stage Bardenpho process, matching the process at the Westside facility. The major steps of the conversion included rerouting various flow streams, refitting some of the aeration tankage with mechanical mixers for anoxic reactors, and renovating many of the fine bubble diffusers.

The only major construction associated with the conversion involved installing a new and more efficient internal recycle pump station with attendant piping. The conversion allowed a re-rating expansion of the existing facilities with only minor new construction onsite.

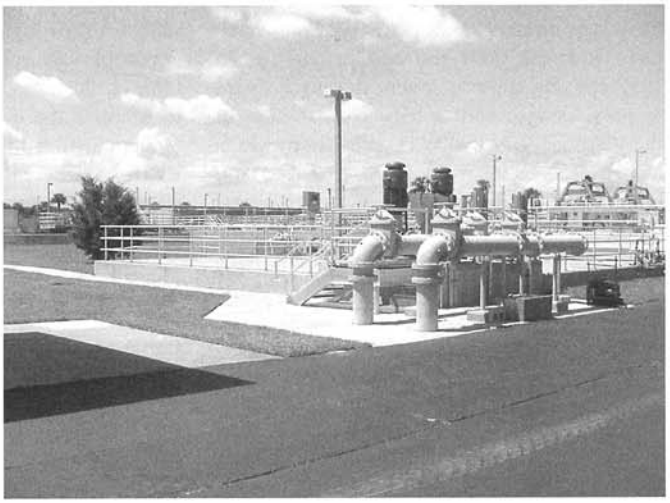
Bill Banks, plant superintendent at Bethune Point, inspects low pressure, low intensity UV lamps.



The Trojan Technologies Systems UV4000 ultraviolet disinfection equipment is designed to provide basic level disinfection up to 26 mgd, and high level disinfection up to 13 mgd.

The MDP (Master Distribution Panel) / Generator building and the 6,000 gallon above ground fuel tank at Bethune Point. The structure was designed so the floor slab is above the 100-year flood elevation; hence the two-plus foot difference between floor slab and existing grade.

Bethune Point is situated along the west bank of the Halifax River. McKim & Creed increased capacity at the plant from 10 to 13 mgd; converted the treatment to a safer, cleaner UV system; changed the process to a Bardenpho system; and incorporated a UPS system.



This view of the ultraviolet disinfection tank at Bethune Point shows the two reuse transfer pumps / motors and discharge piping. Each pump, rated at 2,800 gpm, is capable of pumping reuse water to a ground level storage tank or to the 42-inch effluent main, which serves as the storage tank between Bethune Point and Westside Regional Wastewater Treatment Plant, located eight miles away.

Finally, the biological de-nitrification filter was converted to a traditional deep bed filtration mode.

The city ran a detailed pilot plant during the winter of 1998 to test the efficiency of UV disinfection as a possible replacement for the traditional chlorine. Using data from the city pilot plant, McKim & Creed designed the first large-volume, unrestricted public access reuse application for UV light disinfection to be permitted in Florida. Using the pilot data, McKim & Creed worked with city and DEP staff to create a system design based on the guidelines of California's Title 22 Standards for UV Systems in Public Reuse Applications. Site visits to existing facilities in California were critical to the design process.

Design of the full-scale system was based on the Trojan UV4000 single arm medium pressure equipment. The system was designed around a single continuous channel with four banks of lamps per channel, in compliance with the Title 22 guidelines. One side of the existing chlorine contact structure was used for UV reactors, while the other side of the tank was retrofitted to serve as both a reuse transfer pump station and a diversion box for continued flow to the river discharge. All the channels and structures were covered with removable covers to inhibit the growth of algae in the channels.

