

FOCUS: SEWER

DRIVING DOWN I/I

CIPP lining and grouting of lateral connections proves to be a sound formula for tightening sewers in Graettinger, Iowa

By Joe Hastreiter

For years, the wastewater utility in Graettinger, Iowa, dealt with a major wet-weather problem — clear water flowing into the sewer system. With a high water table, the city's inflow had been running at about five times the acceptable level.

Typically, residents have to drill down only 34 feet to hit water. This high water and resulting inflow created wastewater treatment problems. The city had tried over the years to reduce infiltration and inflow (I/I). In the late 1960s, the utility did some grouting on its Main Street line, mainly focusing on active leaks.

and the other two cells were raised two feet. "The lagoon was not expanded to the size dictated by the city's flow, but to the maximum size we thought was reasonable," says Wall.

At 7 feet deep, the lagoon's primary cell holds 11.9 million gallons, the secondary cell 8.8 million gallons, and the third 8.4 million gallons. The lagoon covers 19.7 acres.

By enlarging the lagoon, the city was able to get a variance from its discharge permit from the Iowa Department of Natural Resources (IDNR): The agency no longer requires testing for ammonia and nitrogen.

Still, efforts to reduce I/I had to continue. "The directive to continue I/I reduction has become almost a standard comment in reports filed by the IDNR following wastewater facility inspections across the state," says Wall.

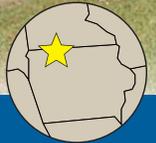
Another plan

Graettinger's permit states that wastewater must be held in the lagoon for 180 days. When spring rains and snow melt arrived, however, the expanded lagoon proved unable to meet the detention time. According to Paul Kroenke, city utility superintendent, the DNR then wanted the city to switch to continuous discharge. "That would change our whole mode of operations and make it difficult to obtain a new permit," he says.

For one thing, Kroenke explains, "discharging continuously from the lagoons 365 days a year requires aeration, and we didn't want to go there. Furthermore, DNR discharge regula-



A technician from Visu-Sewer Clean & Seal Inc. starts an inspection of a sewer main in the City of Graettinger, Iowa, as part of the city's program to control inflow and infiltration.



tions require monitoring the flow of the Des Moines River daily to assess the dilution rate. We needed to know how many cubic feet were running on a particular day at the time of discharge."

Located in northwest Iowa, Graettinger, with about 900 residents, is too small to afford its own measuring station. The nearest one is at Humboldt, Iowa, about 70 miles south. Consequently, Wall set up a database from the Humboldt station that Kroenke could access using his computer, but the solution was more complicated than that.

The utility had to expand its effluent testing to include ammonias and nitrogen, "just what we were trying to avoid," says Kroenke. "We have no in-house lab, so tests for TSS and BOD₅, flow monitoring, cell measurement, and pH balancing are outsourced. I can't imagine how much more the additional testing would cost, and we're just too small to absorb that expense."

The effluent meets all its sampling criteria. Kroenke says so much water flowed in that "the samples always showed a less-than symbol in front of

PROFILE: City of Graettinger, Iowa

ESTABLISHED:
1883

POPULATION:
922

AREA SERVED:
0.8 square miles

TOTAL SERVICES:
450

PIPE INFRASTRUCTURE:
7,650 miles of 8- to 12-inch

ANNUAL BUDGET:
\$86,000

WEB SITE:
www.graettinger.net

our numbers." Viewing the continuous discharge option as unacceptable, the utility took another approach: Reducing the volume of groundwater entering the sewers.

