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Main Lift Station Force Main Assessment and Repair
City of Ashland, WI

2015 WWOA Conference

October 8, 2015
Presentation Outline

• Background
• General Force Main Statistics
• Failure Mechanisms
• Assessment
• Rehabilitation
Force Main Data - Materials

Inspection Guidelines for Wastewater Force Mains, Water Environment Research Foundation
Force Main Data – Size

Inspection Guidelines for Wastewater Force Mains, Water Environment Research Foundation
Force Main Data – Age

[Chart showing distribution of force main ages with 68% <25 years, 30% 25-50 years, and 2% >50 years.]
Failure Types

Ferrous
- 3rd Party Damage: 19%
- Joint Leakage: 15%
- Surge Pressure: 10%
- External Corrosion: 19%
- Internal Corrosion: 27%
- Capacity: 10%

Nonferrous
- 3rd Party Damage: 36%
- Corrosion: 27%
- Structural: 27%
- Surge Pressure: 7%
- Joint Leakage: 3%

*Inspection Guidelines for Wastewater Force Mains, Water Environment Research Foundation*
City of Ashland Collection System Overview

- Provides service to approximately 8,200 residents
- 53 Miles of gravity sewer, 989 manholes
- 11 pumping stations and 11,540 feet of force main
History

- New WWTP and Main Lift Station Constructed in 1991
More History

- Filled Ravine
- Rail
Main Lift Station Force Main

- Constructed in 1991
- Ductile iron
- 24 inch diameter
- 5,252 feet long
- Six 150 hp pumps
- Serves more than 80% of City
- Flows in excess of 10 mgd during wet weather events
Main Lift Station Force Main Failure History

- First Leak – Fall 2012
- Second Leak – May 2013
- Two additional leaks suspected in 2013
- All leaks emerged during periods of high flow
- Mode of failure appeared to be external corrosion
Main Lift Station Force Main Failure History
Risk Based Assessment and Rehabilitation

- Analyze in segments

[Diagram showing a risk matrix with categories for Consequence of Failure and Likelihood of Failure, indicating actions such as "Do nothing," "Low priority," "Monitor," "Investigate more," and "Immediate action."
Likelihood of Failure

- Age
- Pipe Material
- Operating Pressure
- Soils
- Failure History
- Physical Assessment

![Likelihood of Failure Diagram]

**Likelihood of Failure**

- Low priority
- Do nothing
- Monitor
- Investigate more
- Immediate action

**Consequence of Failure**

1. 2. 3. 4. 5. 6. 7. 8. 9. 10.
Consequence of Failure

- Critical Roads
- Environmental Effects
- Health Effects
- Cost to Replace/Repair
- Operational Considerations
Assessment Methods

<table>
<thead>
<tr>
<th>Assessment Level</th>
<th>Assessment Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Desktop Assessment</td>
<td>• Soils Loadings</td>
</tr>
<tr>
<td></td>
<td>• Failure history</td>
</tr>
<tr>
<td>Field Assessment – Random Excavation</td>
<td>• Expose Pipe</td>
</tr>
<tr>
<td>Field Assessment – Targeted Excavations</td>
<td>• Intelligent Excavations</td>
</tr>
<tr>
<td></td>
<td>• Soil Chemistry</td>
</tr>
<tr>
<td>Advanced Assessment Tools</td>
<td>• Continuous Assessment Tools</td>
</tr>
</tbody>
</table>

Other Considerations:

- Can assessment be completed while force main is in service?
- Status of technology
- Likely failure mechanism
- Access
Advanced Assessment Technologies

Types (not an all inclusive list!)

- Acoustic leak detection (locates leaks and air pockets)
- Ultrasonic thickness (continuous or point wall thickness measurement)
- Broadband electromagnetic (wall thickness)
- Magnetic flux leakage (measures wall thickness loss)
- Remote field eddy current (continuous wall thickness, wire breaks [PCCP])

Considerations

- Can it be completed while in service?
- Status of technology/confidence in results
- Likely failure mechanism
- Access
- Pipe material, coatings
- Tethered vs. free swimming
- Retrieval
- Cost!
Ashland Force Main Assessment Methods

Targeted Excavations with Additional Soils Testing

- (Relatively) inexpensive
- Failure likely a result of external corrosion
- Internal corrosion unlikely (no high spots)
- DIPRA
- Soils investigation
Ashland Force Main Assessment - Findings
Ashland Force Main Assessment - Findings

Excavation 3
Ashland Force Main Assessment - Findings

- Low Risk
- High Conseq.

- High Risk
- High Conseq.
Ashland Force Main Assessment - Findings
Force Main Renewal Methods (Not an all-inclusive list!)

**Repair**
- Point repairs

**Rehabilitation**
- Spray on linings (corrosion protection – typically non-structural)
- Close-fit linings (“modified slip lining”)
- CIPP

**Replacement**
- Open cut
- Slip lining
- Pipe bursting

**Considerations**
- Operating conditions
- Site specific parameters
- Life cycle cost
- Accessibility
- Status of technology
- Higher consequences of failure – More conservative renewal method!
Ashland Force Main Renewal

Partial Replacement

- Conservative approach (remember – high consequences of failure!)
- Location
- Cost
- Negligible impact to hydraulics
New Force Main Construction

- Fall 2014, restoration in spring, 2015
- Approximately 1,500 feet
- 24 inch C905 PVC
- Petroleum contaminated soils – nitrile gaskets
- Wrap ductile fittings, add sacrificial anodes
- Existing force main location
Final Tie-Ins and Bypassing

- November 12th-13th
- Three tie-in locations
- Cold and snow! – Not good for pumps!
- Low flow – overnight
- Three 8-inch pumps, 5 tankers, 3 septic haulers
- Multiple loading and discharge locations
Final Thoughts

• Force mains are a critical part of your collection system but are often ignored!

• Document data related to your force mains:
  • Age, size, material, history of failures, etc.

• Do you have an emergency plan in place in the event of force main failure?

• Consider performance (capacity)
• Polyethylene Wrap

• Understand risk! Consider risk of failure and consequences of failure – then determine next steps.
Resources

- Ductile Iron Pipe Research Association (DIPRA)
- Inspection Guidelines for Wastewater Force Mains, Water Environment Research Foundation
- Condition Assessment of Wastewater Collection Systems, United States Environmental Protection Agency
- Rehabilitation of Wastewater Collection and Water Distribution Systems-State of Technology Review Report, United States Environmental Protection Agency
- Condition Assessment of Wastewater Collection Systems, United States Environmental Protection Agency