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PROPIPE PROFESSIONAL PIPE SERVICES

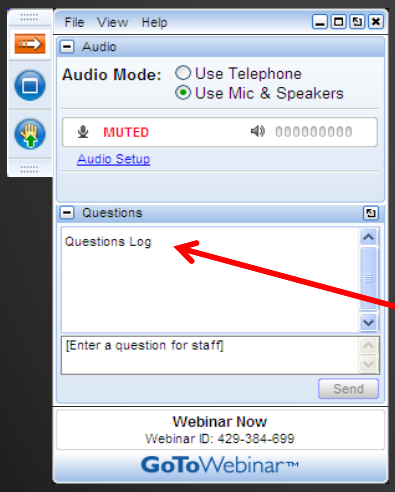
Sewer Lateral Line Repair Challenges & Solutions

March 15, 2018

2:00 – 4:00 pm EST

Water Environment Federation
the water quality people

How to Participate Today



- **Audio Modes**
  - Listen using Mic & Speakers
  - Or, select "Use Telephone" and dial the conference (please remember long distance phone charges apply).
- **Submit your questions using the Questions pane.**
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Water Environment Federation
the water quality people

Moderator

Lynn Osborn, P.E.
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Presenters

City Engineer

Mark K. Papke, P.E., C.P.E.S.C.

City of Lakewood Ohio

Contractor

Tom Carlisle, Owner

Underground Connections

Consultant

Jonathan Kunay, P.E., LEED AP

CDM Smith

Introduction

Challenges and solutions in removing I/I originating in sewer service laterals and at their connections to mainline sewer

- Legal issues addressing private property access and cost allocation
- Selection of materials and technology
- Design, specification and procurement
- Effectiveness of methods used in removing I/I

Case Study

- Pilot program
- Goals and limitations
- RFP / Qualification – Award
- Private property challenge
- Solution decision and use
- Results
- ROW project

Consultant View

- Legal issues with private property
- Condition assessment
- Repair decision matrix
- Assessing results

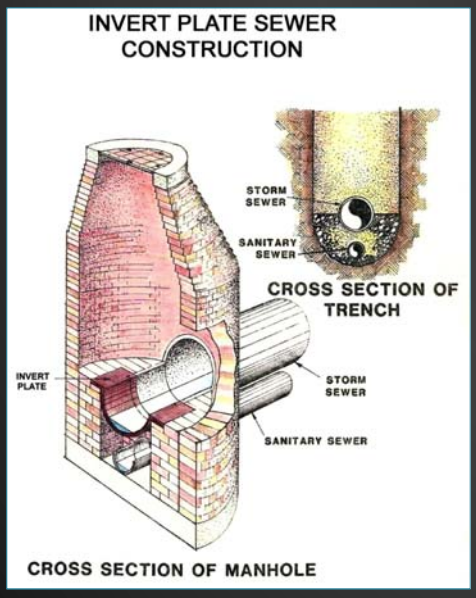
Case Study – Pilot Project

CITY OF LAKEWOOD

Mark K. Papke, P.E., C.P.E.S.C.

Lakewood Sewer System

- 100+ years old, multiple layers of changes and additions. WPA construction prominent.
- Majority of housing built in first 3 decades of 20th Century
- Over/Under sewer construction
- Over 38 miles of Combined Sewer
- Over 65 miles of Sanitary Sewer
- Over 69 miles of Storm Sewer
- Overflows to Lake Erie, Rocky River and wet weather to NEORSD with 9 Permitted CSOs (7 active)



Typical Sewer Pipes beneath Lakewood's Streets

I/I Problems

- Shifted or missing invert plates can often lead to increased water in the sanitary sewer
- 2' sections of VCP pipe comprise of the sewer mains. Leaky joints.

