

Construction crews begin a cured-in-place pipe installation. W.K. Dickson



Find a problem?

Streamlined sewer rehabilitation approach can save costs, hasten repairs

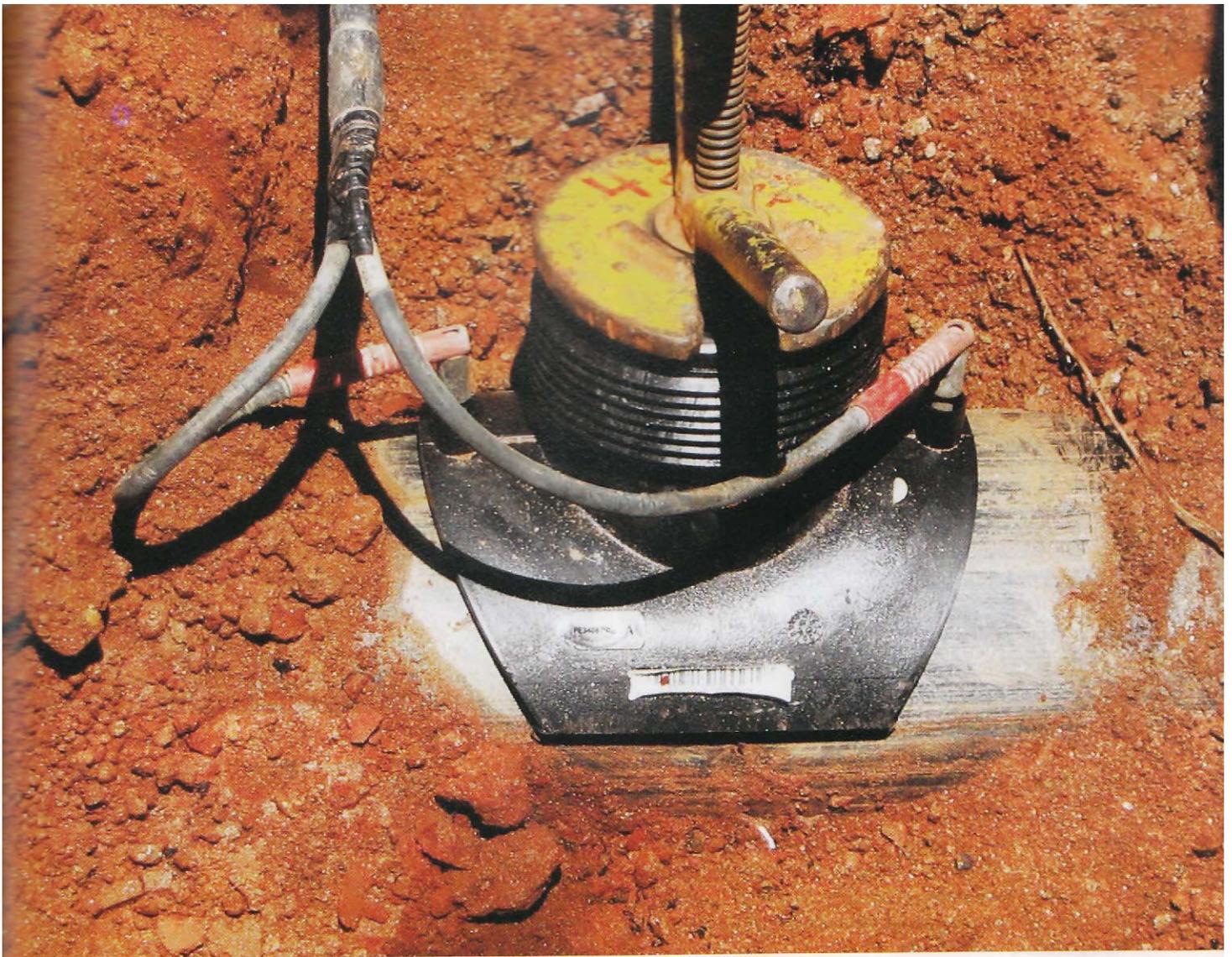
Ryan W. Hager

To comply with tightening regulatory requirements and restore the performance of its sewer system, the City of Conover, N.C., has implemented a long-term sanitary sewer rehabilitation program. The rehabilitation and repair work is designed to reduce infiltration and inflow (I/I) in order to eliminate sanitary sewer overflows (SSOs) and increase sewer capacity.

