Omaha Public Works Tackles Challenging WRRF Rehabilitation Projects

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- City of Omaha
  - Founded in 1854; Population 446,970 (2016)
- Average annual population increase of 3,344 from 2012 - 2016
- The population density of Omaha is 1242 persons per square kilometer. Since the year 2000, the city has grown more than 13% and the state entirely has grown consistently
- Nearly 1.3 million people reside within the Greater Omaha area, comprising a 50-mile (80 km) radius of Downtown Omaha, the city's center.

City of Omaha Public Works Department

- City of Omaha sewer system:
  - 3 types of collection systems
    - waste or raw sewage (sanitary)
    - rainwater runoff (storm)
    - both (combined)
- The City owns and maintains just over 2,100 miles of sewer collection pipelines in a service area that is approximately 320 square miles
- They provide service for a population of approximately 600,000.

Omaha Service Area:

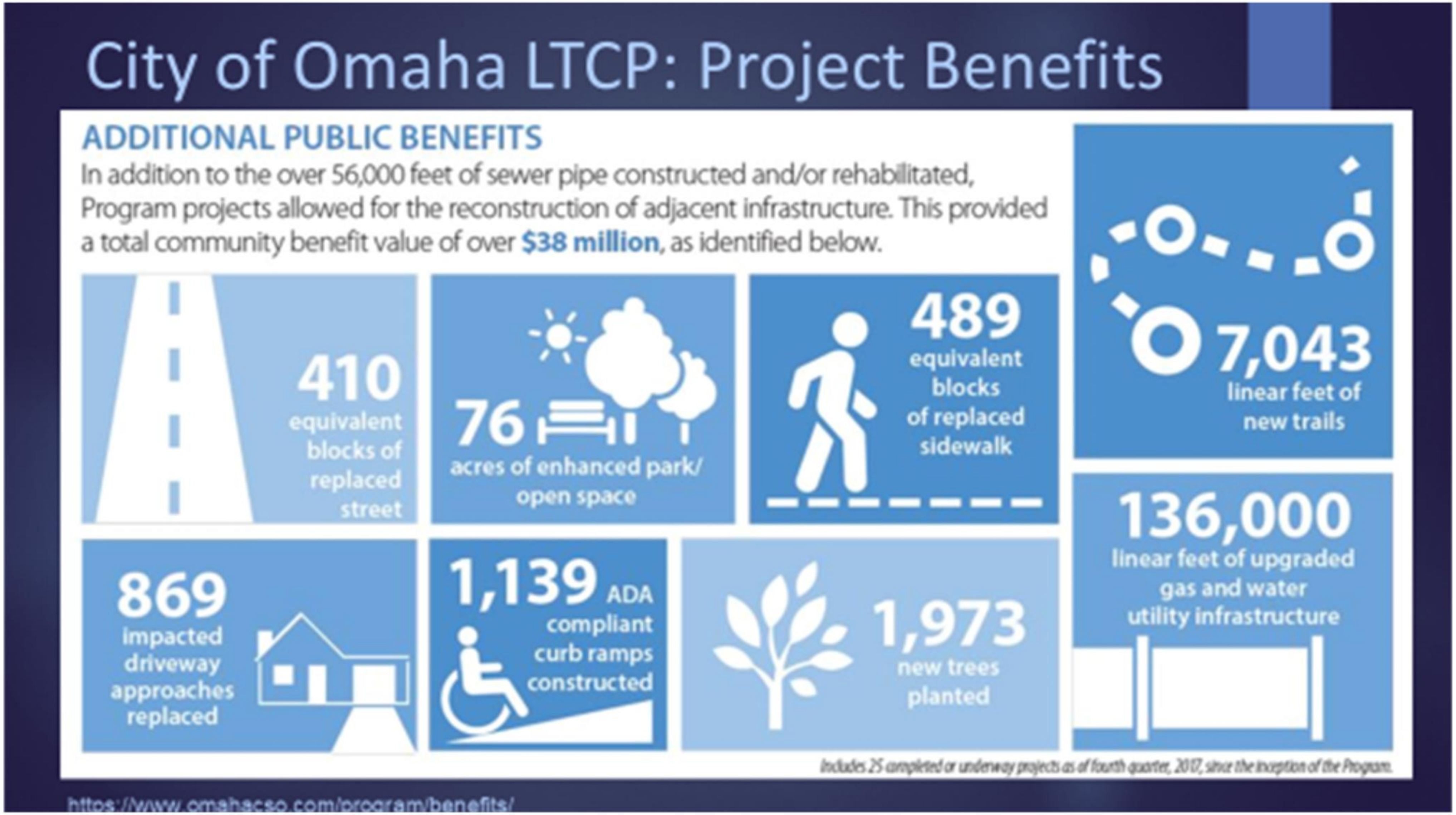
Source: https://publicworks.cityofomaha.org/residents2/sewers/sewer-system