EPA directive eliminate CSOs

↓

City had 2006 LTCP with CSO storage tunnel

↓

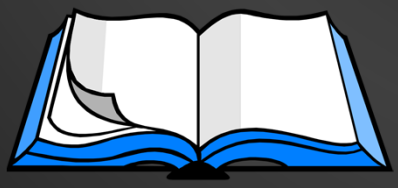
City opted for
Integrated Planning
Analyze CSOs by watershed use a toolbox of solutions (High Rate Treatment, Source Control, Green Infrastructure, etc.)

WWTP NPDES Permit Language

- As a result of ongoing sewer system studies, it is now understood that there are cross-connections at numerous locations in the 'over-under' sewers.
- These cross-connections are located at individual private property laterals as well as on the main sewers lines and stem from the original design of an 'over-under' sewer system.
- These cross-connections/discharges had not been previously identified and are still not completely understood in terms of location, number, and degree of contamination.
- A planning level development and evaluation of control alternatives to reduce/eliminate sewage discharges. The planning level evaluation shall consider possible outcomes of the pilot sewer separation study in development and evaluation of control alternatives.
- Analysis of financing for rehabilitation and corrections on private property. Costs often exceed normal expectations of what homeowners can absorb

Evaluation of Infiltration/Inflow Program

Unpublished Technical Report EPA-68-01-4913
July, 1980
by Donnelly, Conklin, Phipps & Buzzell, Inc.



System I/I Reduction – Public Sewers

	Predicted	Achieved
CMSD, NC	83%	Increase
Mt. Holly, PA	60%	23%
Castle Rock, WA	82%	60%
Centralia, WA	60%	3%
Dunsmuir, CA	99%	0%
Shelton, WA	70%	Increase
New Buffalo, MI	85%	1%
Amity, PA	85%	24%
Sussex, WI	92%	7%
Conyngham, PA	92%	17%
Cortland, NY	39%	Increase

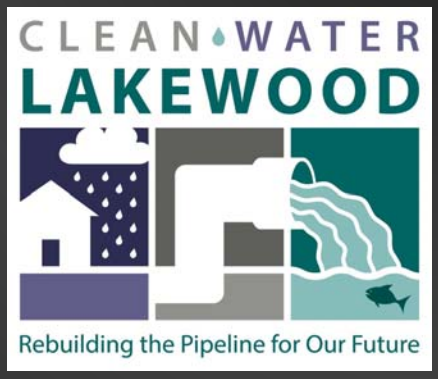
Need to address the source too – Private Property

Conklin Observations

- I/I removal in only the public sewer is not effective
- I/I component of design flows are exceeded at WWTPs
- I/I migrates to lateral connections and non-rehabilitated joints
- Seasonal variations impact levels of I/I
- I/I from private property generally constitutes over 50% of the total I/I

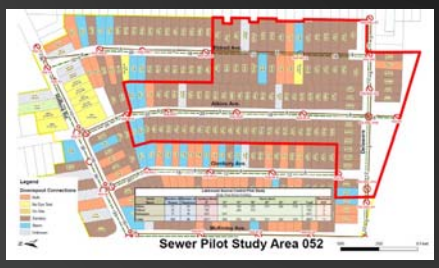
Program Goals

- Improve water quality
- Compliance with Clean Water Act and Ohio law
- Reduce I/I
- Reduce overflows
- Develop program that considers
  - financial impact on residents
  - technical effectiveness
- Develop future programs, corrections and compliance initiatives



Private/Public Work

Lakewood Pilot Site



- Controlled area
- 102 structures (of 17,700 citywide)
- All houses flow into a single point
- Very good data of current state
  - Dry weather and wet weather
  - Allows measurement before and after
  - All houses in area were built in the same time period and are of similar design
  - Previously targeted in 1990s for removal of storm from sanitary

Planning & Commitment

- Mayor's office conducted regular meetings
- Engagement from all departments
- Private property work strategies
- Financing options
- Legal research

