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August 2008—Sewage Sensors, by Jean Thilmany

In South Bend, Ind., a computer network is reaching into the sewer.

Engineers from Purdue University and the University of Notre Dame are working with a private company to create a wireless sensor network to prevent raw sewage in South Bend from overflowing into waterways, especially during storms, said Luis Montestruque. He is the chief executive officer at EmNet LLC of Granger, Ind., the private company involved in the plan.

The sewage will be selectively released later, so that it flows into the treatment plant when capacity is available, preventing the waste from being dumped into Indiana waterways.

Called CSOnet, the system will be composed of computer chips that communicate with each other over a wireless radio network. These microcomputers are embedded in the city sewer system and are connected to the manhole sensors and other flow and pressure sensors and a system of valves, Montestruque said.

The system will use a network of 105 manhole-mounted sensors and computer-controlled valves to automatically hold back the flow of rainwater and sewage in pipes and retention basins until the storm has passed.

Feedback from sensors will also be used to monitor hydraulic conditions in the sewer system, indicating when excess runoff and raw sewage are about to overflow. Then, valves will divert the flow into temporary storage sites.

Unlike other wireless systes, the network doesn't require a command center and can be reprogrammed wirelessly from a remote location. The sensor information would be relayed to a server operated by EmNet.

Such embedded wireless sensor networks could have a place in hundreds of cities around the world faced with similar sewage-overflow problems, Montestruque said.

One challenge to system design is its environment, which isn't quite the dripping, hushed subterranean rat's paradise one would expect. The sensors mounted on the undersides of manhole covers will have to perform in an urban setting full of interference sources, said William Chappell, a Purdue assistant professor of electrical and computer engineering who helped design the sensor technology.

"The sensors must be made to operate in harsh conditions and adapt to changes in the wireless system like interference or the presence of parked or moving cars," Chappell said. "And the system will need to broadcast sensing data generated underground to a network that operates above ground."

Despite the challenges, CSOnet is expected to be up and running in summer 2009