

# Potable Water Pipe Placed Under Lagoon

Water line dislodged by hurricane is replaced.

By Steven B. Gross

**O**n October 19, 2005, the devastating wind and rain of Hurricane Wilma hurled a wave of destruction upon Quintana Roo, the Mexican state on the eastern coast of the Yucatán Peninsula. In its path, the storm left \$7.5 billion of damage, drastically affecting the economies of the highly popular Quintana Roo tourist cities Cancún and Cozumel. It was the costliest Atlantic hurricane in Mexico, and the second costliest natural disaster in Mexican history, following only Hurricane Pauline in 1997.

Among the extensive infrastructure casualties was a water transfer pipeline that ran underwater along the bottom of

Laguna Conil, a lagoon off the north coast of Quintana Roo between the Gulf of Mexico and the Caribbean Sea. The pipeline connected Isla Holbox, a small island off the northeastern tip of the Yucatán to the Quintana Roo mainland. The storm dislodged sections of the submerged high-density polyethylene (HDPE) pipeline, which floated to the surface and took a beating in the Gulf. This also cut off the 26-mile long island from the vital potable water supply of Chiquilá, Quintana Roo.

To fix this problem, Quintana Roo's Comisión de Agua Potable (CAPA), or Commission of Potable Water, called on engineer Francisco Vicke Andrews, of Chihuahua City, Chihuahua, who had

done previous work for CAPA. Vicke Andrews designed and installed a similar potable water transfer line five years earlier, leading from Punta Sam, Puerto Juarez, to Isla Mujeres, another small island off the northeast Yucatán coast in the Caribbean Sea. This PVC pipeline, however, was still in place and operating after the big storm.

"After Hurricane Wilma, we examined the HDPE pipeline from Chiquilá to Isla Holbox and noticed a lot of problems with it," he says. "Boats had hit the pipe and rocks had cut it, causing much damage. HDPE pipe floats easily, and if any air gets into the line, it will float up to the surface immediately. I told the CAPA authorities that we would have to

go with a higher technology pipe, and I recommended CertainTeed® (www.certain-teed.com) Certa-Lok™ Yelomine™ PVC (modified polyvinyl chloride) Pipe, which I had used in the Isla Mujeres project. In the five and a half years since installing that line, they haven't had to perform any maintenance, even after Hurricane Wilma."

Because of the previous success with Yelomine, CAPA immediately approved Vicke Andrews' specification. Though most typically used on land in international mining, irrigation, and trenchless water distribution applications, Yelomine provides the strength necessary for turbulent tropic waters. Pipe sections are connected through an easily assembled, high-strength restrained joint system, using PVC couplings with integral O-rings that provide a reli-



*Because of the difficult and unusual environment, the engineer designed and used a special lever system tool to help assemble the pipe.*

able hydraulic seal. The pipe also features strong UV-protection, which is ideal for the intense, water-penetrating sunlight of tropical regions.

The need for a more efficient and dependable water line from Chiquila to Isla Holbox has grown in recent years. For many years, Holbox Island has been home to little more than a small fishing village with only modest tourism. However, over the past three years, the island has rapidly increased its influx of tourists by promoting its attraction of whale shark viewing.

"A few years ago, Isla Holbox only had about 800 people living there, and now, they have closer to 2,500," Vicke Andrews says. "During the tourist season in the summer, they'll have about 3,000 more people. They predict that the amount of tourists is going to significantly increase each year, and in 2009, they expect to have about 6,000 people coming in. That's why the Commission of Water and Sewer wanted me to install a water transfer line that would support the population better. The new line is designed to serve about 20,000 people."

Since PVC pipe requires a much thinner wall than other pipe with a comparable pressure rating, Yelomine improves flow efficiency, which will reduce the costs of pumping water to the island.

Vicke Andrews designed a pipeline similar to his previous design for Isla Mujeres, calling for 35,270 ft of ten-in. SDR 32.5 (125 psi) Yelomine pipe to be strung out across Laguna Conil from Chiquila's beach to Isla Holbox's beach, connected to the mainland water main and then submerged. The maximum depth of the pipeline would be about 25 ft. The design and installation method of the project was filled with Vicke Andrews' ingenuity and ability to make use of available resources to get the job done.