Project Delivery Challenges

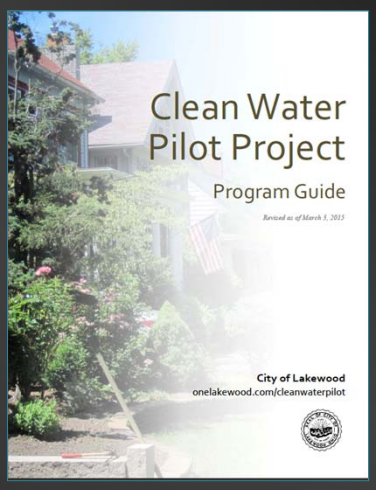
- Field investigations
- Confirmation of cross connections
- Public input meetings
- Financial assistance
- Property owner agreements
- Contractor engagement
- Ownership of connections
- Liability
- Bonding
- Insurance
- Performance guarantees
- Homeowner coordination
- Revisions to ordinances regarding bidding
- Legislation

Private Owner Impact

- Required by Ordinance to allow Authority to inspect and order corrections required
- Contractor interaction to schedule inspections and work
- Resident owns corrective work and responsible for future maintenance
- Per parcel cost estimate $7,500
  - City 90%, Homeowner 10%
  - Finance option 10 yrs, 0% interest

Program Guide

- Pilot Project Area
- Rationale
- Goals of the Program
- Authority for the Program
- Scope of the Program
- Ownership of Corrections
- Payment for Corrections
- Conditions of Financial Assistance
- After the Project is Completed



Public Meetings

- Communication with property owners is crucial
- City held public meetings with the property owners
  - Introduction of Program
  - Program Guide Distributed and Discussed
- Non-attending property owners were mailed an information packet and resources
- Representatives on hand to answer property owner questions and concerns

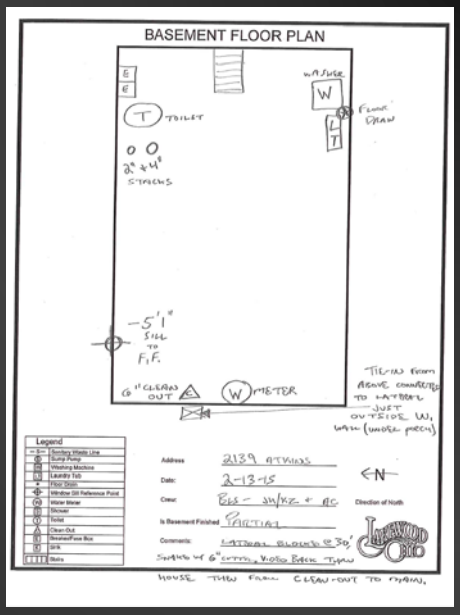
Project Process

- CCTV of Sewer Main and Laterals (PACP/LACP)
  - Found areas that needed immediate repair
  - Lateral launch sanitary / Storm could not lateral launch
  - Attempted to located Test Tees in the field
- Internal House Investigations
  - Captured information for design of remediation alternatives
  - Installed automated water meters in conjunction with investigations
- External Investigations
  - AECOM contracted to dye test exterior downspouts, yard drains, and footings to identify where storm water was entering the sanitary sewer

Internal House Investigation

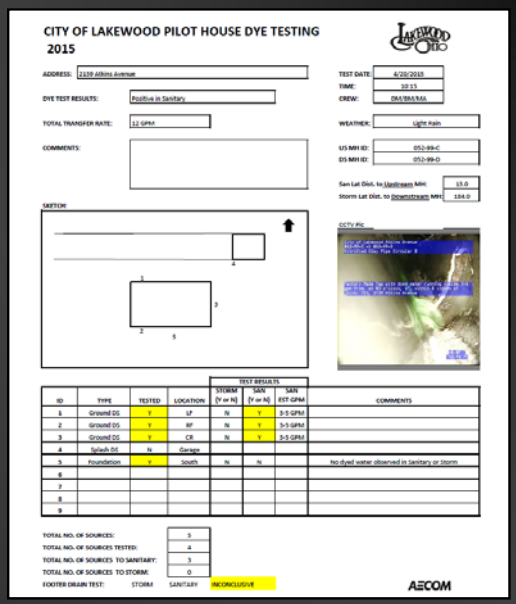
Developed internal form capturing the necessary information for design of potential remediation Alternatives

