Riverside Uses FFRPP Rehabilitation for the Magnolia Avenue Sewer Force Main Project

By: Paul Gagliardo, MPH, PE, Gagliacqua Consulting

Riverside is a city in and the county seat of Riverside County, California, in the Inland Empire metropolitan area about 50 miles southeast of Los Angeles.

The city owns and operates a sanitary sewer collection system consisting of over 830 miles of sewer lines ranging in size from 4 inches to over 50 inches in diameter with some more than 120 years old. Treatment is provided at the Regional Water Quality Control Plant (RWQCP), which provides preliminary, primary, secondary, and tertiary treatment for a flow rated capacity of approximately 46 million gallons per day (mgd). In addition to wastewater from the City's collection system, the city also provides domestic and industrial wastewater treatment services for the Community Services Districts of Edgemont, Jurupa, and Rubidoux. The RWQCP comprises two treatment plants and a common tertiary filtration plant, serving a population of almost 400,000 people. At the plant, wastewater is treated to tertiary levels before it is reused for irrigation or discharged to the Santa Ana River.

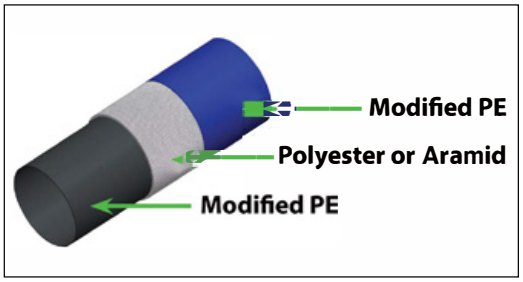
In 2024, the City of Riverside faced a significant challenge in rehabilitating a 2-mile-long, 24-inch concrete-lined and coated steel force main pipeline installed in the 1970s. The forcemain had experienced internal corrosion that affected its structural integrity. Following a failure and major cleanup effort in the early 2000s, the pipeline was decommissioned and left out of service. The city constructed a redundant force main to maintain operations and decided to mothball the original pipeline due to concerns over further failures. However, increasing demands for system redundancy necessitated its rehabilitation.

> *"Rehabilitation methods often cost 50-75 percent less than full pipe replacement."*

The Magnolia Avenue Sewer Force Main Rehabilitation project focused on the repair and rehabilitation approximately 9,845 L.F. of an existing 24-inch Cement-Mortar Lined & Coated (CML&C) steel pipe.

Municipal pipeline rehabilitation using a liner system generally offers significantly greater value compared to a total replacement. This trenchless rehabilitation technique is typically much less expensive, requires less permitting, causes minimal disruption to the community, and takes less time to complete. It can extend the life of existing infrastructure while still maintaining functionality, making it a more cost-effective option for most situations where the pipeline is not severely damaged. Rehabilitation methods often cost 50-75 percent less than full pipe replacement, resulting in substantial savings. Because relining projects only have access pits and not open trenches, the permitting requirements are much lower. This reduces time to completion, cost, and complexity. Properly rehabilitated pipelines can have their lifespan extended by 50 years, delaying the need for complete replacement. Rehabilitation projects usually take less time to complete compared to full replacement, minimizing service disruptions. Project sections can be opened and closed within a day. The interruptions involved with the trenchless method are minimal. When using a Flexible Fabric Reinforced Plastic Pipe (FFRPP)or CIPP pipelining for pressure applications, the restoration takes place from access pit to access pit. Digging to replace pipes will require more time, be more disruptive, and increase expenses. There are also other factors to consider, including diverting traffic away from the area where the contractors are digging. Another factor with the dig and replace method is that surface restoration is also necessary.

Since the city had already constructed a separate force main pipeline to replace the existing one, they were aware of the cost and disruption implications. When it came to increasing capacity and redundancy in the area the obvious choice was to rehabilitate the existing pipe with a trenchless liner system.



BulletLiner™ FFRPP can operate at pressures from 75 psi to 300 psi



BulletLiner™ has a basic three step installation procedure: 1) fold the liner into a U-shape, 2) Pull the liner through the host pipe, and 3) expand the liner

CIPP is a trenchless method for repairing pipes that involves inserting a flexible liner into an existing pipe, inflating it, and then hardening it with heat or ultraviolet light. CIPP is suitable for repairing pipes that do not need to be upsized and can be completed in less time than other methods.

