

# “Design/Build” for Trenchless Rehabilitation

Find and Fix: lessons for success

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**CDM  
Smith.**

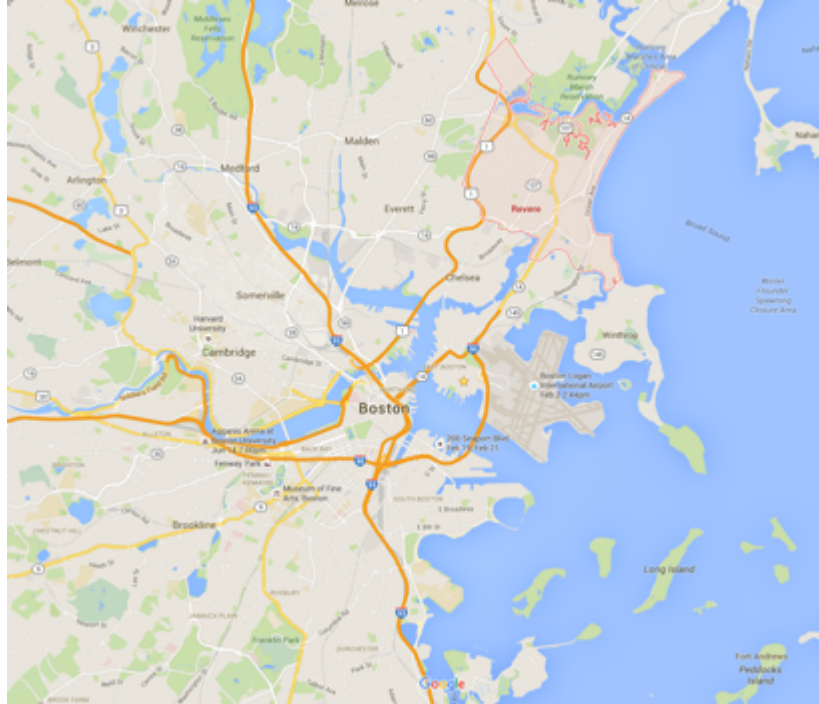
# Outline

- City of Revere Stats
- Project Background
- Find & Fix Approach
- Identification of Potential Scenarios
- Development of Specifications
- Conclusions



# City of Revere, MA

- Population: 55,000
- Land Area: 10 mi<sup>2</sup>
- 99 Miles of Sanitary Sewers
  - Clay Pipe
  - 100 Years Old
- 12 Pumping Stations



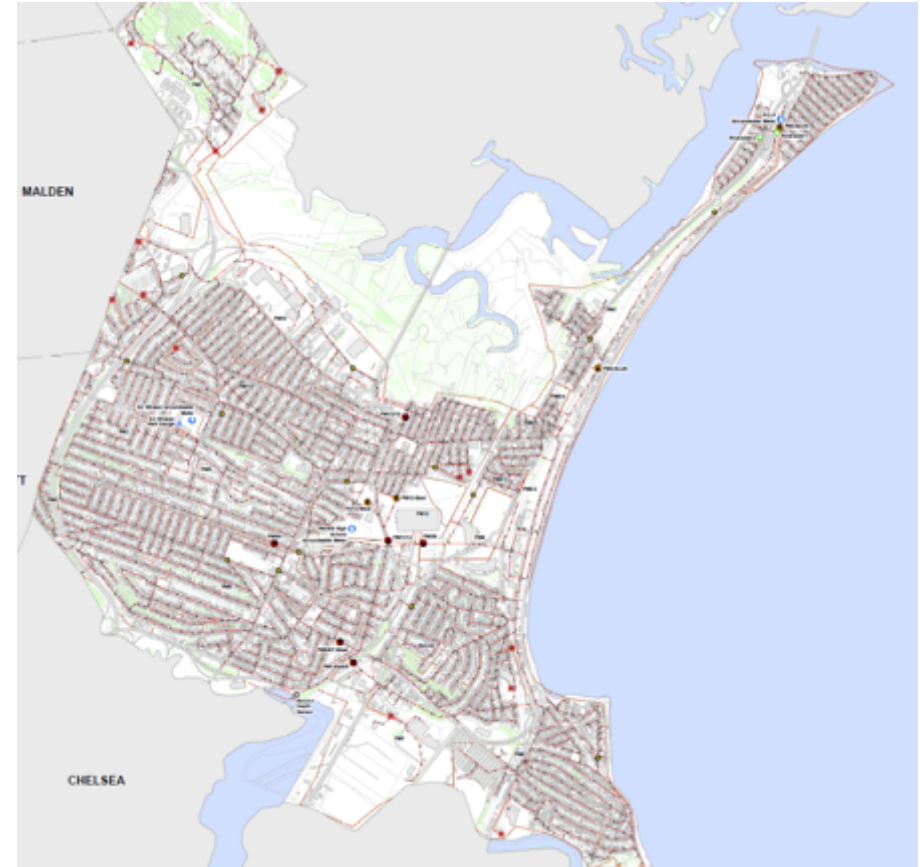
# Consent Decree (CD)

