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NO VALVE LEFT BEHIND

Proactive valve maintenance pays dividends in Rutherford County, Tenn.

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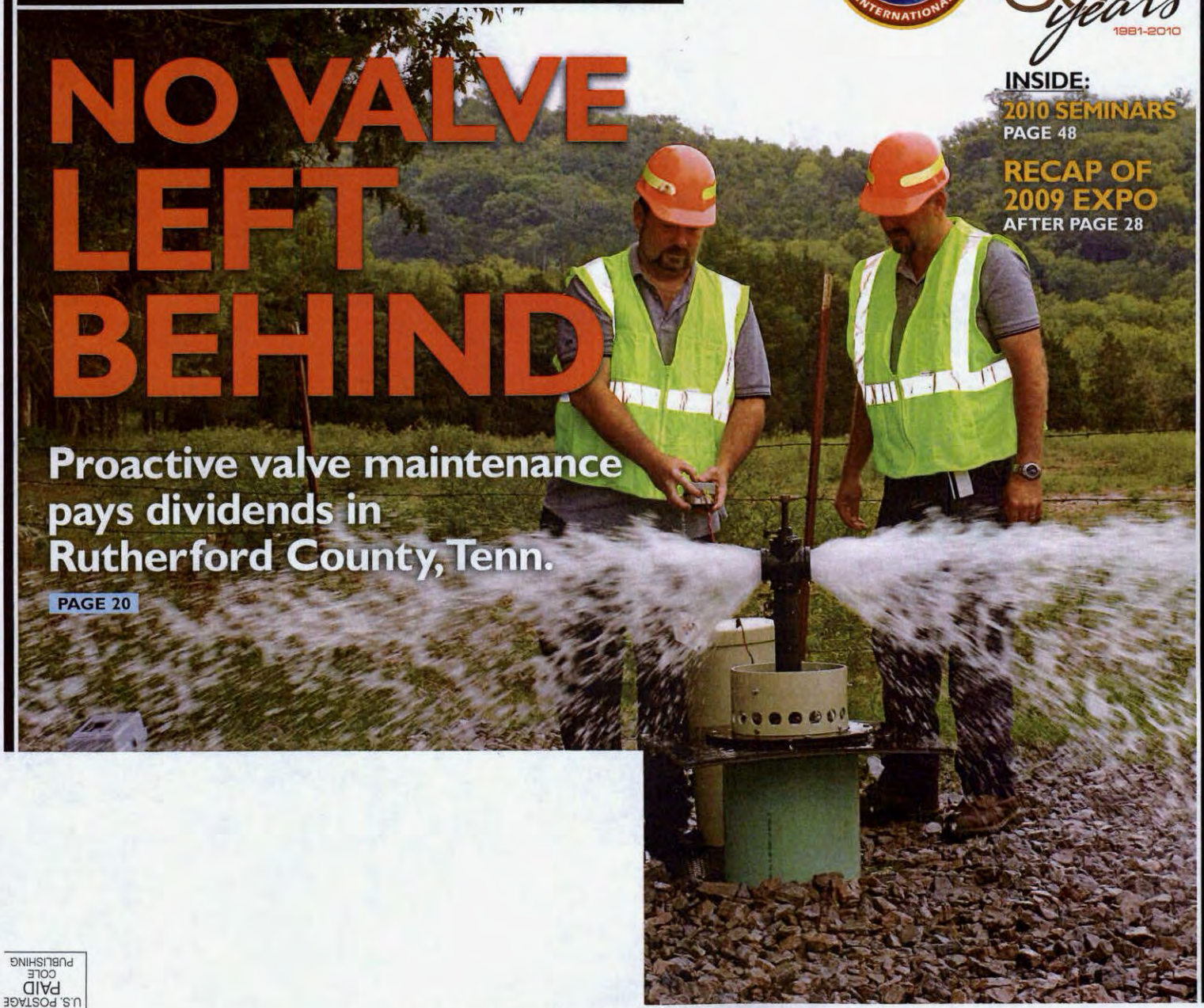

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Glenn McCarty (right) and Bill Dunnill of the Consolidated Utility District of Rutherford County use an ERV-750 extended-reach valve exerciser from E.H. Wachs as part of the district's comprehensive valve maintenance program. (Photography by Joy Dement)

FOCUS: WATER

NO VALVE LEFT BEHIND

A Tennessee utility's proactive valve maintenance program quickly pays dividends in reduced manual labor, reduced leakage, and better asset data

By Jim Force

The water distribution crew at the Consolidated Utility District of Rutherford County, Tenn., is starting to sleep a little easier these nights.

That's because they've launched a comprehensive maintenance program to locate, identify, clean, and exercise over 16,000 valves along the district's 1,300 miles of water mains, and fix those in need of repair. It's a planned, proactive program.