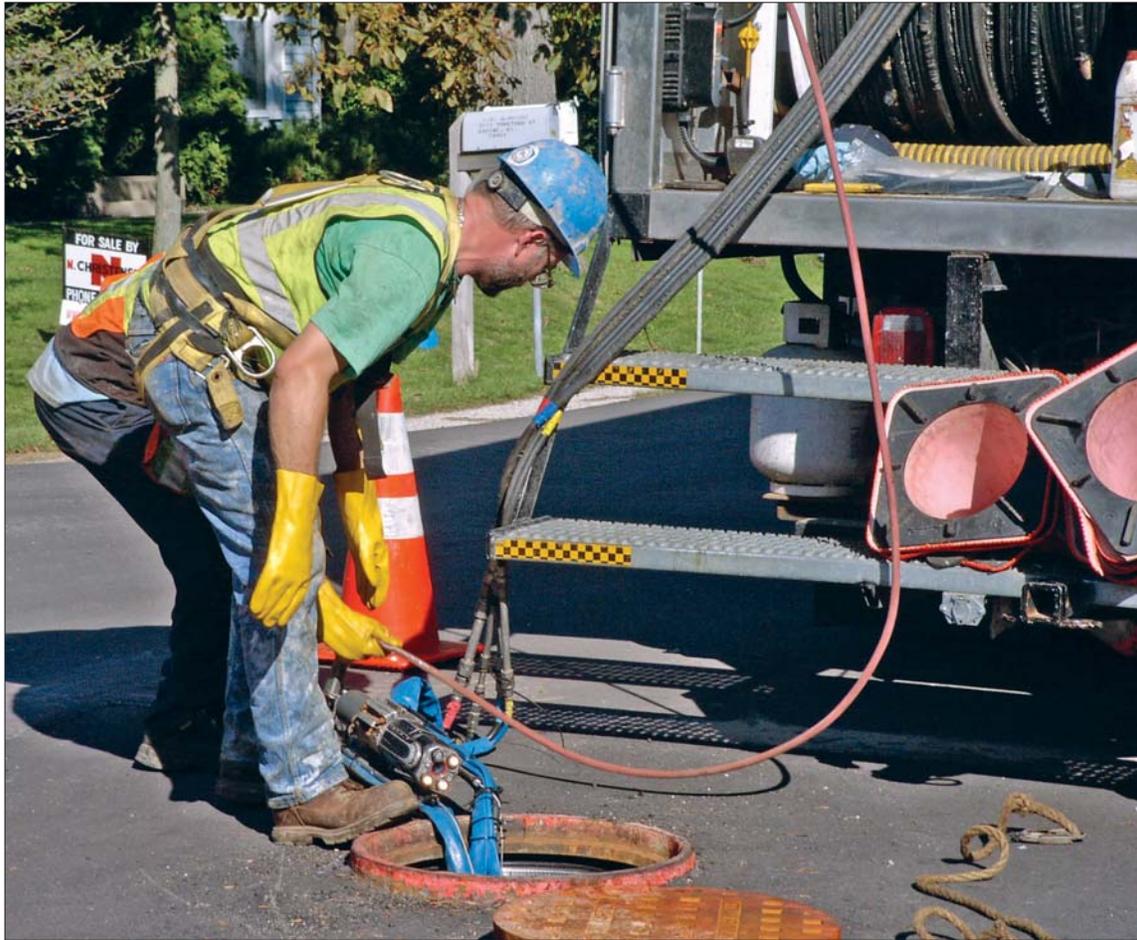
Video points to problem

Utility staff had good reason to



A fully outfitted camera van lets operators control the inspection and record findings.

Then in 1994, Graettinger expanded its wastewater treatment lagoon system, says Thomas Wall of DeWild Grant Reckert & Associates (DGR), the city's engineering consultant firm in Rock Rapids, Iowa. A third cell was added



Camera inspection precedes CIPP lining in the city's I/I control program.

capacity of the lagoons,” says Wall. The two-year process to line 3,050 feet of city sewers began in 2003. DGR identified the pipe sections to be repaired and helped the city pursue and justify the funding, which came from the Iowa State Revolving Fund (SRF) loan program.

Requests for bids were sent to six companies and Visu-Sewer Clean & Seal Inc., a National Liner installer in Pewaukee, Wis., was selected. As a result of the favorable bid price, the city was

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Paul Kroenke

able to add more blocks to the project, bringing the total to 22. This included 13 blocks of 12-inch sewer on Main Street, seven blocks of 8-inch line on side streets (those with the worst infiltration), and two blocks of alleys that the city had been unable to clean.

Visu-Sewer video-inspected the lines, cut roots, and cleaned the pipe with high-pressure waterjetters. The crew worked from manhole to manhole, inserting the liner through the pipe section using water inversion.

Lining the pipes

The custom-designed liner was made of 6 mm and 7.5 mm needle-woven polyester felt. The first step is a wet-out process in which the liner is laid on a processing table and a resin and catalyst system injected. The liner is then fed through rollers that compress the “dry bag” to a specified thickness and saturate it with resin.

To prepare the liner for the pipe, the first five to six feet are opened to a circular shape, and the leading edge is fastened to a circular frame. This results in a pocket into which water is pumped. The force of the water propels the liner down the pipe and turns it inside out.

Once deployed, the ends of the liner are secured, and the water is heated to 180 degrees F to activate curing. Temperature and water pressure are maintained throughout the process. Once cured, the liner is cooled and the ends trimmed and secured inside the manhole.