Civil Action No. 1:10-cv-11460

- Entered into in 2010 with MassDEP & USEPA
- Violations of Clean Water Act
- Compliance Requirements
  - Eliminate sanitary sewer overflows (SSOs)
    - Capacity Assessment
    - Sewer System Evaluation Survey (SSES)
    - Comprehensive Wastewater Management Plan (CWMP)
    - Comprehensive Stormwater Management Plan (CSMP)
    - Illicit Discharge Detection & Elimination Plan (IDDE)

# Capacity Assessment

- Flow Metering Program
- Delineate Flow Meter Areas
- Prioritize Areas to Investigate
- Perform SSES



# Sewer System Evaluation Survey (SSES)

- Accelerated Timeline
  - Flow Isolation
    - 4,000 gpd/idm
  - CCTV Inspections
  - Manhole Inspections



# Sewer System Evaluation Survey (SSES)

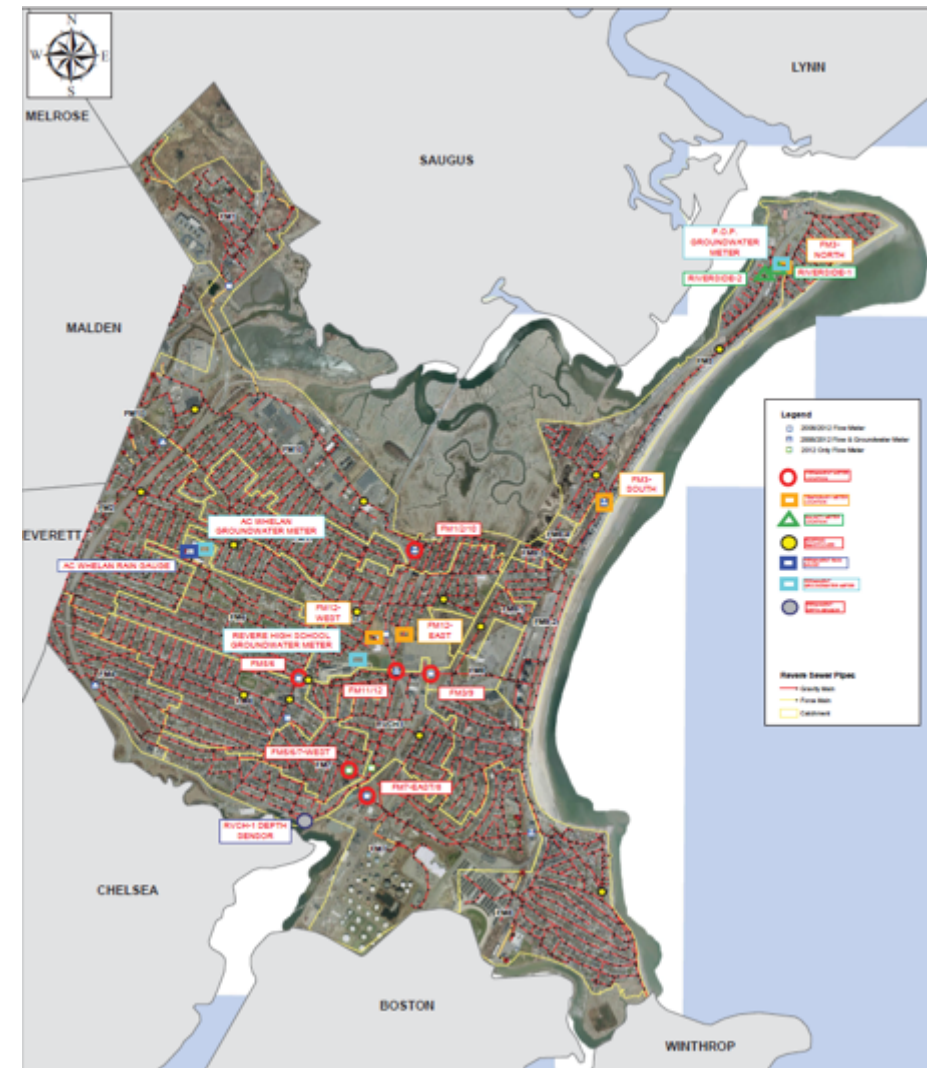
- Widespread Defects Found
  - Sewer Pipes
  - Manholes
- Due to Material & Age
  - 100 Year Old Clay Sewers