"Not only did we have to design the line, but we also had to design a lot of the tools to make the installation possible," Vicke Andrews says.

## Setting the Posts

Serving as engineer, contractor, and project manager, Vicke Andrews assembled a work crew with knowledge of the region and previous aquatic experience by hiring 12 divers from the Chiquila

and Holbox area. The workers began by setting posts in the water between Chiquila and Holbox Island, following the course that the pipeline was to take. Vicke Andrews and his crew then began to assemble seven sections of pipe at a time, each section measuring 20 ft long, on land before pulling the 140-ft assembly out into the lagoon with a boat-mounted crane.

The pipe was fed between the side-by-side posts on the transfer line's route. As the water got deeper, pipe sections were brought out by boat and handed to the workers, who would continue adding on to the growing pipeline, which somewhat resembled a large yellow water snake after a while.

"You have to drop the pipe and pull it together very tightly," Vicke Andrews says. "You cannot use normal pipe installation methods. When you're working in the water, the forces you apply are not always 100-percent efficient." For this reason, Vicke Andrews designed and used a special lever system tool to help assemble the pipe in this difficult and unusual environment.

Vicke Andrews took precautions to keep the pipeline floating during installation. After each pipe section was added, it was roped to the posts that were on each side of it. To ensure that the pipes would float temporarily, he put plastic bags tightly over exposed pipe ends and held them on with rubber bands. Once the pipeline made it across Laguna Conil and was connected to the water main on Holbox Island, the crew started preparing for the submersion of the pipeline. The divers dug a trench for the pipeline in the bottom of the lagoon. Then, they removed all of the ropes and the plastic bags on the pipe ends and allowed the pipe to gently sink into the trenches.

To help hold the pipeline in place, Vicke Andrews had large, 2,161-lb concrete slabs made to sit on top of the pipeline at various intervals. After the pipeline was laid in its trench, the slabs were brought out in the water by boat, and a crane was used to put them in the water. This was a particularly challenging part of the project, as currents running through the bottom of the lagoon made the waters rougher and complicat-

ed the maneuvering of the slabs, Vicke Andrews says.


"You can't imagine what it was like to move those slabs from the factory, two miles away, then move them to the posts and slowly lower them into the water," he says. "We had to build a special floating device to float the slabs down to the bottom and put them gently over the pipe."

The project was completed in October 2006, and CAPA was able to begin pumping water through the transfer line. Vicke Andrews says he was pleased with how the Certa-Lok Yelomine pipe performed during and after installation.

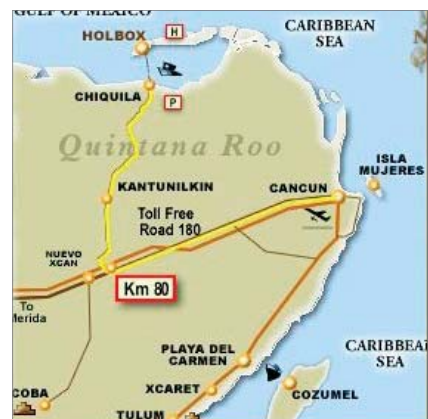
"It's a high-quality pipe, and it performs very well" he says. "It's better than other materials because of its strength, and it's easier to handle as well. Plus, Yelomine responds very well to sunlight and has higher impact resistance than standard PVC, making it more tolerant to installation handling. It's a good product."

The new water transfer line has performed well since October. Overall, Vicke Andrews is happy with how the project turned out.

"The CAPA authorities are very happy with this line, just as they were with the one we designed for Isla Mujeres," he says. "There were a lot of challenges, but it was a nice project."

Establishing himself as an independent engineer and contractor in 2002, Vicke Andrews has 31 years of experience in the industry and focuses on potable water and sewer projects. 

*Mr. Gross is with CertainTeed Corporation.*



*Because of increasing tourism, Isla Holbox required a reliable supply of potable water, even if it did have to be installed at the bottom of a lagoon.*