City of Omaha Long Term Control Plan (LTCP)

Project Goals and Timeline:

- Reduce overflows from combined sewer outfalls
- Improve water quality in the Missouri River and Papillion Creek
- Initial LTCP developed in 2006 and approved in 2009; Implementation began in 2009
- Omaha is committed to implementing the LTCP by October 2037

CSO Program Schedule


City of Omaha LTCP: Project Benefits
ADDITIONAL PUBLIC BENEFITS
In addition to the over 56,000 feet of sewer pipe constructed and/or rehabilitated, Program projects allowed for the reconstruction of adjacent infrastructure. This provided a total community benefit value of over $38 million, as identified below.
410 equivalent blocks of replaced street
76 acres of enhanced park/ open space
489 equivalent blocks of replaced sidewalk
7,043 linear feet of new trails
869 impacted driveway approaches replaced
1,139 ADA compliant curb ramps constructed
1,973 new trees planted
136,000 linear feet of upgraded gas and water utility infrastructure
Includes 25 completed or underway projects as of fourth quarter, 2017, since the inception of the Program.
https://www.omahacso.com/program/benefits/

City of Omaha LTCP: Project Benefits

Riverfront Development

Safe Waters for Fishing

Improved Water Quality for Boating

Green Infrastructure in Public Parks

https://www.omahacso.com/program/benefits/

Evaluating Solutions

- Trench-and-replace
- Cured-In-Place (CIPP)
- High-Density Polyethylene (HDPE)
- Fine Aggregate Composite Concrete (FACC)
- Coatings