# Comprehensive Wastewater Master Plan

- Based on Metering & SSES Results
  - Large Portion of System to be Rehabilitated
  - Private Inflow Removal
  - Drainage Improvements
- Meet Requirements of Consent Decree



# Comprehensive Rehabilitation Program

- Effectively Address Widespread Defects
- Consists of:
  - Cured-In-Place Pipe (CIPP) Lining
  - Service Lateral Connection Lining
  - Manhole Rehabilitation
  - Private Inflow Removal
  - 25,000 – 30,000 LF Areas

# Comprehensive Rehabilitation Program

- Proven to Remove High Percentages of Infiltration/Inflow
  - 40% - 70%
- Successfully Implemented in Various Municipalities Throughout the Country
- Recommended and Initiated in the City of Revere, MA.

# Traditional Comprehensive Rehabilitation Design Approach

- Perform Sewer System Investigations
  - CCTV Inspection
  - Manhole Inspection
- Develop Design Drawings & Specifications



# Traditional Comprehensive Rehabilitation Design Approach

- CCTV Inspection Costs

Pipe Size (inches)	CCTV Inspection & Preparatory Cleaning	CCTV Inspection & Heavy Cleaning
8"-10"	\$1.25 - \$1.65/ft	\$2.00 – \$3.00/ft
12"-15"	\$1.50 - \$1.75/ft	\$3.00 - \$3.50/ft
24" – 36"	\$2.50 - \$3.00/ft	\$9.00 - \$10.00/ft

# Traditional Comprehensive Rehabilitation Design Approach

- Manhole Inspection Costs
  - Vary Based on Type

Inspection Type	Cost
Surface Inspection	\$55 - \$75/each
Video Inspection	\$100 - \$125/each

# Traditional Comprehensive Rehabilitation Design Approach

- Develop Design Drawings & Specifications
  - Review CCTV Inspection Videos
    - Identify Locations & Extents of Spot Repairs
    - Determine Pipe Size, Material, Depth, Number of Service Connections (open/capped), Drop Connections
    - Define Surface Conditions
  - Review Manhole Inspections
    - Determine Rehabilitation Recommendations (Cementitious/Epoxy Lining, Frame & Cover Replacement)

# Traditional Comprehensive Rehabilitation Design Approach

- Design Drawings & Specifications
  - Extents of CIPP Lining & Spot Repairs
  - Manhole Rehabilitation Actions
  - Detail How Spot Repairs and Trenchless Rehabilitation Are Performed
    - Approved Materials & Installation Methods



