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Texas Water Savers

News of Water Conservation and Reuse in Texas

Texas Water Resources Institute

Texas Agricultural Experiment Station

Harlingen Water Works attracted Fruit of the Loom with dependable water supply

Treated wastewater supplies dye plant

In 1988, the City of Harlingen sought to attract new industry to expand its economic base. The Lower Rio Grande Valley appealed to Fruit of the Loom as the site of a new textile bleaching and dyeing production facility. Labor and land were in plentiful supply, but the limited water supply from the Rio Grande combined with the water's natural salinity seemingly formed a barrier to building the plant in Harlingen.

Fruit of the Loom required 2 million gallons per day (mgd) of water with exacting requirements for hardness, dissolved solids, pH, and mineral concentrations for their startup operations.

photo by Jan Gerston/TWRI

Harlingen Water Works System Engineer Dennis Raymond in the pressurized sand filter plant installed by Harlingen Water Works to filter wastewater in preparation for reverse osmosis and eventual delivery to the adjacent Fruit of the Loom factory. This 66 tank installation is the largest in existence.

Working in partnership, the industry and the utility arrived at a solution in this water-strapped south Texas city—specially treated wastewater from the Harlingen wastewater treatment plant would furnish process water to the adjacent Fruit of the Loom plant. Reuse is nothing new to Harlingen—its golf course has been irrigated with treated wastewater since 1962. The city's water supply comes from its permit for 22,000 acre feet per year from the Rio Grande. The Fruit of the Loom reuse saves 2,750 acre feet of water per year from being diverted from the Rio Grande.

Harlingen Water Works System contracted out the design and construction of a reverse osmosis (RO) plant. Two separate 1-mgd trains were on line by 1991. A separate wastewater treatment section was constructed to handle industrial wastewater return. Fruit of the Loom sited their facility adjacent to the wastewater treatment plant.

The partnership has proved so successful that Harlingen Water Works has now embarked on a project to double the total output, from 2 mgd to 4 mgd. Along with Rice University and the U.S. Bureau of Reclamation, the utility is now researching the feasibility of reusing the Fruit of the Loom return flow. On the drawing board are plans to put a portion of Fruit of the Loom water in a continuous loop: first, use as process water by the production plant, next, returning to Harlingen's plant for sand filtration and RO treatment, and finally back to the factory for use as process water. Using this configuration, Fruit of the Loom will demand only make-up water from the Harlingen wastewater plant.

"Because you can't wear out water, we're going to treat and recycle the wastewater back to the factory once again," said System Engineer Dennis Raymond. "Then, the factory will demand only make-up water from us, and we could use 3 mgd of municipal wastewater for another application."

Conversion of the wastewater treatment plant from a secondary municipal treatment and discharge process to an RO pretreatment process was accomplished solely by in-house engineering expertise. Raymond designed a unique treatment facility to supply water meeting the specifications of the RO plant.

First, water from the final clarifier step of secondary treatment is pumped to the segmented-disk filters, the first pretreatment step, which remove particles larger than 10 microns. Water is then sent to covered storage tanks.

From the storage tanks, water is pumped to an array of 66 pressurized sand filters, with a combined output of 7 mgd, capable of filtering particulate matter larger than 0.45 microns. This bank of filters is the largest such installation in existence, according to the manufacturer, Sonitec.

From the pressurized sand filters, water is pumped directly to the cellulose acetate RO unit to filter out dissolved solids down to 0.001 microns. RO-treated water is stored in two clear well tanks totaling 8 million gallons. A 20-inch pipe leads from the storage tanks to the Fruit of the Loom factory. RO output is now 2 mgd. After completion of a planned second phase expansion, output will double to 4 mgd.