"We want to get to a point where we don't have to send three people out in the middle of the night to find a valve and try to open or close it," says Jennifer Wood, engineer-in-training with the district who is helping develop the program. Assistant general manager Bill Dunnill puts it another way: "We call it 'No Valve Left Behind.'"

No ordinary district

The Consolidated Utility District of Rutherford County is not your ordinary water utility. It is one of the later arrivals on the Tennessee scene, created in the 1960s as an amalgamation of several smaller water districts in response to rapid growth in a formerly rural area outside of Nashville.

In 1978, the utility's Board of Commissioners authorized plans for a new water treatment plant, and the K. Thomas Hutchinson plant began operation in 1981, with a capacity of 4 mgd, drawing from the East Fork of the Stones River, which is fed by J. Percy Priest Lake. In 1988, the plant was expanded to 8-mgd capacity, and it has since been expanded to 16 mgd. Plans are in motion to increase capacity to 30 mgd.

The CUDRC is the largest water utility district in Tennessee, and its far-flung network of water mains presents some unique challenges. In some cases, lines extend more than 30 miles from the water treatment plant to customers at the other end of the county. It was becoming common for crews to shut down more and more valves to contain leaks in the system, and that was increasing the number of water customers affected by an outage.

In response, the district has implemented a number of innovative programs to solve problems and continue to serve high-quality water to its more than 130,000 customers.

Keeping valves in shape

A first step was to establish a sound valve maintenance program built on regular valve exercising. In early 2009, after issuing a Request for Proposals and testing four valve exercise machines, the district purchased a VMT-1 valve maintenance trailer supplied by E.H. Wachs.

"We hadn't had a proactive valve maintenance program in the past, and we knew we needed a valve exercise machine to begin

PROFILE:
Consolidated Utilit District of Rutherford County Tenn.

POPULATION SERVED:
130,000 (44,000 meters)

SERVICE AREA:
Rutherford County in suburban Nashville

WATER CAPACITY:
16 mgd

INFRASTRUCTURE:
1,300 miles of water mains

EMPLOYEES:
88

ANNUAL BUDGET:
$20 million

WEB SITE:
www.cudrc.com

THE VALVE EXERCISER

A valve key connected to the district's trailer-mounted valve maintenance system is turned to exercise a valve.

The Consolidated Utility District of Rutherford County uses a VMT-1 platform-mounted valve exerciser on a single-axle trailer rated at 7,000 pounds.

Supplied by E.H. Wachs, the unit includes the ERV-750 extended-reach valve exerciser, as well as vacuum tools to clean out valve boxes. The exerciser develops up to 750 foot-pounds of torque and operates on a hinged arm that can extend as far as 13 feet.

The arm swivels 270 degrees so that it can reach valves from curbside. An onboard Recon control unit (Trimble) also acts as a data logger and microprocessor. Although the system can include a GPS, the district deferred on that option, choosing to use its existing GPS.

The vacuum apparatus contains a 500-cfm blower, a 2,500-psi/2.5-gpm pressure washer pump, and tanks for water and debris. A water hose reel, two jetting rods, and a hydraulic hose reel for connecting pneumatic tools are also included.

"Startup went very well," says assistant general manager William Dunnill. "There was a learning curve as there is with any equipment, but the process wasn't complicated."

the program," says Dunnill. The utility took delivery of the valve trailer in April, while sending staff members Stanley Beason, Glenn McCarty and George Jones to special training at the Pipe and Valve Institute near Chicago.

Once acclimated to the technology, the district got started checking valves right away, but not in random fashion. "We knew that ultimately we wanted to review our entire valve system, but we didn't want to just start jumping all over the place," Wood says. At her direction, the utility laid out a work plan containing a grid pattern, based on the pressure zones around the water treatment plant, and starting with the zone nearest the plant.

"We located and exercised all valves and hydrants in a particular grid, hundreds of valves in some cases, before moving on to the next grid," she says. "Our plan is to make it through the entire system, as much time as it takes."

Dunnill adds, "We want to locate every valve in the system, box it, turn it, shoot it, and if necessary, fix it, even if it only has pressure on one side." After startup of the exerciser, the district assigned two full-time operators to the task on a 40-hour-per-week schedule.

After six weeks, Dunnill added two summer interns and began operating the unit for six 12-hour shifts per week. This virtually doubled the number of valves exercised in one week, and by the end of the summer, the crew had covered over 1,650 valves, about 10 percent of the total.

And what did they find? Dunnill says almost 30 percent of the valves needed attention. "It wasn't always critical," he explains, "but they needed something — mapping, cleanout or exercising." His records show that 1.5 percent of the valves were closed when they should have been open; 4.1 percent were partially closed, restricting flow; and 5.8 percent were inoperable.

That means that 10 percent had significant problems. On a less critical note, in 2.5 percent of the cases, valve data was errant or the mapping was inaccurate. Another 5 percent of the valves needed other repairs, such as box leveling.