Also included automated water meter installation



External Investigation

AECOM was contracted to dye test the exterior downspouts, yard drains, and footings to identify where storm water was entering the sanitary sewer



Sources of storm water mixing with sanitary sewage

- Connections from house to wrong pipe in the street
- Gutter drains (downspouts)
- Foundation drains
- Yard and driveway drains
- Broken pipe and defective connections
- Separated joints
- Trapped storm laterals with no cleanout

Private Project Delivery

- Design-build method chosen as most efficient
- Council approved through an ordinance
- Resolved many complex issues with working on private property

Work Scope – 2 Separate Contracts

Private

- CIPP lining
- Pipe bursting
- Directional drilling
- Removal of storm water traps
- Replace direct connections
- Where footing drains present, install sump and pump to storm

Public ROW

- Separate combined manholes
- Point repairs
- CIPP lining
- Main/lateral connection seal
- Grouting storm sewer joints

Contract Award

- Awarded to highest ranked contractor
- Negotiated price
- Bonding issue resolved

Underground Connections, LLC

Case Study – Pilot Project Construction

UNDERGROUND CONNECTIONS

Tom Carlisle, Owner

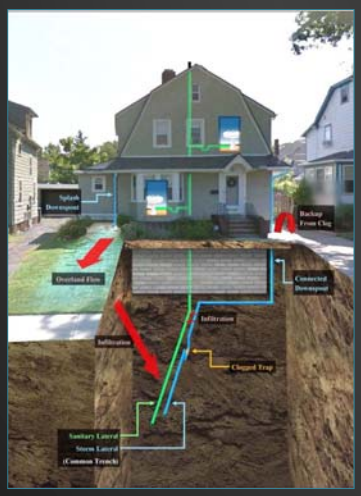
Introduction
Private Project Execution

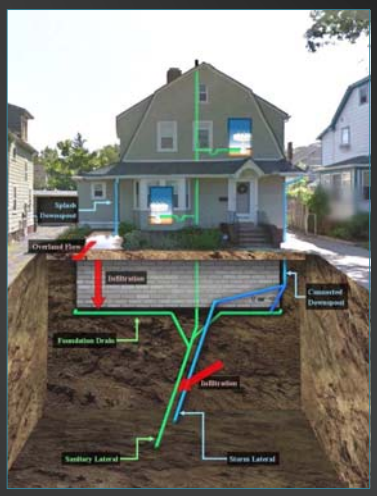
- Underground Connections background
- Challenges anticipated on this project
- Trenchless advantage

Project Sequence

Data Review	UC reviews available data	CCTV reports for each property	
Inspection	Schedule scope of work meeting with owner	Performs inspection	
Estimate	Prepares cost estimate (worst case scenario)	Upon city approval notifies property owner	
Proceed	Owner has 30 days to opt-in, opt-out, contest	City submits notice to proceed to UC for opt-in	UC schedules work with property owner
Completion	UC performs work and City inspects	Property owner billed 10% of actual costs	Warranty two (2) years from acceptance

Private Work



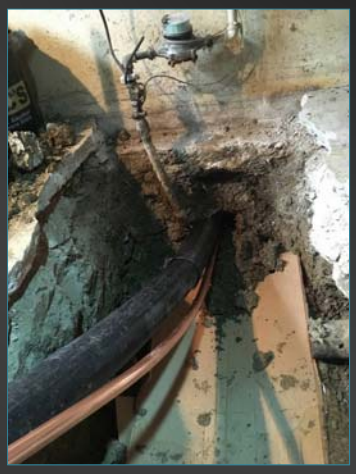


Lateral Lining - CIPP

- CCTV assure no footing drain before lining
- Remove roots or obstructions
- Lined laterals to eliminate infiltration