Conover provides water and sewer service to more than 5500 customers. The city's sewer system is composed of two major basins, including more than 190 km (120 mi) of sewer lines. The flow from one of these basins is treated at a neighboring municipality's wastewater treatment facility. In the other basin, an

average 2460 m³/d (0.65 mgd) of flow is conveyed via 88,000 m (290,000 ft) of sewer interceptor and collection lines to the 5700-m³/d (1.5-mgd) Northeast Wastewater Treatment Plant.

The Northeast Outfall/L'Echo Park service area was a high priority for repair. The subbasin, with some sewer lines reported to be nearly 100 years old, has a long history of maintenance issues. The city's oldest and most prominent residential neighborhood, L'Echo Park encompasses part of downtown Conover and numerous commercial establishments. The recurring SSOs during rain events prompted immediate corrective action to this service area, which comprises approximately 23,000 m (76,000 ft) of gravity sewer lines and 350 manholes.



A high-density polyethylene pipe (HDPE) service connection fuse is welded to the main HDPE pipe.
W.K. Dickson

Fix it!

Selecting the approach

When selecting the sewer rehabilitation technology, the primary challenge was finding a cost-effective way to minimize service interruption and impacts to the properties. With the assistance of W.K. Dickson & Co. (Charlotte, N.C.), the City of Conover performed a preliminary investigation to determine the primary problematic sewers within the service area. The aboveground investigation was performed during both dry and wet weather periods. It was intended to provide a basic idea of the deficient sewers, rather than identify specific problems. The information gleaned from this effort, combined with Conover's historic knowledge of the problem areas, helped the project team identify 5600 m (18,500 ft) of sewer lines as the most problematic. The project team used this footage as the basis for performing an alternatives analysis.

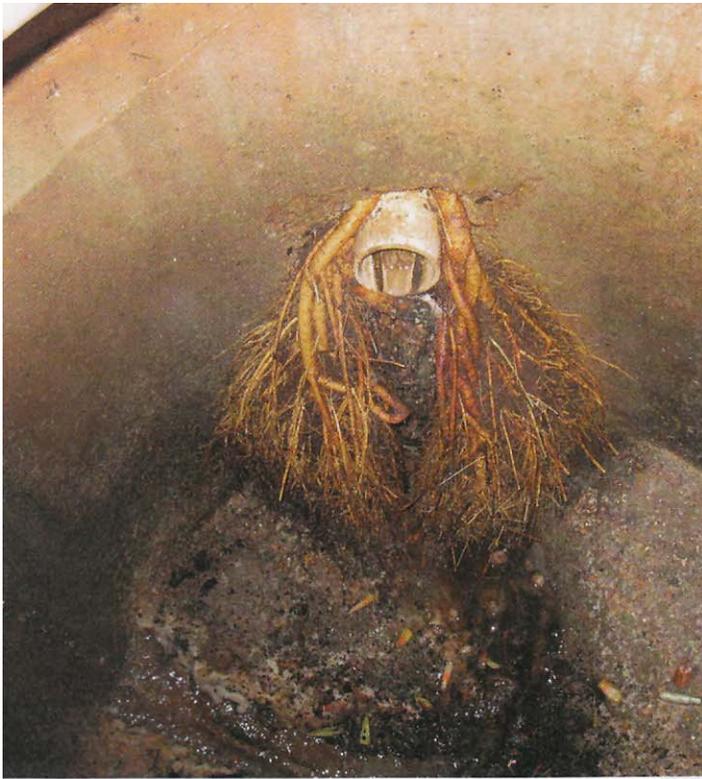
The alternatives evaluated included a total replacement for \$2.8 million, a total cured-in-place pipe lining for \$2.1 million, or selective repairs for \$1.7 million. The city opted for the selective

repairs alternative, as it was the least expensive approach and would minimize impacts to the residential properties.

Find-it/fix-it

The selective repairs were performed using a "find-it/fix-it" approach that combined field investigation and engineering analysis with actual rehabilitation. This approach consisted of five primary steps: identifying the target area, conducting a preliminary investigation, bidding a "nonspecific" construction project, inventorying sewer system problems, and issuing construction work orders.