Seeing the benefits

With a majority of the valves still to be reviewed, Rutherford County is already seeing benefits. Wood recalls one case where an old 30-inch valve required 370 turns to fully open or close it. "In the old days, operators performing so many turns would have thought something was wrong and might not have had the patience to fully exercise it," she says. "With the valve exerciser, we are able not only to exercise the valves but also to add the collected data to the map for future operators."

Dunnill mentions another case where the valve program located a 24-inch valve that was not sealing. "The parts required to rebuild the valve were about $9,000," he says. "We pulled the lid and looked inside before ordering them. The inspection revealed that the valve was full of tuberculation. We used the pressure washer and vacuum on our new valve exercise machine to clean it out and restored the valve to full service at the cost of labor alone."

There's one other benefit of the valve exercise machine. "Lots of times we have a good chance of washing stuff out of the valve seat by simply operating the valve up and down," says Dunnill. "In most cases we won't have to pull the lid and manually clean the valve to assure a good seal."

He also sees value in the data being collected. "Data is a critical tool," he says. "This is a great way to gather and store data for future reference." Although the utility uses its own Trimble GPS units for accurate recording of valve locations, "The new machine enables us to interface field data, such as torque curves, the number of turns required to operate, and maintenance history, directly with our GIS system," Dunnill observes.

That makes the system stronger. "When we leave, we know whether that valve is operable," he says. "If

The district uses an Elster AMCO sonic meter for flow testing.

Mark Lee uses a portable automatic flusher from Kupferle Foundry.

not, a work order is issued and maintenance corrects the problem."

Finding and fixing leaks

Leaks waste water, cost money, and generally drive water managers crazy. At the CUDRC, leaks were wasting up to 30 percent of the treated water — about 3.0 mgd.

The problem is aggravated by the rock structure that underlies the area: The water simply disappears into underground rock fractures. "That's production capacity we can't sell," says Dunnill. His staff is making an extra effort to find and prevent leaks.

"Once a week on Wednesdays, managers and field personnel from all areas — leak technicians, flushing, valve exercise, customer service, disinfection, engineering, construction, maintenance — all get together to discuss problems in the system," Dunnill says.

"We learn from each other, and we're focused on water loss. We're listening for leaks. We're flushing. We're identifying lines that are no longer needed and abandoning them. We're valving off new lines with no customers, such as in new subdivisions that are sitting idle. We want to eliminate all risks that we don't need to accept."

"Data is a critical tool. This is a great way to gather and store data for future reference. The new machine enables us to interface field data such as torque curves, the number of turns required to operate and maintenance history directly with our GIS system."

Bill Dunnill

The leak detection crew is employing several leak detection protocols. Using small portable mag meters from Elster AMCO Water, they are isolating various portions of the system, and then comparing actual flow rates with calculated flows from the hydraulic modeling software. If the flow is significantly greater than the model, a leak is likely.

Forest Hill (left) and Glenn McCarty use the vacuum function on the valve exercising trailer to clean a valve box.

The district is becoming meticulous on monitoring the many unmetered fire lines in its sprawling system. "We recently purchased a strap-on meter manufactured by GE Sensors," says Dunnill. "We use it to occasionally monitor specific sections of large-diameter pipe, but more often fire lines to see if there's any flow where there shouldn't be."

In addition, the newer unmetered fire lines are equipped with double detector checks. In those cases, crews have exchanged the customer's low-flow detection meter with one of the district's Badger Orion AMR meters (Badger Meter Inc.). This allows the district to monitor those lines monthly in conjunction with running normal meter routes.

All of these efforts are paying off. "We've seen a tremendous improvement over this past summer," Dunnill reports. Unaccounted-for water dropped from the high 20s to the low teens. "And, knock on wood, it will be even lower in the future," he says.

Flushing out old water

Hydrant flushing is another major initiative. It takes time to move water from one side of the system to the other, especially in the farthest reaches where water demand may be low. Chlorine residuals can drop and disinfection byproducts can rise, particularly in summer.

For those reasons, the district has installed some 30 automatic flushing units manufactured by Kupferle Foundry. They turn themselves off and on at night when demand is low to minimize any hydraulic effects. "By flushing, we maintain fresh quality water at the end of the system," Dunnill says.

In addition, the automatic flushing units have been married to the district's automatic meter reading (AMR) system so that water consumed for flushing can be accounted for. "We have an accurate record, and our water-quality personnel can reference this information to ensure the quantity they need to maintain chlorine residuals is sufficient," he says.

A PDA included with the valve maintenance trailer lets Glenn McCarty enter data on a valve.

The district's total program, from valve exercising and repair to leak detection and flushing, is designed to be proactive. "Everybody ought to have a proactive maintenance program," says Wood. She reports that the district is experiencing fewer outages, less manual labor, lower leakage, and an increased comfort level.

"It's not just about fixing problems we know about," she says. "It's about avoiding problems in the future." Especially on those dark and rainy nights. ✦

MORE INFO:

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