Case Study

Village of Tequesta RO Water Treatment System

Project Details

Location: Village of Tequesta, Palm Beach County, Florida

Application: Water Desalination

Capacity: 5.1 mgd

Engineering: Arcadis Engineering

Commissioned: 1997; 2007

KOCH MEMBRANE SYSTEMS™

Overview

When the Village of Tequesta discovered significant salt water intrusion in the superficial aquifer that was the town's main water supply, officials developed a plan to draw water from a much deeper aquifer.

Unfortunately, the water in the deeper aquifer was far more brackish, with a much higher salt content. This meant that while the aquifer itself would not be subject to salt water intrusion, it would clearly require desalination before it was suitable for consumer use.

Water from the upper aquifer had been treated using a standard aeration filtration system to remove iron, and was subsequently chlorinated. However, since the water from the upper aquifer was much purer, it did not require the level of treatment that deeper water did. Thus, the existing system had not been designed to provide the desalination that the deeper aquifer demanded.

The Challenge

To build a water treatment system capable of providing the level of desalination needed for a municipal water supply.

The Solution

Reverse osmosis (RO) is a filtration process known to be the most energy efficient method of removing dissolved salts from water. Koch Membrane Systems (KMS) was selected to supply an RO system by Arcadis Engineering, the firm contracted to design a new water treatment plant for the Village of Tequesta.

"We were confident that a membrane process, specifically reverse osmosis, would be the optimal approach," said William D. Reese, vice president of Arcadis.

For Reese, choosing KMS was relatively simple. About 10 years before the Tequesta job was initiated, he had worked with KMS on a membrane project for the Village of Wellington, also in Palm Beach County.

"The Wellington project really demonstrated what Koch Membrane Systems was capable of," said Reese. "It showed me the scope of what the company could do, not only with the membranes that they manufactured but with the company's overall expertise in water treatment and desalination."

The new facility was built to house a maximum of three 1.2 mgd RO trains, for a total capacity of 3.6 mgd. Currently there are two installed trains; the second one was commissioned in 2007. Both trains use KMS membrane elements.

Roy Fallon, chief operator of the water treatment plant at the Village of Tequesta, says that the performance of the RO system has been exceptional. "There's no doubt that the RO system has done everything we had hoped it would. It's been almost maintenance free, which has saved us substantial dollars in labor costs. It was eight years before we reached the point when the KMS membranes underwent their first cleaning. It was pretty remarkable."

The Treatment Plant

The new facility housing the RO system was designed as a concrete block structure that would blend in with the architectural landscape of the village. And since there is a fair amount of noise associated with the pumps that feed the membrane process, they are housed in a different room, creating a far more comfortable operating environment when maintenance on the membranes is required.

After the water is pumped from the newer, deeper water source, booster pumps increase the pressure to provide the proper operating pressure for pre-treatment with sulphuric acid to keep the pH low; the lower pH helps keep the hydrogen sulfide gas dissolved in the well water throughout the process. An anti-scalant is then added to prevent the formation of carbonates, after which the water travels one micron through a pre-filter, before going to the high pressure pump which provides the feed pressure for the RO membranes.

Once at high pressure, about 276 psi, the water is forced through the semi-permeable membranes to separate the impurities; the filtered water or permeate passes through the membrane and the concentrate is sent to waste and discharged. The permeate from the RO is pumped to the clear-well, or finished water tank, where it's mixed with the 2.74 mgd of water still being drawn from the upper aquifer and going through a filtered systems; the entire mix is then treated via the older filtration process, then goes into a clear well.

The entire water treatment system is fully treated with chlorine and computer-driven; any out-of-range conditions are immediately communicated to plant operators for remediation or shutdown. This RO permeate is a very high-quality water, more like a distilled water, which makes it an excellent complement to the older water source.

"Combining the two water sources produces a perfect blend," says Reese. "The older source comes out with a couple hundred parts per million of calcium hardness, which helps improve the taste. By blending it with the newer source, we still have enough calcium for taste concerns but overall it's a purer end product. And with over 5.1 mgd of total capacity, we're more than satisfying the needs of our customers, even in times of peak demand."

Product Overview

KMS offers a wide range of RO elements suitable for a variety of separation requirements. Our pre-engineered, packaged water treatment systems using RO and NF technology offer optimum water treatment for brackish and seawater applications within a compact, skid-mounted package.

KMS offers two options to suit your needs: Standard pre-engineered RO packaged plants complete with all equipment; and modular, reduced-scope Vessel Control Block suited to larger projects and operators who prefer to provide auxiliary equipment.

For larger systems, KMS engineers can design and build a custom system to meet your specific needs.

Both KMS packaged and custom water treatment systems offer:

- A flexible, cost-effective design with lower auxiliary equipment costs
- Fast installation and start-up
- Capacities ranging from 565-1,700 m^3/d (150,000-450,000 GPD)
- Production of high-quality permeate water
- Drinking water and industrial wastewater recycling

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