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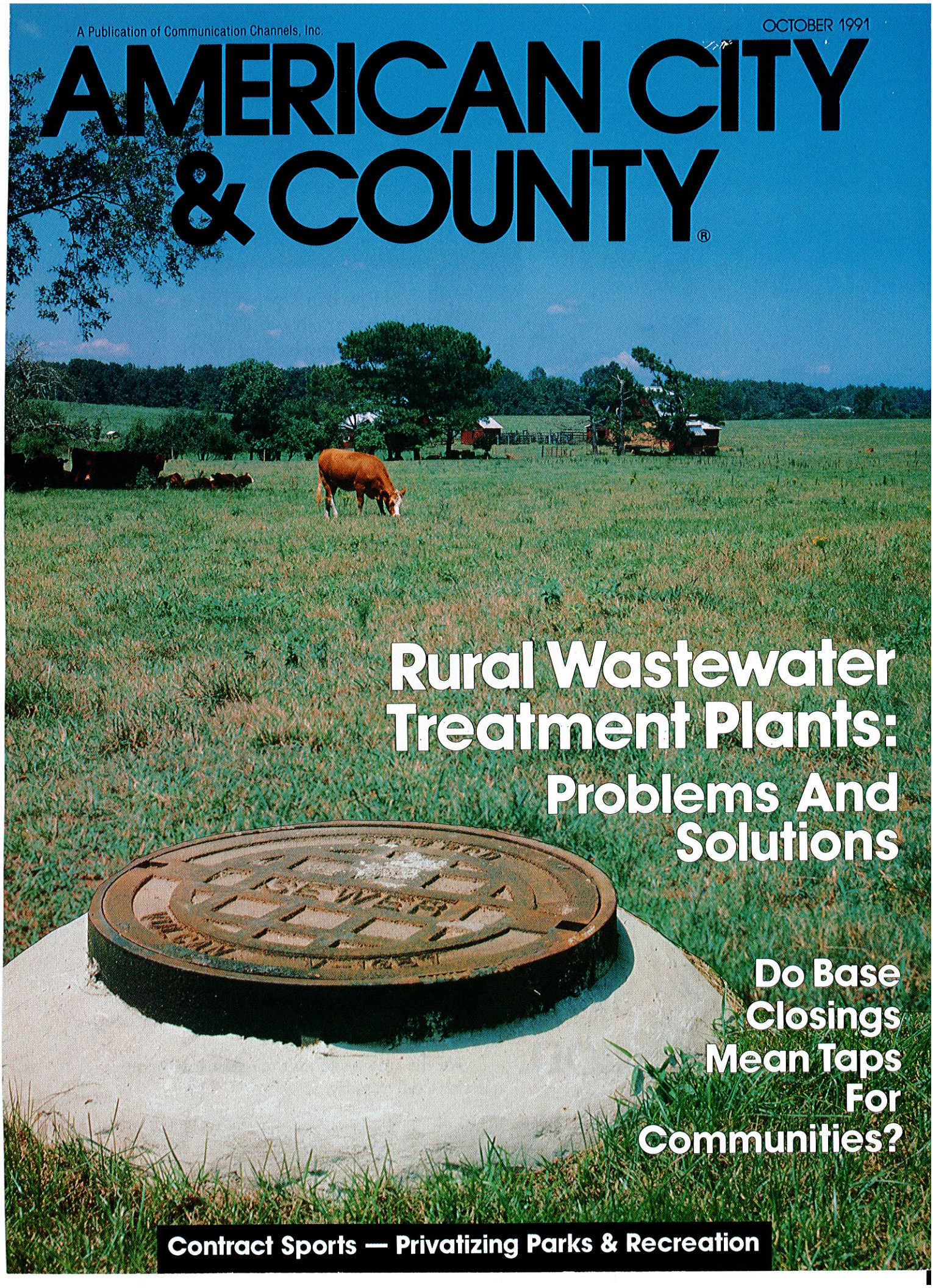

Rural Wastewater Treatment Plants: Problems And Solutions

Do Base Closings Mean Taps For Communities?

Contract Sports — Privatizing Parks & Recreation

Concrete Arch Bridge Restored in Pasadena

Pasadena, Calif., recently completed the $1-million rehabilitation of the San Rafael Bridge, a classic concrete arch span over the Arroyo Seco. The project's purpose was twofold: restore the bridge's distinctive architectural details and prevent additional deterioration that eventually would threaten its structural integrity.

At the time of its completion, the San Rafael Bridge was an important link between Pasadena's commercial center and newly annexed neighborhoods. By linking eastern and western Pasadena, the bridge played a key role in the city's development. However, modern roadways have relegated the structure to light traffic moving to and from nearby neighborhoods.

"The project's main purpose was to arrest the deterioration of the bridge," said Clark Robins, structural engineer for the project. "Yet a strict part of the specifications was to preserve the architectural character."

The work called for a range of expertise in concrete repair and restoration. The project included removing, replicating and replacing the ornamental balustrade; reconstruction of the pedestrian sidewalk and curbs; repair of spalled concrete; and removal of six inches of roadbed which were replaced with a two-inch asphalt traffic surface. The San Francisco branch of Western Waterproofing Co., general contractor for the project, completed the work in 10 months.

The bridge has an overall length of 431 feet. With a rise of just under 43 feet from its spring points, the main arch is 154 feet long with 50-foot backspans. There are no piers at the arch ends. Instead, the bridge deck is supported on columns spaced on 16-foot centers starting at each end of the bridge. The center portion of the arch carries the traffic deck directly.

The nine-inch-thick, reinforced concrete deck is a two-way slab with six-foot, eight-inch spans. The deck-support beams cantilever beyond the deck edge beam to support the sidewalk. Where the beams bear on the support columns, concrete brackets were cast at 45-degree angles upward from the columns to the cantilever beams.

The ornate balusters were precast units on 16-foot centers corresponding to pier spacings. Pole-mounted street lights, characteristic of the period, were spaced at even intervals along the bridge.

The city's consultants determined that although the superstructure remained essentially sound, the bridge had been built with insufficient concrete cover over the reinforcing bars (rebars). Moisture penetrated tiny cracks in the concrete and migrated to the rebars, causing them to corrode and the concrete to spall.

The bridge was closed to traffic throughout the rehabilitation. The first step was to create scaffolding to access the outside faces and the undersides of the bridge. The work then began with demolition of severely deteriorated elements and the preparation of spalled areas for patching.

Because of the deterioration of many vertical beams and brackets carrying the bridge deck and sidewalk, crews had to repair them in a "leap frog" sequence, skipping every other one to ensure continued support for the bridge. □