# Traditional Comprehensive Rehabilitation Design Approach

- Design Drawings & Specifications
  - Contain Permit Obligations
    - Wetlands
    - State Highway Access
    - Adjacent Buried Infrastructure
  - Permit Requirements
    - Special Materials/Procedures (Control Density Fill)
    - Pavement Thickness
    - Traffic Management

## Find & Fix Method

- “Design/Build” for Trenchless Rehabilitation
- Can Save Money and Reduce Project Duration
  - Eliminate the Need to Perform Inspections Prior to Design
- Success Directly Related to Completeness of Design Specifications
  - Carry Items to Cover all Types of Scenarios That May Be Encountered During Construction
- Construction Oversight (Resident Engineering) is Equally Important

# Determination of Potential Scenarios

- Spot Replacement of Sewers
  - Federal or State Owned Roadways
    - Special Paving Requirements
    - Generic Permits
  - Ground Surface Features
    - Private Property
    - Easements
    - Curbing Types
  - Subsurface Conditions
    - Cobbles, Rail Ties, Contaminated/Unsuitable Soils, Etc.





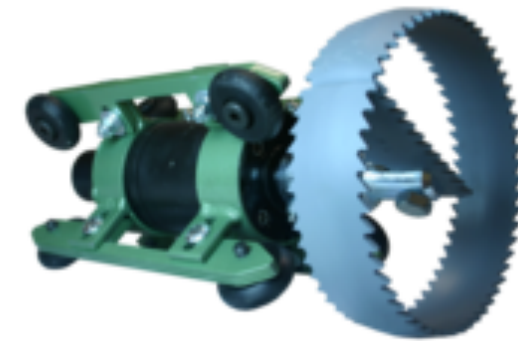
# Determination of Potential Scenarios

- Previously Lined Pipe
  - May Require Lateral Lining
    - Services Not Properly Reinstated
    - Capped Services Reinstated
    - Protruding Taps Not Ground Down



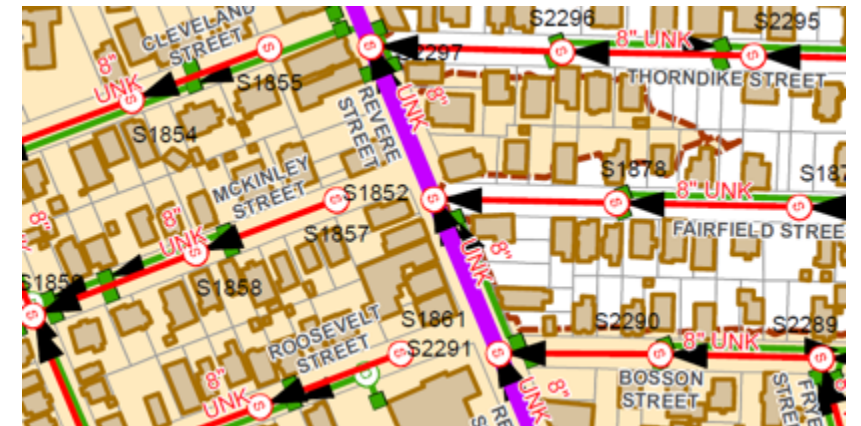
# Determination of Potential Scenarios

- Multiple Protruding Taps
  - Prevents Access from Both Sides
  - Typical Rotary Cutter Cannot Be Used
  - Lateral Reinstatement Device Is Needed
    - Equipment Not Usually Owned by CCTV Contractor



# Determination of Potential Scenarios

- Large Changes in Quantities
  - Sewers Might Be Lined or PVC Pipe
    - Less Lining Than Originally Thought
  - GIS Database Could Have Inaccurate Pipe Sizes
    - Bid Items for Specific Sizes Could be Larger or Smaller
    - Review Record Drawings