Evaluating Options: Trench & Replace

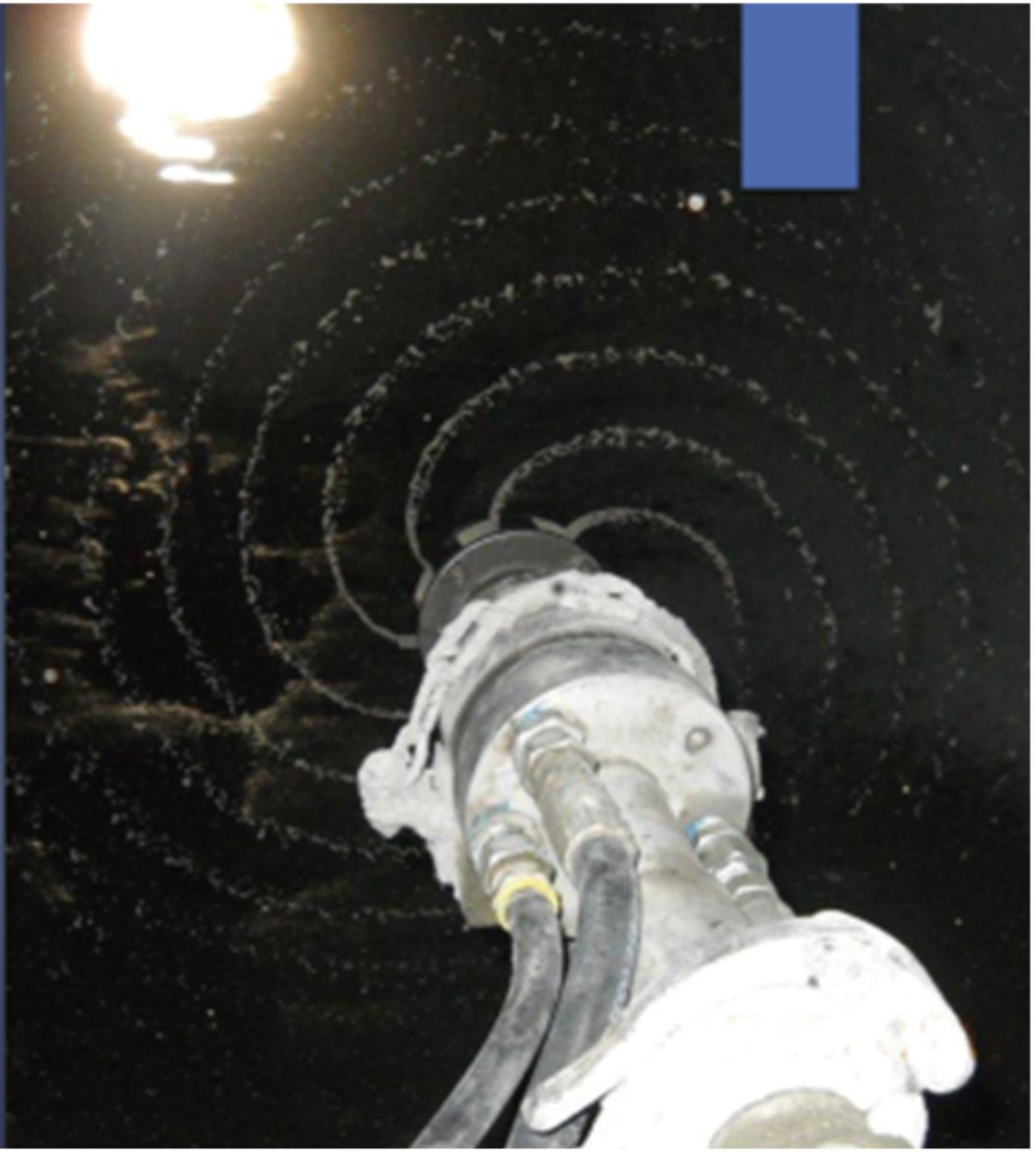
- Useful if larger pipe is needed to increase flow capacity
- Disrupts surface activity; economic costs to business owners and other stakeholders can be prohibitive
- Stopping traffic, environmental disruption, and disturbing other underground assets such as power lines, can also be costly
- Except in undeveloped areas, most cities will go to great lengths to avoid digging new trenches

Evaluating Options: CIPP

- Good choice for the rehabilitation of smaller diameter pipe
- Does not require new trenching
- Collapse and failure during installation is fairly common when CIPP is applied to very large diameter pipe
- Fabricating custom liners for long runs of large diameter pipe can be prohibitively expensive
- Doesn't adhere to old pipe (allowing water flow in the annular space)
- Can't usually negotiate bends in pipe
- Installation can be inhibited by weather and soil conditions

Evaluating Options: Fine Aggregate Composite Concrete (FACC)

- Standard application involves centrifugally casting interiors of pipes ranging from 30-inches to 120-inches in diameter
- Can be applied to elliptical and other odd-shaped pipe
- Can be hand applied in larger diameters with same structural results
- Complete equipment and material system
- Evaluated and approved by numerous large agencies, including DOTs, counties, and municipalities throughout the US, Canada, China, and Australia