This technology is currently the most common method for gravity pipe rehab applications, but is still in the early developmental stages for pressure pipe applications with many limitations including distances, size, QA/QC limitations on site, and pressure capabilities. The specifications used by the city in the bid process required contractors to bid using the CIPP solution. The bid proposals received exceeded the $7 million budget by over 30 percent. Because the bids received were more than 30 percent over budget the bids were rejected, and an alternative solution was sought.

CPM Pipelines proposed the BulletLiner™ System as an alternative solution to the city. CPM specializes in providing field inspection services for pipeline condition assessment projects and specialty pressure pipe rehabilitation systems and technologies. CPM has executed thousands of projects throughout the United Sates. Innovative cost-efficient systems of this type were first

Liner is very flexible and can be installed through 45 degree bends and 90 degree bends with downsizing

> *Properly rehabilitated pipelines can have their lifespan extended by 50 years.*

Installation requires only two small access pits

FFRPP can be pulled 2000 to 8000 feet between pits

introduced by CPM pipelines in 2013. The BulletLiner System™ was introduced in 2023, and in just two short years has over 50,000 feet of installations.It is a semi-structural Class 3 pipe FFRPP rehabilitation system. It is NSF 61 approved, contains no PFAS and is suitable for the transportation of various liquids including potable water, reclaimed water, wastewater, with drinking water approvals in numerous countries. It is a three layer product including an inner liner made of modified polyethylene (PE), an inner woven pressure layer of polyester or aramid and an outer jacket of modified PE. It can operate at pressures from 75psi to 300 psi.

It is a close fit liner and can be deployed in pipes from 2 inch to 64 inches in diameter. It can be used in many trenchless rehabilitation applications including gas and oil and works independent of the host pipe, or in conjunction with the host pipe dependent upon the specific project design parameters and pressure requirements. This type of system has been internationally proven for over 25 years, and BulletLiner™ for the past 12 years. This method has been used to rehabilitate over 200 pipeline segments totaling over 1000 km of pipe length. The BulletLiner™ has a basic three step installation procedure; 1) fold the liner into a U-shape, 2) Pull the liner through the host pipe, and 3) expand the liner.

There is no connection or bond between the host pipe and liner system, so it allows the liner to flex independently of the host pipe. The slightly rigid liner maintains a round shape inside the pipe even without pressure. It is flexible and can easily be pulled through 45 degree bends.

The liner is flexible, foldable, and light with the material strength of a steel pipeline. Due to the extreme flexibility, it opens up a variety of rehabilitation applications without having to trench and remove pipelines. Installation requires two small excavation pits or access points for rehabilitating a deteriorated section of pipe.

This reduces the conventional pipeline replacement noise, traffic disturbances, time-consuming reconstruction as well as environmental and economic impacts to surrounding landscape and businesses. This system, designed for restoring the structural integrity of aging pipelines, offered several advantages over traditional methods, including requiring less access pits, streamlining installation and providing a similar solution to CIPP at a lower cost. Trenchless rehabilitation techniques require minimal excavation, reducing surface disruption and inconvenience to residents and businesses. FFRPP systems can be pulled 2000 feet or more between access pits depending on size and geometry.

In some cases, when pipe is straight, it can be pulled up to 8000 feet. Minimizing access pits reduces costs and impact on the surrounding community and traffic.

This solution provides a budget-friendly, permanent rehabilitation to aging infrastructure with a 5-year material warranty, and 50-year design life at approximately one-third the cost of dig and replacement.

The city revised its specifications and bid documents to allow for the use of the FFRPP technology. The project was rebid with the BulletLiner™ System specifications, and SAK Construction emerged as the sole bidder, meeting the City's budgetary and technical requirements. By reducing access pits from 20 to 11 and liner installations from 15 to 8, the BulletLiner™ System brought the project back within budget at $6.75 million. Completed in late 2024 the project achieved a renewed pipeline with a 50-year design life with a 5-year warranty.

The City of Riverside has successfully modernized its sewer infrastructure and maintained redundancy while adopting an innovative, cost-effective solution. This project underscores Riverside's commitment to proactive asset management and positions the city as a leader in adopting new technologies to enhance utility performance.

ABOUT THE AUTHOR:

Paul Gagliardo, MPH, PE *is an independent consultant assisting and advising innovative water sector startup companies. He has held leadership positions in the water and wastewater business for over 30 years at the city of San Diego, American Water and multi-national consulting companies. Paul has been a judge for the Imagine H2O Accelerator since its inception in 2009. He is a registered engineer in the state of California and has a Master's Degree in Public Health. He is also the host of The Water Entrepreneur podcast.*