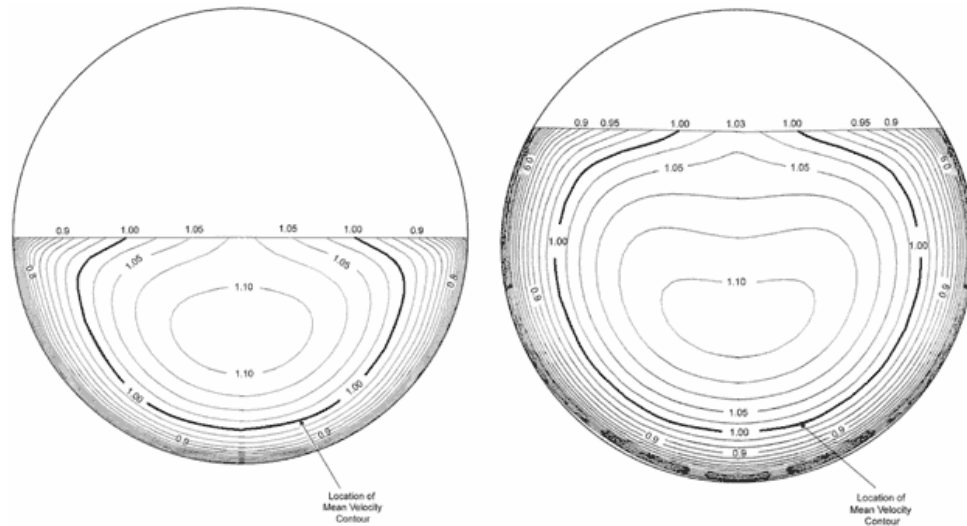
# Determination of Potential Scenarios

- Unknown Service Lateral Connections
  - Status: Active or Capped is Unknown
    - Dye Testing May Be Required to Confirm
  - Incorrect Reinstatement Could Result in Backups or Need for Short Liner



# Determination of Potential Scenarios

- Surcharged Sewers
  - Initial CCTV Inspection Cannot be Performed
  - Bypass Pumping May Be Required to Perform Inspection/Rehabilitation



# Determination of Potential Scenarios

- Project Delays/Contract Duration
  - Many Unknowns That Could Cause Delays
    - Extra Spot Repairs
    - Changes in Liner Quantities Affect CIPP Ordering
  - Projects Could Extend Into Winter Months
    - Certain Rehabilitation Products Do Not Work in Cold Weather