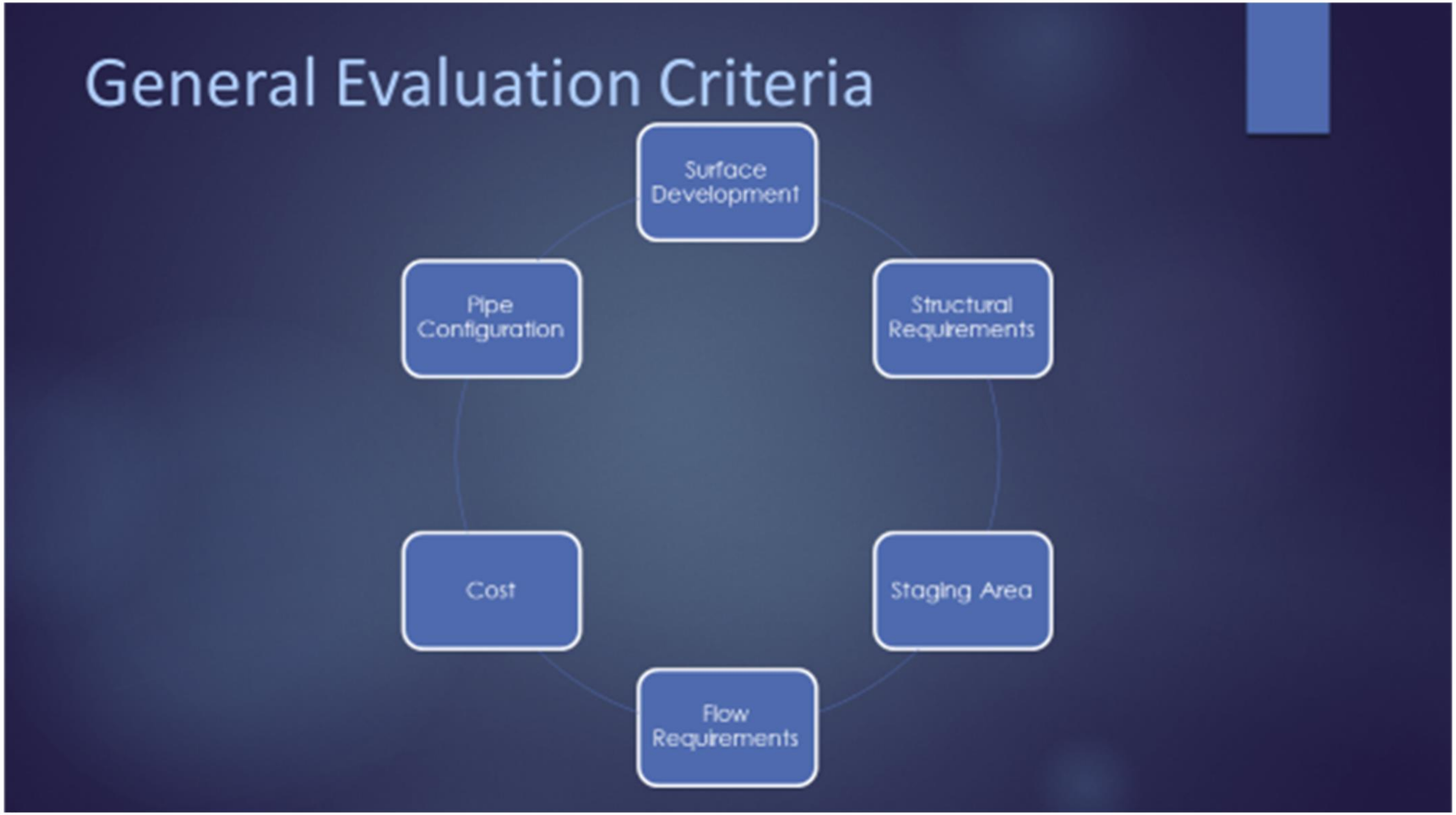


Evaluating Options: HDPE

- Structural solution
- Pros and cons are similar to CIPP
- Requires relatively large staging areas
- Nearly always causes significant reductions in flow capacity due to the smaller diameter of the HDPE replacement pipe

Evaluating Options: FACC Continued

- Creates a new, structurally sound and waterproof pipe that adheres tightly to the original pipe
- Fiber-reinforced materials have high tensile strengths, cure quickly, and stick to a variety of materials including CMP, RCP, cast iron, steel plating, brick, and clay
- Staging areas are modest
- Bends are no problem
- Work can be interrupted and resumed without leaving seams
- Flow reduction is minimal


General Evaluation Criteria
Surface Development
Structural Requirements
Staging Area
Flow Requirements
Cost
Pipe Configuration

Design Criteria - Considerations

- Strength
- Density
- Elasticity of the mortar
- Loading considerations
- Soil type
- Ground water pressures
- Existing structural conditions
- Anticipated changes in conditions
- Diameter and depth

