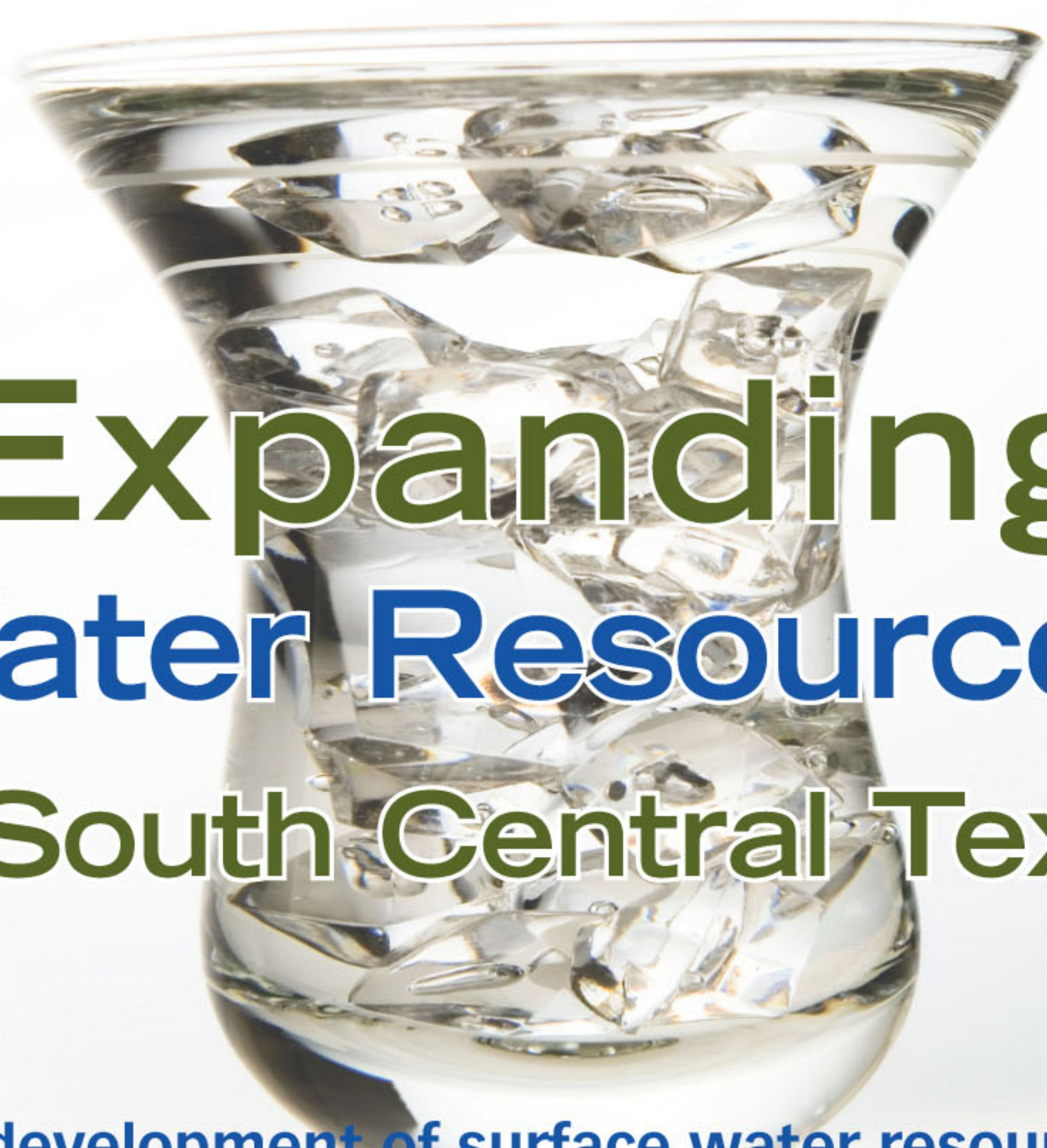


A clear glass filled with water and several ice cubes, with light reflecting off the surfaces.

Expanding Water Resources in South Central Texas

Rapid development of surface water resources

By Evelyn M. Scibelli

For more than two centuries, the Edwards Aquifer, one of the most prolific artesian aquifers in the world, has enabled San Antonio with cities and towns in the surrounding region to grow and prosper without utilizing surface water. An artesian aquifer is a geological formation in which water is under sufficient hydrostatic pressure to be discharged to the surface without pumping.

Historically, the Edwards Aquifer was able to serve the diverse agricultural, industrial, recreational and domestic water needs of almost 2 million users in south central Texas, allowing San Antonio to emerge as America's eighth largest city, despite its semi-arid climate at the edge of the vast Chihuahuan Desert.