After the L'Echo Park service area was targeted, the engineering consultant performed a preliminary aboveground investigation to understand the severity of the problem. Next, the project team prepared construction documents that included specifications for a multitude of construction repair techniques. The construction documents included all pertinent construction repair details, a project area map generated from a geographic



Pipes damaged by severe root intrusion (left) were repaired with injection grouting (right). W.K. Dickson

information system (GIS) database of the sewer system, pay item descriptions detailing work to be performed, and technical specifications. The more than 200 bid items included

- sewer cleaning and closed-circuit television (CCTV) inspection of various-diameter sewers;
- various point repair lengths and depths to repair sewer defects via excavation;
- service lateral rehabilitation via excavation;
- rehabilitation of manholes using specialized cementitious coating;
- pipe replacement to address capacity issues;
- manhole replacement and rehabilitation, such as manhole raising and installation of watertight covers;
- installation of cured-in-place pipe lining for shorter sections of the sewer line; and
- pipe-bursting with high-density polyethylene lining, manhole to manhole.

While the bidding process was under way, the consultant performed sewer system evaluation surveys throughout the selected basins. The first priorities were the trunk sewer manholes and the main collector manholes.

The consultant performed smoke testing to identify leaks in the sewer lines, as well as areas that might need further investigation through CCTV cameras. This resulted in CCTV investigation of approximately 11,580 m (38,000 ft) of sewer lines, nearly twice the amount of sewer originally identified as most problematic, highlighting the flexibility of the “find-it/fix-it” approach. All leaks identified from the smoke testing were repaired, regardless of the amount of inflow that may have entered the leaks. Field sketches showed the exact location of the repaired leaks. The project team identified and compiled system problems and repairs in a GIS database.



Prior to the repairs, water-filled manholes were common after moderate rain events. W.K. Dickson

Next, construction work orders were submitted to the contractor for implementation. Work orders consisted of tabular forms identifying the repair line items from the bid form, estimated quantities, repair locations, and maps highlighting the repair areas. The first work order was to clean the sewers and inspect them with CCTV to further isolate the sewer defects.

Upon review of the inspections, the consultant determined that repair work, such as point repairs, sewer replacement, and sewer linings, should be performed. CCTV inspections were also performed for known maintenance problems and points of recurring overflows. The consultant then produced sequential work orders for sewer-line and manhole repairs using GIS. It is important to issue sewer-line repair work orders before manhole work orders to avoid damage to newly restored manholes.

Results

The contractors performed extensive rehabilitation work in the Northeast Outfall/L'Echo Park subbasin (see table, above). All of the severe I/I defects and most of the moderate defects were repaired via point repairs. The contractor repaired all inflow defects regardless of severity. The final cost of the rehabilitation work was approximately \$1.4 million.

Conover reaped many benefits from the find-it/fix-it approach. The city was able to show regulatory agencies that it had a strategic plan for minimizing overflows and reducing I/I. An "on-call" contractor was available to perform any needed rehabilitation throughout the construction period.

The city saved time and money by avoiding traditional permitting, design, and bidding processes. Once the manholes and sewers were inspected and evaluated, the engineer immediately wrote work orders to the contractor to repair the identified leaks. The "design" and rehabilitation work was streamlined for quick, effective repairs. Since the design and construction phases occurred at the same time, sewer cleaning and CCTV inspections were conducted once, rather than the two times required

Rehabilitation work in the Northeast Outfall/L'Echo Park subbasin

Investigative work completed	
Manhole inspection/inventory	350
Smoke testing	76,000 ft
CCTV inspection	38,000 ft
Rehabilitation work completed	
Main sewer rehabilitation (total basin = approx. 76,000 ft)	
CIPP	5,964 ft
Pipe bursting	1,925 ft
Line replacement	1,325 ft
Point repairs	114
Manhole rehabilitation (total basin = approx. 350 manholes)	
Cementitious mortar coating	59 manholes
New manholes	10
Inflow dishes	55
New frame and solid cover	8
Locate and raise manholes	3
Raise manholes to grade	15
Reset existing frame and cover	37
Rebuild benches and invert	52
Seal active wall leaks	24 manholes
Service lateral rehabilitation	
Repair/replace laterals	120
Repair/replace cleanouts	160

CCTV = closed-circuit television.
CIPP = cured-in-place pipe.

for a traditional approach. This alone saved the city costs of \$5 to \$10/m (\$1.50 to \$3/ft).

Conover will continue using this approach to fast-track rehabilitation construction and reduce peak wet weather flows.

Ryan W. Hager is a project manager at W.K. Dickson & Co. Inc. (Charlotte, N.C.).



A construction crew fuses two pieces of high-density polyethylene pipe in preparation for pipe-bursting operations. W.K. Dickson