Omaha Water Resource Recovery Facility (WRRF)

Built in 1964
Adjacent to Missouri River on Nebraska/Iowa border
Treats an overall average of 25 million gallons per day of wastewater
Improvements needed to increase this treatment capacity for wet weather flows to reduce the amount of untreated water sent to the Missouri River

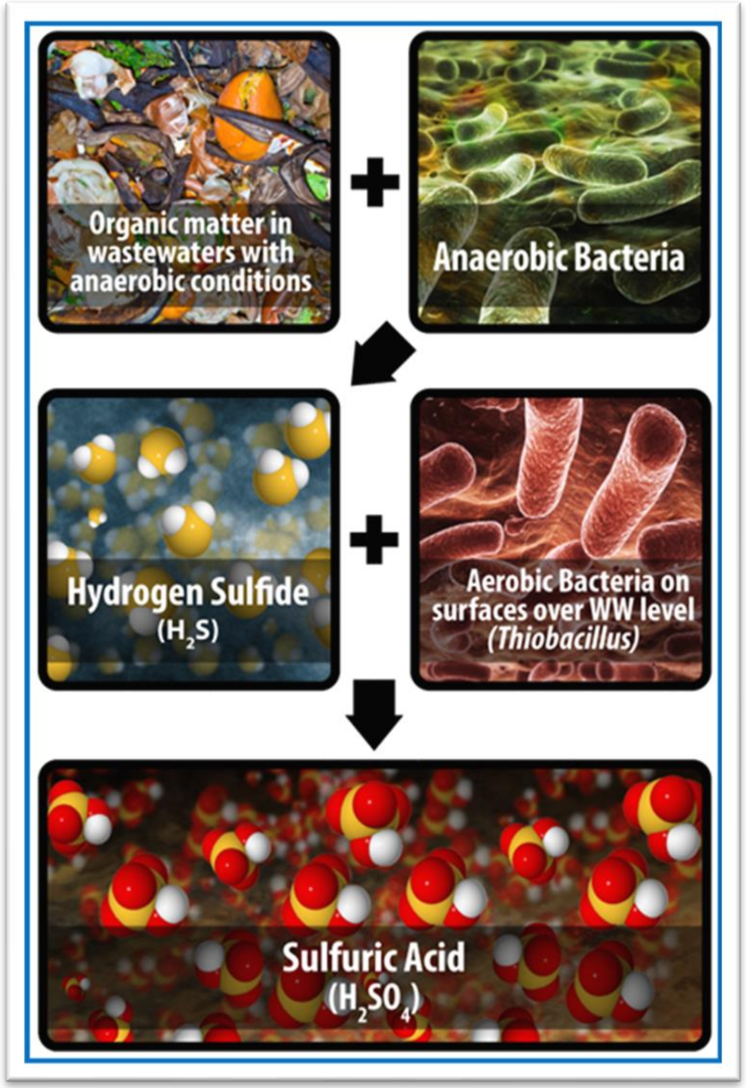
Protecting Sanitary Sewer Systems from MIC

- Perfect conditions make sanitary systems highly susceptible to MIC
- Systems can be protected from MIC damage
- Damage can be repaired

Organic Matter and MIC

The conditions required for H2S corrosion are:

- Presence of dissolved sulfides in the wastewater.
- Release of H_2S gas from the water phase to the gaseous phase.
- Biological oxidation of H_2S to sulfuric acid above the wastewater surface in a pipe or basin.
- Acid attack on the moistened surfaces of cementitious or metallic surfaces exposed to the atmosphere.