During recent decades, however, demand for water in the region has increased well beyond the aquifer's capacity, leading to increasing concerns about the welfare of



Hollow-fiber filled ultrafiltration cartridges pictured above remove turbidity and provide potable water for the surrounding communities.

endangered species and regional economies that depend on spring flows from the aquifer.

Strict limits have been placed on the use of the aquifer, forcing water districts to rapidly develop surface water resources to satisfy current potable water needs and support future growth. The challenge has been to increase capacity while meeting stringent regulatory requirements of the Safe Drinking Water Act (SDWA). The Surface Water Treatment Rule (SWTR) requires surface water to be filtered and disinfected prior to distribution to control giardia, cryptosporidium, viruses, turbidity and coliform bacteria.

Ultrafiltration handles highly turbid surface water

To meet the capacity requirements and safe water regulations, several water districts have turned to ultrafiltration (UF) membrane technology. One of the first to do so was the Canyon Regional Water Authority (CRWA) at its plants in New Braunfels and San Marcos, northeast of San Antonio.

"When we were faced with the need for rapid expansion of our surface water treatment capacity, we decided to utilize membrane filtration because it could filter far more water at a lower cost and in a smaller footprint than the conventional sand filtration system we had in operation," said David J. Davenport, the general manager of the CRWA.

In June 2002, the New Braunfels plant commissioned a 4 MGD ultrafiltration system composed of two parallel units, each containing 48, 8-inch diameter by 72-inch long PMPW hollow fiber cartridges from Koch Membrane Systems Inc. (KMS) of Wilmington, Mass. A single, 2 MGD unit was also installed at a newly constructed CRWA plant in San Marcos.

"Within a month of commissioning our new membrane system, it was immediately put to the test by a 500-year flood and exceptionally high turbidity levels," said Davenport. "It was amazing to see the membrane system continue to perform, while the conventional sand filtration systems in the local area needed to be shut down."

Turbidity levels rose to record highs – reaching 4,000 NTU on July 5, 2002. The membrane system continued operating throughout the crisis, providing water to two above ground clearwells and continuing to distribute high quality water to CRWA's customers. "This experience demonstrated the most beneficial aspect of membrane technology: its ability to supply quality drinking water regardless of the turbidity levels in the feed water," said Davenport.

During a normal July and August, when demand for water is at its highest, the turbidity of the feed water from the Guadalupe River typically fluctuates between 6 NTU and more than 100 NTU, averaging approximately 17 NTU. The PMPW polysulfone membranes have a pore size that provides a 100,000 molecular weight cutoff. This mechanical barrier produces consistent product water quality below 0.05 NTU, regardless of feed water turbidity.

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The PMPW ultrafiltration cartridge unit above from KMS is a certified NSF-61 compliant 10-inch diameter hollow fiber cartridge for potable water treatment.

Additionally, these membranes are credited with 4-log (99.99-percent) removal of giardia, cryptosporidium and viruses by the California Department of Health Services.

Capacity expansion on a small footprint

By mid-2003, the CRWA needed to increase capacity to meet customer growth that was outpacing earlier projections. The CRWA decided to install a PMPW-10 cartridge, a 10-inch diameter UF hollow fiber cartridge containing 60 percent more membrane surface area, and capable of filtering 60 percent more product water than its 8-inch predecessor.

During the summer of 2005, six PMPW-10 filtration units were commissioned, producing 14.4 MGD at the New Braunfels plant. The original two PMPW-8 units were moved to the San Marcos plant to expand the previously installed PMPW-8 system.

Low maintenance

"Our systems are highly automated. They maintain low transmembrane pressure, with a once-a-month cleaning routine," said Davenport. The monthly clean-in-place protocol consists of recirculating softened potable water containing 200 ppm of chlorine through the membranes at 95 to 110°F at a pH adjusted to 12 with NaOH. Occasionally a citric acid solution (pH 3) is used.

The use of ClO₂ to control algae has been an effective pretreatment step for the New Braunfels system. Approximately 1 ppm of ClO₂ is injected into the raw water line year-round, with a typical residual of 0 to 0.3 ppm going into the membrane system.