The next step is to re-instate the laterals to restore sewer service to prop-



A crew prepares a CIPP lining from National Liner for a trenchless repair job on a main in Graettinger.

suspect deteriorating pipe joints as the problem. In 1976, a video inspection program revealed defects in the sewer lines, and experience confirmed the observation. “Whenever it rained and the water table rose, so did the flow numbers,” Kroenke says. “When it was dry, the numbers went back down.”

The joints were a major problem: Nearly every one leaked. The clay tile pipes had been laid as a Work Progress Administration (WPA) project during the Depression. “Old sewers were laid with short pieces of pipe 2 1/2 to 3 feet long,” DGR’s Wall observes. “This resulted in hundreds of handmade

joints packed with hemp or rope after the spigot was inserted into the bell.”

Packing was supposed to be inserted all the way around the joint, but offset joints, where the spigot sits on the bottom of the bell, were a common problem. “Someone working in a deep trench and fighting water probably didn’t do a very good job of making those joints,” says Wall.

Several decades later, Graettinger faced the challenge of improving the integrity of its sewers, especially the 12-inch clay main outfall sewer running for about 13 blocks along Main Street’s business district. The cost of replacing that sewer under a concrete street would have been prohibitive. “Because of our sandy soil, we probably would have lost the whole street trying to replace that line,” says Wall.

The liner option

As an alternative, Graettinger chose to install cured-in-place pipe lining. Buried about 20 feet down, the Main Street sewer was suspected as the largest contributor to infiltration because of its depth, sandy soils, and proximity to the Des Moines River.

“By lining the Main Street sewer, we believed we would achieve enough reduction to come within the treatment

erty owners. After video-inspecting the repaired pipes, the Visu-Sewer crew deployed a remote-controlled pneumatic cutter to open the laterals.

Kroenke observes that residents of small towns need access to main street businesses because, typically, they can't drive across town to find a similar store or service. In Graettinger, essential businesses included a grain elevator, beauty shop, medical clinic and café.

"Visu-Sewer really took care of the people and businesses," Kroenke says. "When they had to interrupt businesses or activities, the crew worked straight through the weekends to complete that part of the project. It all worked out and couldn't have been handled better. The communication was excellent."

After finishing Main Street, the lining crew moved to the side streets, and finally the alleys.

"By lining the Main Street sewer, we believed we would achieve enough reduction to come within the treatment capacity of the lagoons."

**Thomas Wall
DeWild Grant Reckert
& Associates**

Lateral grouting

In the last step to prevent infiltration, connections to the main line were grouted in place. During this process, three bladders within the lateral packer from Logiball Inc. were used to isolate the connection: two in the mainline (one on each side of the connection) and a third in the lateral. The bladders were inflated and the joint pressurized to force gel grout out and around the

connection. As the grout set, it stabilized the soil and formed a watertight seal.

"The process was something to watch," says Kroenke. "After work, I would stop to see what they were doing. They would go through the sewer with a camera and cutter. They had it measured so well, they could spot the indentation from the laterals. At each indentation, they cut a hole in the middle of the invert, then ground it out, bigger and bigger, until it tapered smoothly into the existing sewer. It was just as neat as could be."

Flow reduction

The impact of the lining process was instant: Kroenke could tell immediately what sections the crew had finished on Main Street. The drop in flow was so dramatic that at first he questioned the numbers. "I decided to re-figure my volumes because I thought I miscued, but the numbers were correct," he says.

The flows dropped by 400,000 to 500,000 gpd over four weeks. "I have never seen that dramatic a change," says consultant Wall. "If you reduce

flow by 500,000 gallons a day, that is almost 350 gallons per minute. That is a lot of water."

Wall says Graettinger's flow should be around 80,000 gpd. Before the lining/grouting was done, the peak flow was 600,000 to 700,000 gpd. "The lining has resulted in a twofold advantage for the community," he says. "It reduced the infiltration and inflow and extended the life of the wastewater infrastructure."

Kroenke observes that the lining project reduced flows enough to satisfy the DNR. "Our objective was to re-qualify for our original permit — the one we've had for more than 20 years — and eliminate the additional expense of sampling for ammonias and nitrogen," he says. "Visu-Sewer made it possible. That is a big relief."

Visu-Sewer president Keith Alexander notes that cured-in-place lining technology has been used for more than 30 years in sanitary and storm sewers and



A lateral packer system from Logiball Inc. is deployed on a grouting project. Grouting and CIPP lining were the city's preferred methods of sealing lines against I/I.



in a variety of industrial applications. The liners are designed for a 50-year life.

"Many communities facing groundwater infiltration have found that CIPP lining along with lateral connection grouting can be very effective," says Alexander. "It helps them deal with the problem, maintain their permits, and avoid the uncertainty and added cost of trying other abatement measures."

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