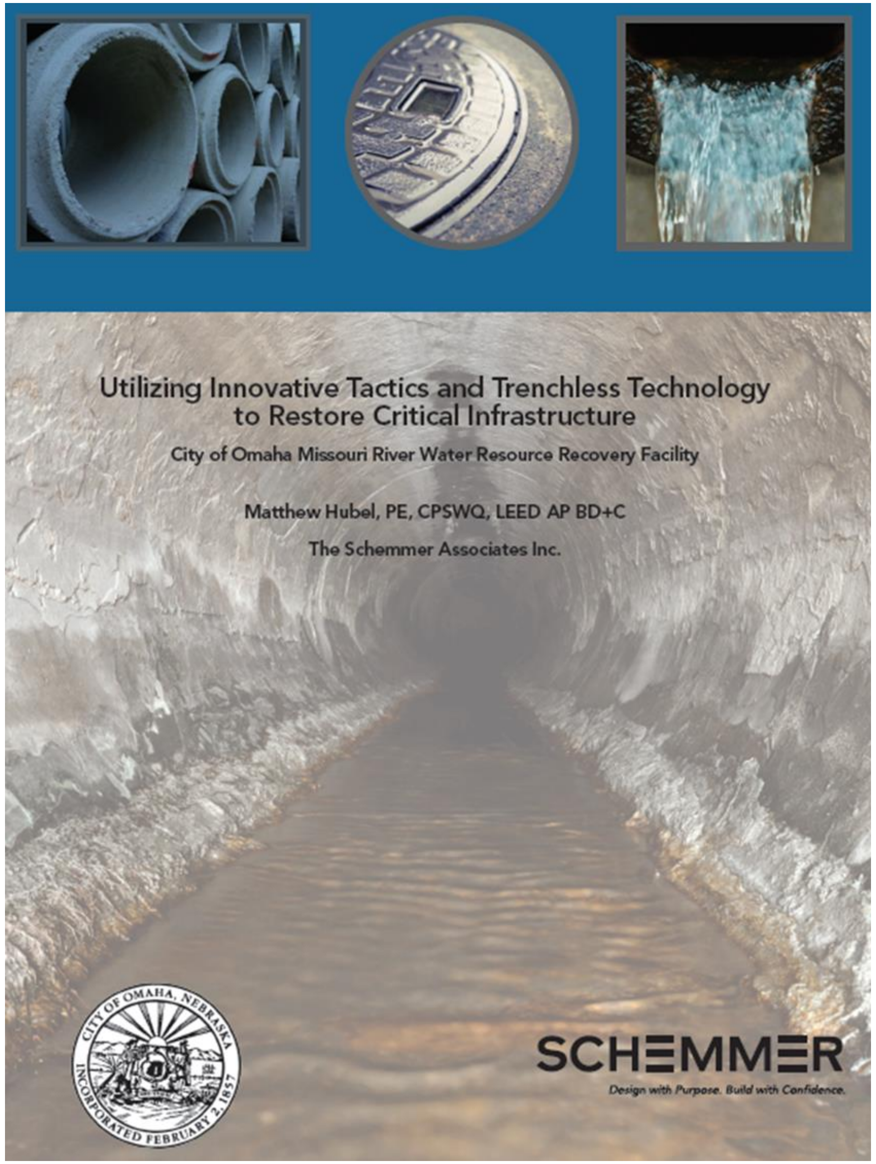
Omaha Water Resource Recovery Facility (WRRF)

Mission

The goal of the project was to repair or replace these channels to provide another 50+ years of reliable service life while maintaining full functionality and operating capacity of the water resource recovery facility. This undertaking would require an innovative design approach, advanced technology and a collaborative effort from the engineer, owner, and contractor.

Complex Challenges

After nearly 60 years of service, the reinforced concrete outlet channels from the Primary Clarifiers at the City of Omaha's Missouri River Water Resource Recovery Facility had experienced severe deterioration from hydrogen sulfide corrosion and decades of constant use. The task of fixing this issue by means of repair or replacement faced a number of complications that would inform how the project was completed.



Completed Project

Project Specifics

Project Team	Project Budget	Project Schedule
Owner **City of Omaha**	Engineers Estimate **$1,750,000**	Estimated Design Duration **11 weeks**
Engineer **The Schemmer Associates Inc.**	Bid **$1,448,445**	Actual Design Duration **7 weeks**
General Contractor **ACE Pipe Cleaning**	Final Cost **$1,450,000**	Estimated Construction Duration **120 days**
Manufacturer **CentriPipe**		Actual Construction Duration **90 days**