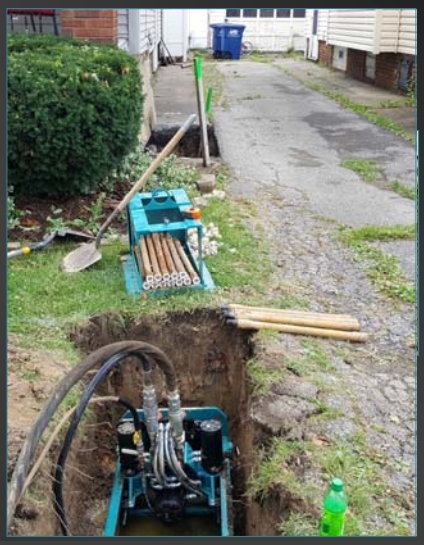
Lateral Replacement - Pipe Bursting

- Broken / collapsed pipe
- Replaced with HDPE



Drains and Downspouts - HDD

- Found all storm laterals had traps
- Rerouting of drain or downspout under driveway or sensitive areas
- Utilized directional drilling to minimize disruption and restoration costs



Construction Challenges

- Access
- Homeowner communications
- Individual home investigations
- Storm water traps encountered
- Restoration work

City of Lakewood

LESSONS LEARNED & RESULTS

Lessons Learned

- Communication is crucial
- Cooperation of municipal departments in project planning and development of legal alternatives to overcome private property work pays dividends
- Contractors communication skills just as important as construction skills when working on private property
- Approach each house as its own project
- Eliminate redundant and less effective pre-project inspection
- Storm water traps were the major defect in conveying storm water to the proper sewer. Retesting each property after work using a slower water volume would have found further I/I issues.

Project Results

- Removed 70% of I/I (Private lateral lining & ROW work)
- Private property costs were controlled and 90%+ residents were cooperative. **100% complied!!!**
- Quoting residents worst case cost procedure resulted in meeting or exceeding resident's expectations vs. costs surpassing original quote
- Began Phase 2 replacement of the storm collector pipe from the downspouts to the storm lateral
- Future plans – proceed with program citywide once all results in and program determined to be successful and economically reasonable

Consultants View

CDM SMITH

Jonathan Kunay, P.E., LEED AP

Service Laterals and Their Connections to Mainline

Contribute Up To 50% of System Infiltration

Lateral Lining Systems

- Proven technology
- New technologies and methods of installation
- Documented successes
- Important tool in your rehabilitation arsenal
- Critical for comprehensive rehabilitation programs

Purpose of Lateral Lining

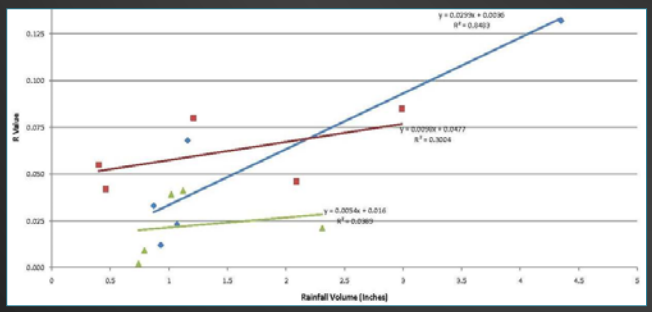
- Seal annular space and connection between service lateral and CIPP lined mainline sewer
- Rehabilitate service lateral pipe to various lengths
- Increases life of critical component of the collection system

Comprehensive Sewer System Rehabilitation

- Mainline
- Service lateral
- Manholes
- Private inflow

Rationale for Comprehensive Approach

- Proven to remove high percentages of I/I - 50% to 75%
- Successfully implemented in various municipalities
- Most successful in smaller sub-areas 10,000–20,000 lf



Need for Comprehensive Approach

- Consent order/decree
- Clean Water Act violations
- Widespread defects
- 100+ year old sewers
- Poorly maintained
- Failure of shotgun approach
- Most "Bang for the Buck"