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Inside

Plans progress in Harlingen to double capacity for RO-treated wastewater for industrial uses

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Resourcefulness is the name of the game in Harlingen. By converting four trickling filter basins to aeration and activated sludge basins by wrapping the concrete tanks with post-tension cables, Harlingen Water Works System saved about $2.5 million over the cost of building new tanks. (Trickling filter basins are not designed to withstand the pressure of being filled with water. Activated sludge basins are filled with water.)

photo by Jan Gerster/TWRI

Harlingen Water Works Technician Javier Trevino prepares to work on pumps which move reverse-osmosis (RO) treated wastewater to storage tanks. RO membranes are seen in the background. The RO plant has a present capacity of 2 mgd, which will soon be doubled.

Looking to technology for another improvement, the treatment plant's original traveling bridge sand filter required large quantities of water for backwashing, water which could be used for RO feedwater. The sand filters were replaced with a newer technology—the segmented disk filters—to removed suspended solids.

As with any specialized application, Harlingen faced several challenges in bringing effluent up to Fruit of the Loom specifications.

One problem is the silica Fruit of the Loom uses to set its dyes. Water from the factory contained about 60 parts per million silica, about 3 times the naturally occurring concentration in Rio Grande water. If silica concentrations of silica would tend to coat the sensitive RO membranes. Harlingen Water Works consulted with Mark Wiesner, a Rice University professor of environmental science and engineering, to solve the problem.

Another challenge, unique to South Texas, was algae growth that would not settle out, so instead was eliminated by covering all basins to exclude light, said Raymond. Harlingen Water Works System is now in the process of installing aluminum geodesic domes over two larger storage basins.

Even within the wastewater treatment process, water conservation is paramount. Sediment from backwash water from the segmented disk filters and the presaturated sand filters settles out in a basin. Supernatant water from the top of the tank is drawn off again for filtration starting at the disk filters.

Part of the Loom pays Harlingen Water Works System about $1.20 per 1000 gallons for pretreatment and RO and treatment of the return waste stream plus monthly charges for chemicals, such as antiscalants. The high quality of water allows Fruit of the Loom to operate their equipment at a lower cost than would be possible with potable water because of reduced scaling, fouling, and downtime for cleaning. Using wastewater gives Fruit of the Loom a reliable supply in case of drought.

"You can't wear out water, so we're going to treat and recycle the wastewater back to the factory once again," Dennis Raymond.

or strain on the potable water system.

The equivalent monetary value of similar water rights would be about $1.5 million, assuming willing sellers could be found.

Phase I, the original 2-mgd plant, was funded by a six-member consortium—the Economic Development Authority of the U.S. Department of Commerce, Texas Department of Commerce, Harlingen Water Works System, the City of Harlingen, and Fruit of the Loom, along with an interest-free

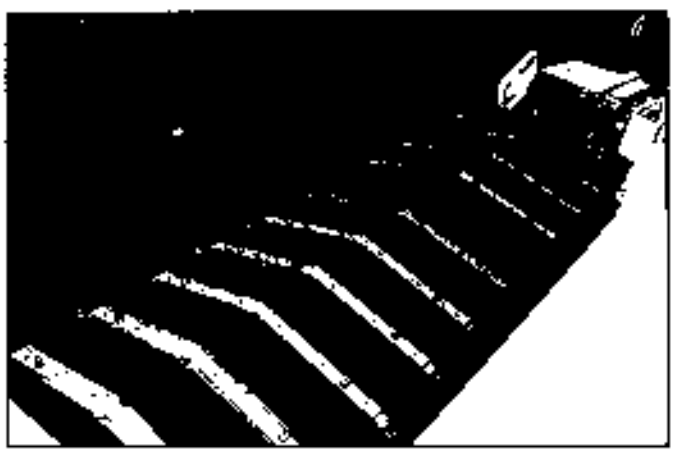

photo by Jan Gerster/TWRI

New technology segmented disk filters replaced existing deep bed sand filters, which required large quantities of water for backwashing. The efficient filters free up more wastewater for RO feed.

loan from Texas Water Development Board. Total Phase I project cost was $9,858 million. Phase II, the doubling of RO output capacity is being funded by a similar partnership, with job creation as its primary goal. The Fruit of the Loom plant employs about 1,600 people.

Harlingen Water Works System won the 1996 AWWA Conservation and Reuse Award in the Direct, Large Utility category.

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