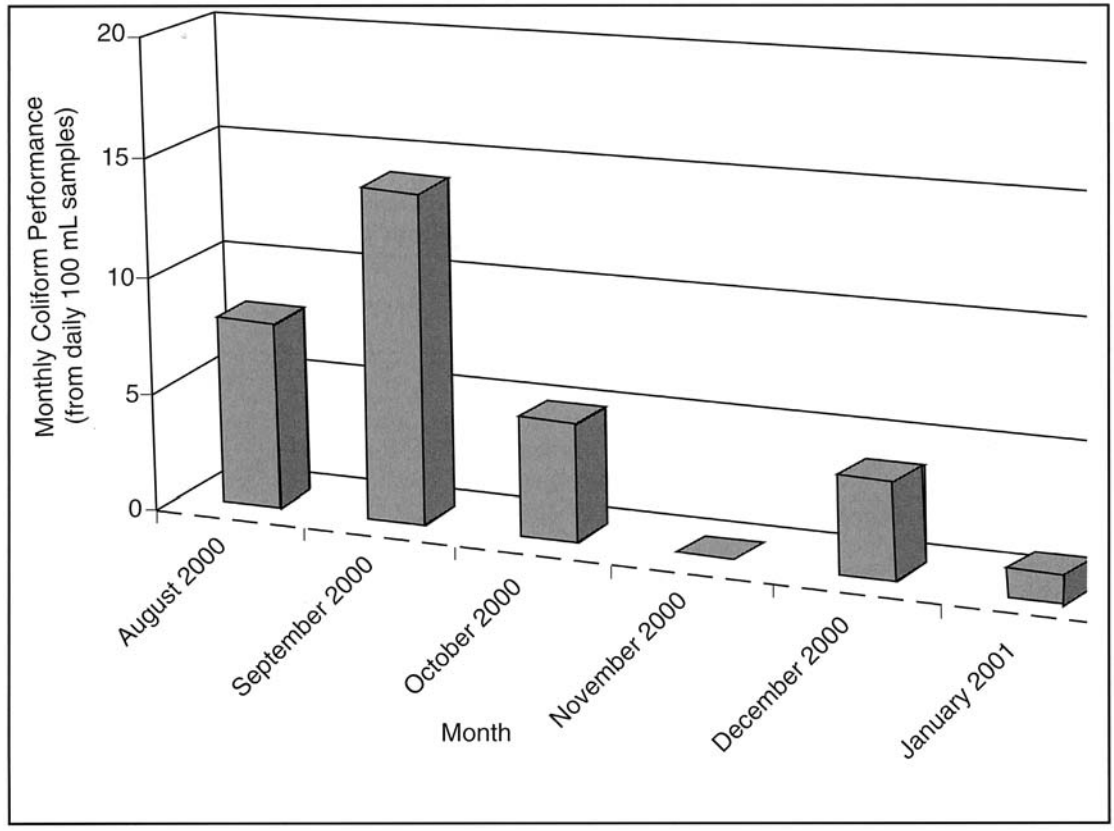
Because the electronic ballasts in modern UV equipment are extremely sensitive to power fluctuations and have a failure time of microseconds, standby power and transfer switches alone cannot act quickly enough to insure continuous operation. And since most of the power fluctuations in the area are only microseconds in duration, on the order of disturbances with upsets of only 3 cycles per second, an inline UPS was deemed to be essential to the security of the system. In addition to providing instantaneous power for up to 15 minutes of operation, the UPS also serves as filter for all power to the UV system and represents the first-ever use of a large UPS to ensure continuous operation of such a system.

Bethune Point was advertised and bid in February 1999. Construction began in April of that year, and the UV disinfection system

was placed into service by December 1999, two weeks ahead of the scheduled compliance date. From pencil and paper to operation, the project was completed in less than 18 months.

The design budget for the Bethune Point project was estimated at $6 million. Competitive bidding resulted in a project cost of $5.3 million. Of that amount, approximately $3.1 million was for the new disinfection system and associated electrical appurtenances.

Effluent from the Bethune Point site is now routinely pumped back into the city's reuse system, permitting the DRIP program to make significant use of the second facility to quench the area's thirst for reuse water. Operation of the UV system over the past year has provided important insights into the design and operation of such systems for non-detectable fecal performance.



The importance of continuous power protection is a critical parameter not routinely considered in the Title 22 Guidelines. The importance of regular cleaning of the reactor channels to prevent background algae growth is another critical parameter not stressed in the guidelines. This valuable experience in the state's first large volume UV reuse system is being used now in the design of other new facilities.

Performance of the system today is far more reliable and has a better operating record than ever provided by the traditional chlorination and de-chlorination processes. ■