Key Component
Lateral Rehabilitation

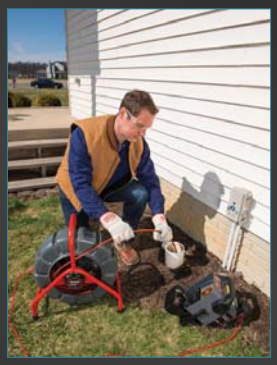
- Lateral connection seal
- Full length lateral lining

Inspection – Pan & Tilt

- Mainline sewer CCTV camera with pan & tilt
- Inspection performed from mainline sewer
- No cleanout/access point needed
- Can typically only see up a few feet

Inspection - Push

- Insert camera through cleanout or other access point
- Distance up to 150 ft

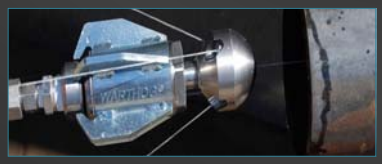


Inspection - Lateral Launch

- Launch camera from the mainline sewer
- No cleanout/access point needed
- Can traverse 80+ feet

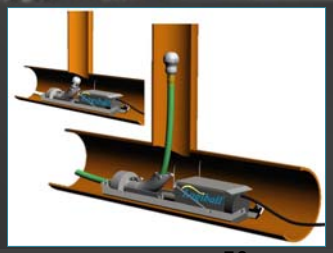
Lateral Cleaning

- Lateral cleaning techniques have improved
- Up to 80+ feet from mainline sewer
- Done with or without a cleanout/access point



Cleaning from Mainline

There are effective tools to clean the laterals from the mainline sewer when above ground access unavailable



Lateral Cleaning

Pre-cleaning

Post-cleaning

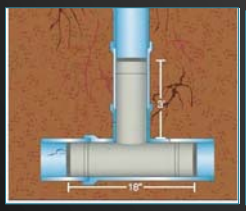
Lateral Rehab Evaluation

- Review CCTV inspection videos – PACP
- Determine extents of defects and deterioration
  - Mainline sewer
  - Service lateral
- Identify location and extents of spot repairs
- Determine service sizes, material, depth, number of service connections (open/capped)
- Evaluate lateral ownership
  - Municipality owns connection only
  - Municipality owns up to right-of-way
  - Municipality owns up to property line
  - Municipality owns up to 4” Cast Iron

Design for Lateral Lining

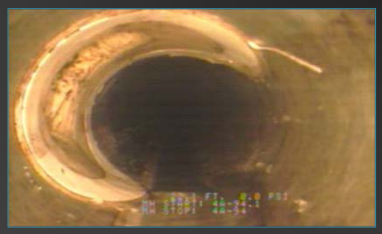
Options for consideration

- Connection in the mainline sewer
- Length of liner up into lateral
- Installation method



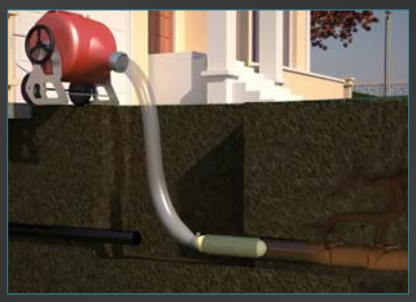
Lateral Connection Seal

- Rehabilitates lateral connection to mainline sewer
- Extends 24” – 36” into service lateral
- Installation performed from the mainline sewer
- Does not require cleanout/other access point
- Brim-Style or Full-Wrap in the main




Full Length Lateral Lining

- Installed from mainline sewer or cleanout/other access point
- Extends various lengths and up to 4" cast iron from property
- Can seal connection to the mainline – installed from mainline
- Some products require a cleanout/other access point



Connection Liner or Full-Length Liner

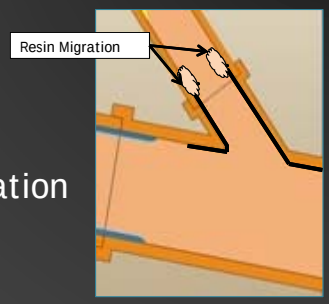
- Distance up lateral needed for rehabilitation
- Goals of the program
  - Consent order driven
  - Structural issues
  - Infiltration issues
- Access - do cleanouts exist
  - Work on private property
  - Product limitations
- Ownership
- Available funding
- Location of groundwater table
  - Can help determine how far up the lateral to line

