Low Pressure Sewer Solutions to Wet Weather Problems

Michigan Water Environment Association
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• Principles of Low Pressure Sewer
  ◦ What is a Low Pressure Sewer System
  ◦ Advantages of Low Pressure Sewer

• LPS Solutions to Wet Weather Problems
  ◦ Infiltration and Inflow (I&I)
  ◦ Basement flooding solution
What is a LPS System

- Wastewater collection systems that use individual residential pumps to convey the flow to a central treatment system, lift station, gravity sewer, or force main

- System consists of:
  - Grinder pumps
  - Small diameter pressure pipe

- Sewer main follows the natural contour of the land
- First used in the early 1970’s
- Provides daily service to millions of users worldwide
- Demonstrated performance, high reliability, and low operating and maintenance costs

Low Pressure Sewer
A Proven Technology
Early Development

Gained popularity due to the ability to provide central sewer service to areas with gravity sewer could not be installed or the cost to do so was cost prohibitive

- High ground water
- Lake communities
- Rural areas
- Flat terrain
- Undulating terrain
- Rocky ground conditions
Experience and demonstrated advantages have expanded the use of low pressure sewer.

Competitive alternative to convention gravity sewer:
- Flexibility
- Lower capital cost
- Construction phasing
- Increased construction schedule
- Lower environment impact and social costs

Wider Acceptance
- Grinder pump unit is located in the yard or basement of each home
Sewage flows into the station from the buildings sewer line.
The basin contains a grinder pump with level controls to turn the pump on and off automatically.
Advantages of LPS Systems

- Traditional Gravity Sewer:
  - Road closings and Detours
  - Expensive dewatering
  - Large, deep trenches
  - Utility replacement
  - Costly restoration

- Low Pressure Sewer eliminates these construction headaches
Advantages of LPS Systems

- Eliminates infiltration
- Small pipe follow surface contours
- Trenchless technologies can be used
- Little disruption to roads, sidewalks, landscaping, and other utilities
- Lower installed cost when compared to conventional gravity sewer systems
Advantages of LPS Systems

- Protects existing infrastructure
- Protects environmentally sensitive areas
- Enhance or limit community growth
- “Right Sizes” collection system lift stations and wastewater treatment facilities
LPS Solutions to Wet Weather Problems
• Infiltration and Inflow (I/I): Clean storm water or groundwater that enter the sanitary sewer system through defective pipes and structures or improper connections.
• Prevent sewer overflows (SSOs)
• Prevent basement backups
• Eliminate health hazards
• Recapture capacity
  ◦ Collection system
  ◦ Treatment plant
• Reduce operations cost
• Demonstrate accountability to the customer
• Repair - Restore sewer to an operating condition or address localized failure and system deterioration

• Rehabilitation - Internal coatings, sealants and linings. Extends operational life and restores functionality

• Replacement – replace existing gravity sewer with new pipeline
Open-Cut and Internal Spot Repairs

Sewer Repair
Cured-in-Place Pipe (CIPP)
Close Fit Lining Systems (Slip Lining)

Sewer Rehabilitation
Pipe Bursting

Sewer Replacement
Traditional Cut & Cover

Sewer Replacement
Trenchless Technologies and Low Impact Cut & Cover

Sewer Replacement
• Conventional gravity sewer rehabilitation methods cannot eliminate 100% of I&I
• Post rehabilitation I&I reduction is generally lower than pre-rehabilitation goals

<table>
<thead>
<tr>
<th>I&amp;I Reduction Approach</th>
<th>I&amp;I Reduction Effectiveness Goals</th>
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<tbody>
<tr>
<td>Rehabilitation of gravity sewers</td>
<td>15% to 20%</td>
</tr>
<tr>
<td>Include rehabilitation of manholes</td>
<td>20% to 25%</td>
</tr>
<tr>
<td>Include rehabilitation of laterals to property line (public laterals)</td>
<td>40% to 45%</td>
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<tr>
<td>Include rehabilitation of service laterals to building discharge (private laterals)</td>
<td>70% to 75%</td>
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Multiple I&I Sources Require...

- Manholes
- Mainline Sewer
- Service Laterals
A Comprehensive Approach

Mainline Sewers

Manholes

Service Laterals
Success = Complete System Rehabilitation

- Mainline sewer
- Manholes
- Service laterals

- Addressing only part of the system, addresses only part of the problem

- Low pressure sewer provides a complete solution

Sewer Renewal Success
Sources of basement flooding
- Surcharging of sewers due to excessive flow
- Sewer clogging

Wastewater backflows through the service lateral and enters overflows drain and plumbing fixtures

Typically addressed by installing backflow prevention valves
- Manual vs. automated
- Flapper/check vs. gate
"...some municipalities have determined that advising property owners to install backflow preventers using flap gates or standpipes provides the property owners limited protection against basement flooding."

WEF Manual of Practice No. FD-6
Existing Sewer Evaluation and Rehabilitation
Basement Flooding Solution
Success Story

Athens, Tennessee
• Frequent sanitary sewer overflows (SSOs) caused by wet weather
• Moratorium on new sewer connections prevented economic growth
• Aging gravity sewer system subject to stormwater infiltration
• Infiltration accounted for a significant increase in flows to the wastewater treatment plant
- The Railroad Ave pump station was always one of the first to overflow

- AUB evaluated
  - System rehabilitation
  - Gravity sewer replacement
  - Septic Tank Effluent Pump (STEP) system
  - Low Pressure Sewer (LPS)

**Railroad Avenue Pump Station**
Goal was to place the grinder pump units as close as possible to the building as possible to eliminate I&I from the service laterals.

- 214 Simplex units
- 2 Duplex units
- 1 Simplex unit with large basin
Overflows were eliminated!

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<tr>
<th>Year</th>
<th>Number of Overflow Events</th>
<th>Discharge Volume</th>
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<tr>
<td>2003</td>
<td>9</td>
<td>494,000 gal</td>
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<tr>
<td>2004</td>
<td>10</td>
<td>265,000 gal</td>
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<tr>
<td>2005 (Project Initiation)</td>
<td>4</td>
<td>16,000 gal</td>
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<tr>
<td>2006</td>
<td>3</td>
<td>10,000 gal</td>
</tr>
<tr>
<td>2007</td>
<td>None</td>
<td>zero</td>
</tr>
<tr>
<td>2008</td>
<td>None</td>
<td>zero</td>
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RailRoad Avenue Pump Station

Results
Results

- Infiltration elimination resulted in reduced flow of 27.5 million gallons per year into the treatment plant
- No overflow events
- No stormwater infiltration
- Yearly savings in treatment cost $90,000
- Construction costs were 35 percent lower than gravity replacement
- No overflow events
- No stormwater infiltration within the low pressure sewer system sub-basin
- Continued cost savings in treatment
- Longer life expectancy for existing lift station
- AUB is expanding low pressure sewer into other sub-basins with failed gravity systems
Thank You

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