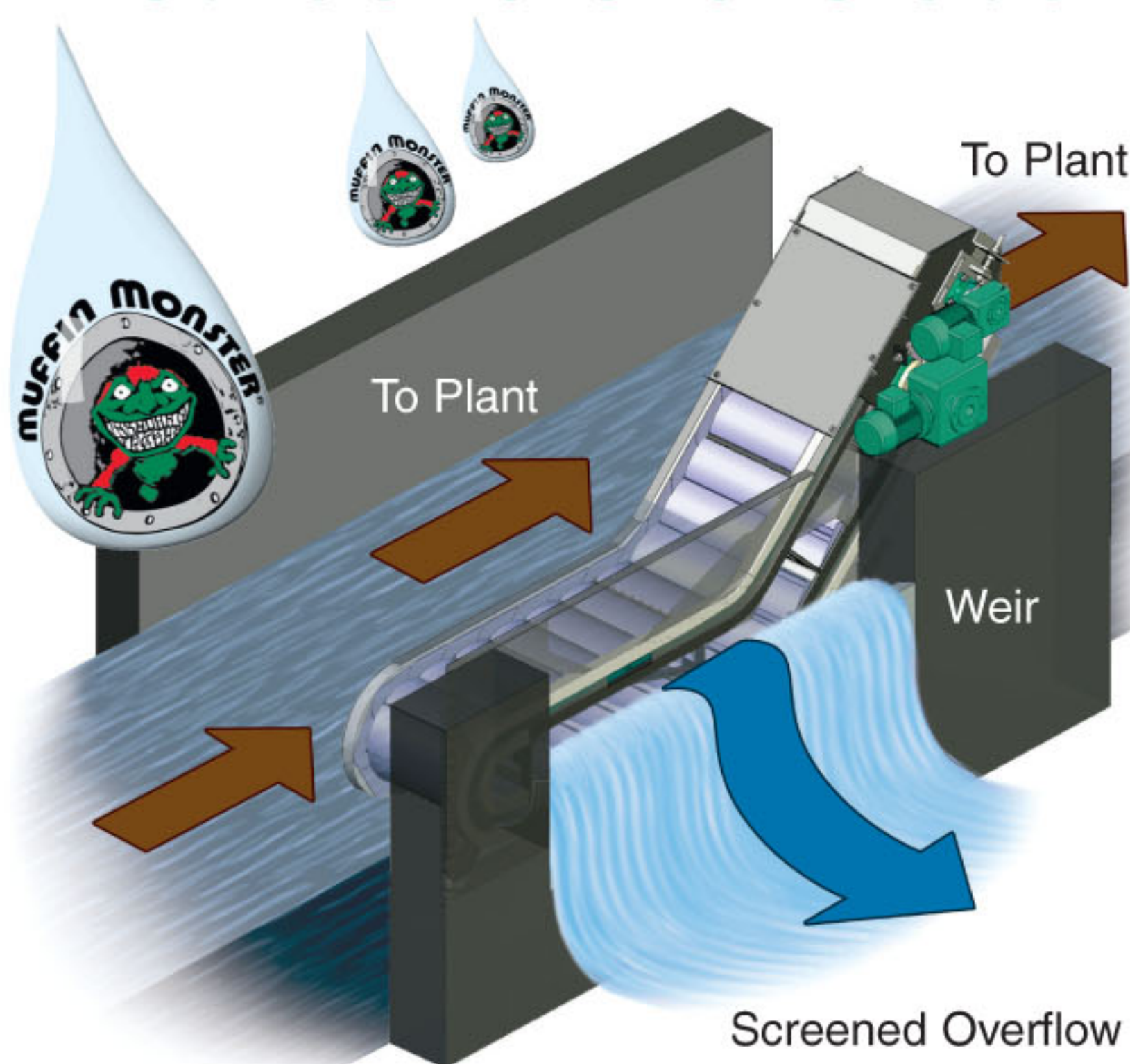
High automation and low maintenance are not only important at larger facilities, but smaller ones as well, as exemplified at the Martindale Water Supply Corp., a 0.5 MGD facility located a dozen

Expanding Water Resources

miles southeast of the San Marcos plant. A 13-cartridge PMPW-8 system, brought online in February 2001, filters well water for 2,500 Martindale area residents. This facility also must comply with the SWTR, because it uses groundwater under the influence of surface water.

"I am the only employee at this facility, besides the office manager, and therefore ease-of-maintenance is critically important," said Steven Fonville, general manager of the Martindale Water Supply Corp. "We barely have to clean the membrane system. However, we do perform a cleaning every

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The Lake Dunlap Water Treatment Plant is owned by the CRWA and is located in New Braunfels, Texas. It is one of the many drinking water plants that have turned its attention to membrane filtration.

six months as a formality, so we don't forget how the process works."

Conservation and economic growth

Successful operation of membrane ultrafiltration plants at the New Braunfels, San Marcos and Martindale plants has spurred wide interest in the technology in the region. "We were one of the first plants, and now there are 15 to 20 similar plants in Texas, in construction or in the process of coming online," said Fonville.

Membrane ultrafiltration technology provides the San Antonio region with a cost-effective method of developing surface water resources. This technology has enabled continued economic growth, while conserving the limited capacity of the Edwards Aquifer. **PE**

About the Author

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