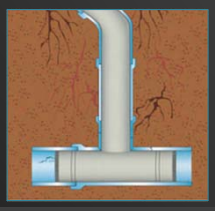
Installation and Sealing Properties

- Hydrophilic End Seals
  - Gasket
  - Paste
- Physical Bonding
  - Resin Migration
  - Epoxy Bond

Installation and Sealing Properties

- Often a contentious issue
- Opinions vary widely
- Installation
  - Inversion method – resin migration
  - Inflation/Packer system – mechanical bond

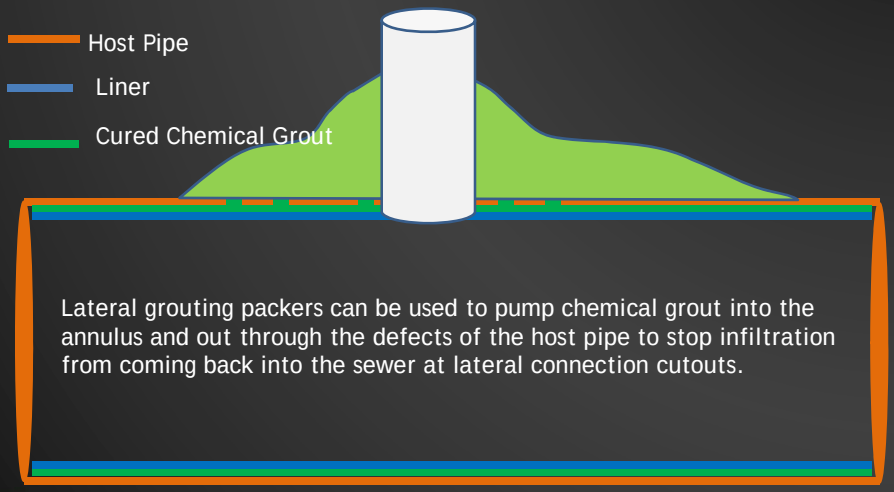




Additional Options for Lateral Rehab

- Grouting
- Pipe bursting

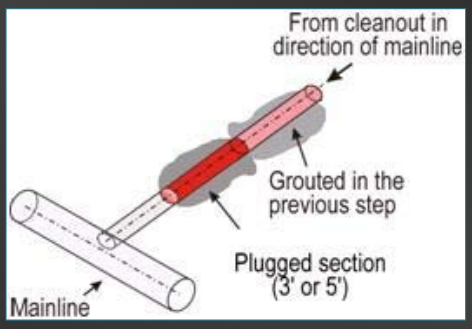
Lateral Grouting After Mainline Lining



Lateral grouting packers can be used to pump chemical grout into the annulus and out through the defects of the host pipe to stop infiltration from coming back into the sewer at lateral connection cutouts.

Lateral Grouting – Push Type

- Access through cleanout
- Grouting along lateral
- Partial or full length

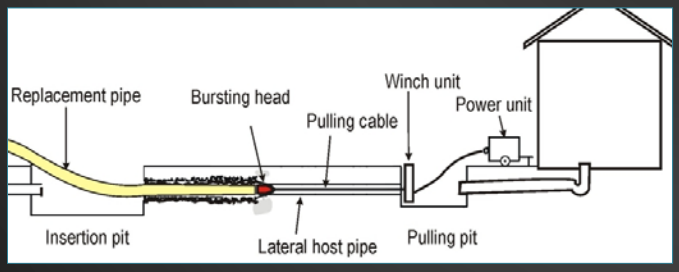


Lateral Tap Connection Grouting

- Mainline diameters from 6”-30”
- Effective sealing distances from 8” through 30 feet
- Diameter of laterals 4”, 5” or 6”

