

CASE STUDY: FLOOD MONITORING

Closing the Flood Gates in Terrebonne Parish, Louisiana



PROTECTING TERREBONNE PARISH FROM HURRICANES

With 987 square miles (2,556 km²) of land and 1,079 square miles (2,795 km²) of lakes and waterways, Terrebonne Parish in Louisiana is actually more water than land. Though the water is the basis for a unique and cherished way of life, it also poses a serious threat to the 112,000 residents of the Parish as climate change drives sea level rise, hurricanes, and stormwater surges that lead to flooding.

After hurricanes Katrina and Rita in 2005, and Gustav and Ike in 2008, residents raised their own money via sales taxes to start building the **Morganza to the Gulf Hurricane Protection System**. Overseen by the Terrebonne Levee and Conservation District, the Morganza includes 98 miles of levees, peaking at 18 to 20 feet in height. Floodgates manage canals, rivers and bayous—the sluggish outlets of rivers that are characteristic of the region—while environmental gates permit flow to wetlands.

The flood gates are based on a highly innovative design called a barge gate, as detailed in **Issue 6 of YSI's Mission Water Magazine**. Opening and closing the gates is aided by tides and natural water flows, but it is ultimately a manpower-based operation. As one operator described, "You have 18 operations employees trying to operate 13 flood gates across 60 miles." It can take six workers as long as 1.5 hours to move a barge gate from the open position to closed. Deploying that entire team is both difficult and dangerous during storm conditions, so timely, accurate data on water velocity, direction and stage is vital to the district.

Monitoring stations for just that purpose were the responsibility of Delta Coast Consultants, and they turned to YSI's Integrated Systems and Services team to fulfill that mission.

MONITORING ON THE MORGANZA

Rather than beginning system design with the sensors, the leading consideration for the Morganza was power and communications, because those are the first things to fail during a hurricane. The team needed a constant and reliable stream of data to not only operate the barge gates, but also to manage other aspects of the intricate water network of the region. It was decided early on, then, that the mains power available at all of the barge gates would be the primary system, but that backup batteries that were recharged with solar panels were a must-have. Battery voltage was among the "parameters" that would be continuously tracked, via the telemetry subsystems. Like mains power, cellular networks could not always be relied on in the throes of a storm or hurricane, so both cellular modems and satellite transmitters were used. Data would be transmitted every 6 minutes using these channels.

The telemetry components were integrated with a datalogger that also had the ports for the primary sensors in the system. **YSI's Nile radar** is a leading non-contact water level sensor that was ideal for this system. The highly accurate Nile radar could track very wide swings in water level, and since it was not in the water it was not at risk of being carried off with high-energy flow, as a submersible transducer might be, and changing flows would not affect the way they might a bubbler.

Changing flows were certainly a major consideration across the entire Morganza system. Jason Kennedy of Delta Coast Consultants pointed out that an incoming tide at one monitoring system can push an outgoing flow two miles away, and notes that flood stages can vary by half a foot (15 centimeters) from one bayou to another. This is why multiple stations were needed to manage flooding across the entire region.

The **SonTek-SL** (side-looker) is ideal for placement at multiple stations across the levee so that operators always have eyes on these dynamics. The SL can be easily side-mounted on bridges, canal walls, riverbanks, and yes, the infrastructure that accompanies barge gates. Operating on the acoustic Doppler principle, the SL is popular for water velocity profiling in coastal applications, because it also has a wave spectra option that calculates and outputs wave-height and period, in real-time.

Between the Nile and the SL the team would have a good handle on the movement of water throughout the region, but anticipating what's to come requires also keeping an eye on the weather in a highly localized manner. "We have more effect from 25-knot south wind now than we ever had—tremendously high tidal events because of normal frontal passages," Kennedy notes. "Ahead of a front, 30-knot southeast winds are almost like a little hurricane."

R.M. Young wind sensors were integrated into the systems, as well as **YSI tipping bucket rain gauges** so that wind speed and direction, and rainfall could also be transmitted to the levy district's command center. Thus the team always knew when storms were blowing in.

Altogether these monitoring stations have enabled the district to operate the flood gates with half the staff that might otherwise be required, which makes this innovative system sustainable from a management and budgeting perspective. The public is also now reaping the benefit of their tax dollar investment.

PUBLIC INTEREST

It didn't take long for residents of Terrebonne Parish who rely on the waterways—the shrimpers and oystermen, the barge haulers, the recreational fishing enthusiasts—to ask for access to the data streaming into the levee district's system.

The district commissioned a public app, then switched to an online service at www.tlcd.org/mobile.

Visitors can click on any of the floodgates that have instruments and get an instant, up-to-date look at flood-side stage, wind direction and wind speed, and the status of the gate. Those who subscribe by sharing their emails and cell numbers can get alerts when the gates are closing or opening.

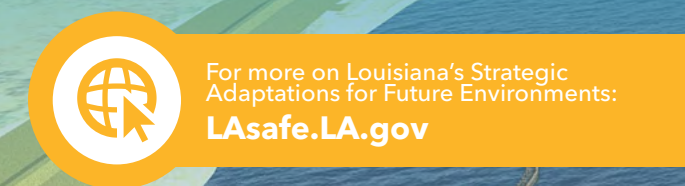
Kennedy says pilots on the system can use the website and alerts to adjust their routes on the Gulf Intracoastal Waterway and other channels based on gate closures — decisions that can keep them working during changes in the weather or get them home safely as storms close in.

News on the gates also allows them to get back to work after storms blow through.

"Everybody wants to know not only when it's going to close, but when it's going to open," Kennedy notes. "We don't want to keep things closed any longer than we have to. There's so much commercial interest in getting out to the water."

To Kennedy, commercial interest is just one part of what the levee system is being built to protect. "You're protecting life and property of the people who live here," he says.

"But the other aspect is you're protecting the culture and the environmental resources. If we were to lose these coastal wetlands, Louisiana would lose its identity. If we lose our coastal wetlands, there's no more seafood, no more crawfish, no more Cajun culture. The communities that have been built here, that's what they're built on."



For more on Louisiana's Strategic Adaptations for Future Environments:
LA safe.LA.gov

