By Darby Ritter

Getting Rid of Grit

Varying flows at an Arkansas plant require a uniquely designed grit removal system

The simple yet effective philosophy undertaken by Rogers, Ark., Water Utilities Plant Manager Mike Lawrence and his staff is "do the very best job we can." Doing the best job at the award-winning Rogers Wastewater Treatment Plant (WWTP) means achieving high treatment standards while keeping related costs as minimal as possible.

"Following the leadership of our utilities manager, we've tried to do everything we can for effluent quality without breaking the bank," Lawrence said, noting that the Rogers WWTP performance includes total nitrogen reduction even though permitting does not currently require it.

People have noticed the quality, including the U.S. Environmental Protection Agency, which has honored the plant twice with Environmental Excellence Awards. Furthermore, visitors to the facility are often struck by its immaculate condition.

Lawrence joined Rogers Utilities as plant manager just a week after the treatment plant was christened 21 years ago. He has since overseen two major expansions, the most recent completed in March 2009. Designed by Black & Veatch and built by BRB Contractors, the expansion affected all phases of the plant, providing for increased flow and upgraded process equipment throughout the entire plant scheme.

Grit Removal Upgrade

A principal component of that scheme is the new headworks facility, which includes screening and a new Smith & Loveless PISTA 360 grit removal system with patented V-Force Baffle. According to Lawrence, grit removal historically caused problems at the plant due to large flow surges that often overwhelmed the original grit and scum system.

"[The original system] was unable to meet our needs during high flows," Lawrence said. "Under these conditions, we not only had the higher flows, which increased the upward velocities in the unit, but the scouring or flushing of grit from the collection system during these events added to the problem."

Because larger quantities of grit flushed through from collection system infiltration and inflow (I&I), grit buildup occurred over time in downstream basins. Working with their consultants, Lawrence and Robert Moore, operations and maintenance manager, sought new approaches to prevent the grit buildup.

The expansion, planned for 20 years growth, increased design conditions to 14 million gal per day (mgd) from 6.7 mgd, while peak capacities were set at 48 mgd because of the I&I from the collection system. This large variance made successful grit removal system selection more complex and with the historical infiltration, also more essential.

Seeking a Solution

True to their philosophy, Lawrence and Moore undertook a thorough evaluation process. Their course of action included numerous visits to other WWTPs, collaboration with colleagues and meetings with various equipment suppliers. They personally observed and evaluated several grit removal approaches, eventually choosing to go with a vortex-type approach.

Even still, the new flow conditions posed challenges for a vortex chamber design. Low daily flows compared to the peak flow would typically necessitate multiple vortex grit chambers and the use of downstream leveling devices to affect proper channel velocities required to move grit. During the evaluation process, Lawrence and Moore became acquainted with the Smith & Loveless technology.

"One of the attractive things about the PISTA was its ability to handle this wide range of flows," Lawrence said, referring to the single-chamber system.

Unlike conventional vortex-type systems, the PISTA 360 grit removal system with patented V-Force Baffle increases velocity during low-flow periods while maintaining consistent grit capture during surges. Flow-control baffles uniquely positioned within a 360-degree, flat-floor grit chamber comprise a patented hydraulic design, which creates a forced vortex for efficiently removing grit at all flows. An opening in the center of the chamber floor allows the grit to move into a lower collection hopper, where it is fluidized and then pumped for cleaning and dewatering.

The key to its success in the Rogers application is the integral V-Force Baffle design, which serves as a water-level control device. When the lower daily flows

ARTICLE SUMMARY

Challenge: The Rogers WWTP's existing grit and scum system did not perform adequately during high-flow periods.

Solution: Rogers Water Utilities planned for a facility expansion—from 6.7 mgd to 14 mgd, with peak capacities set at 48 mgd to address collection system I&I.

Conclusion: The expansion incorporated a new vortex-type grit removal system with water-level control technology, ensuring the high velocity needed for effective grit removal is maintained at all times.

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Left: Once grit is trapped by the PISTA 360, grit turbo pumps move it to the second-stage grit washing and dewatering units.
Center: Dual PISTA grit concentrators and a grit screw conveyor work in concert to wash removed grit and dewater it for disposal.
Right: The PISTA system, with patented V-Force Baffle, removes 98% of all grit at the Rogers WWTP.
Inset: System chamber design.

Photos courtesy of Chad Cooley, Environmental Technical Sales.

ensue, the baffle design causes the water level to change, thus maintaining high velocities across the channel for satisfactorily moving grit into the chamber. Before the introduction of this design, the most common way of controlling the velocity in low-flow periods was to back up flow with a downstream submerged weir. The pre-engineered PISTA 360 with preset inlet and outlet openings supplants the need for a downstream submerged weir.

By integrating water elevation settings with the baffle design, the overall outlet footprint requirements also decreased and enabled the outlet channel to make a 90-degree turn just past the chamber. Most significantly for Rogers Water Utilities, the need for multiple vortex-type units was eliminated. Instead, a single Model 50B PISTA 360 with V-Force Baffle (rated at a 50-mgd capacity) covers daily and peak flows in a single chamber. It not only reduced capital costs by nearly half, but it also lessened the long-term energy, maintenance and operational costs by not requiring operations and maintenance of multiple systems.

During their evaluation, Lawrence and Moore visited other PISTA installations and followed them up with a trip to Smith & Loveless' factory in the Kansas City metropolitan area to confirm their leanings.

"We visited [the] facility to help us be sure that the PISTA system was one that would meet our needs," Lawrence said. "The fact that I was impressed with representatives of Smith & Loveless further increased my comfort level with the PISTA system."

The installation of the PISTA 360 grit removal system not only improved the plant's grit removal efficiency to a high standard, but its unique design allowed Rogers Water Utilities to save on capital and long-term operational costs. For all involved, it was a job well done. WWD

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