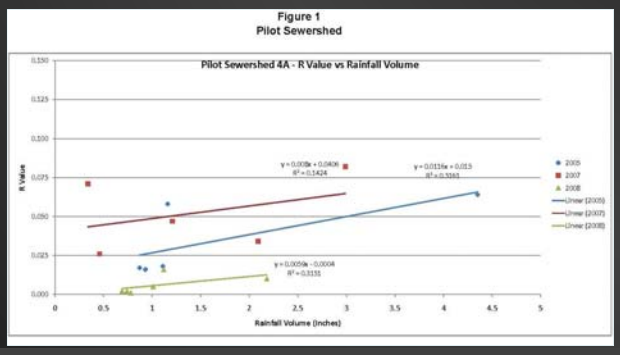
Lateral Bursting

- Lateral upsizing is desired
- Badly damaged laterals
- Replaces existing lateral with new pipe



Verification of Flow Removed

- Re-meter study area and control area
- Analyze groundwater conditions pre- and post-construction
- Evaluate changes in control area
- Perform regression analysis



Conclusions

- Rehabilitating only mainline pipe addresses only a fraction of infiltration
- Lateral rehabilitation recommendations include many variables
- A detailed evaluation of the collection system is required
- New technologies/advances should constantly be evaluated
- Detailed verification analysis is critical to defending approach

Questions??

Resources

- Publications
  - *Overview of Lateral and Main/Lateral Connection Lining and Sealing Technologies*
  - Past presentations
  - Tech Tips
- Specification Guidelines
- Pipeline Assessment Certification (PACP/LACP)
- Training
  - CIPP and Manhole Inspection
  - Fundamentals in Municipal Grouting

NASSCO.org

Thank you from our Speakers

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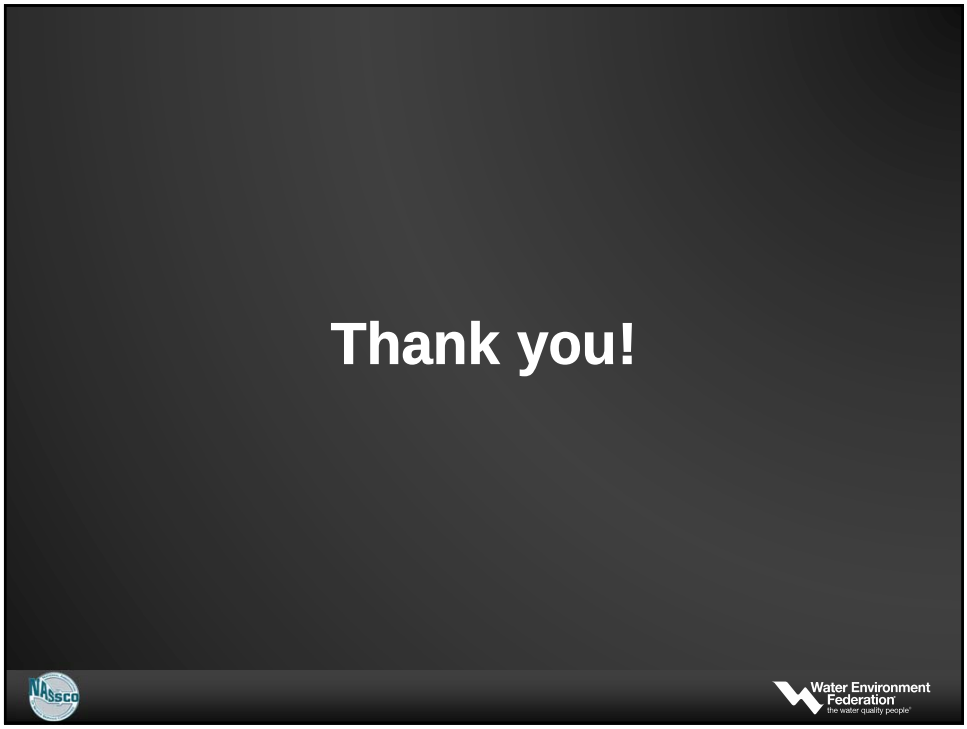
Thank you!
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