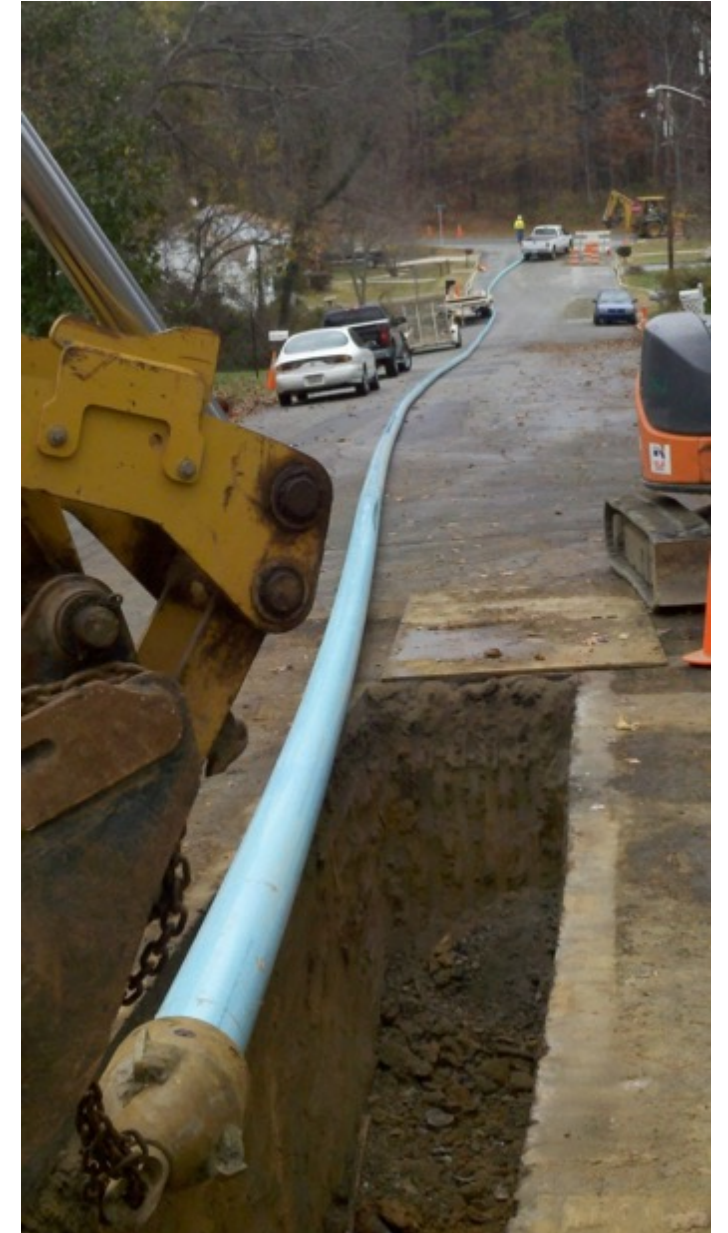
# Determination of Potential Scenarios

- Unknown Infrastructure
  - Connectivity Issues
  - Missing or Extra Sewer Pipes
  - Missing or Extra Manholes
    - Manholes Could Be Buried



# Determination of Potential Scenarios

- Additional Trenchless Options
  - Conventional Dig and Replace Spot Repair Not Possible
    - Utility Conflicts
    - Depth of Repair
  - Other Rehabilitation Techniques May Be Needed
    - Pipe Bursting

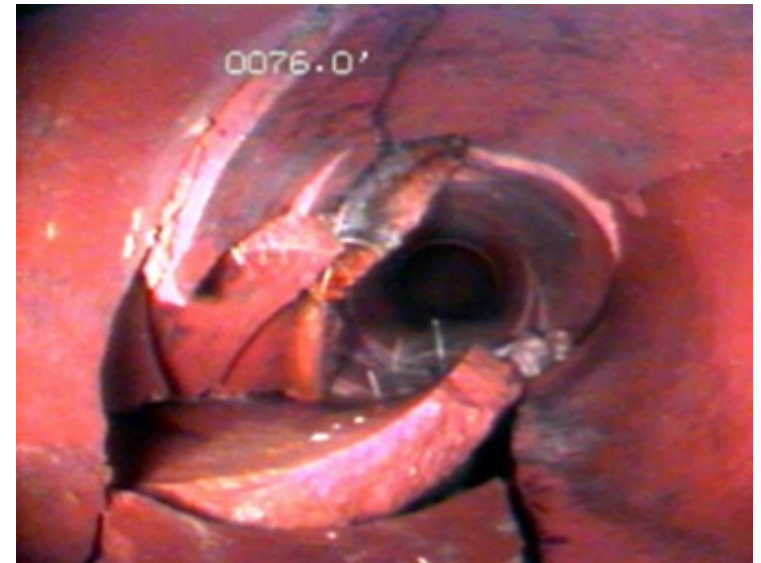


# Development of Specifications

- Development of Robust and Detailed Technical Specifications is Critical to Success
- Unique Bid Items Required
- Enhanced Language in Measurement & Payment Needed

# Development of Specifications

- Spot Replacement of Sewers
  - Include Bid Items to Account for Various Possibilities
    - Pipe Size
    - Depth
    - Length of Repair
    - Surface and Subsurface Conditions
  - Estimate Quantities Based on Review of System



# Spot Replacement Bid Items

Item Number	Description	Estimated Quantity	Unit	Unit Price	Total
14a	Remove and Replace (8-in thru 12-in) existing VC sewer (0'-8' deep) up to 8 linear feet	11	Each	\$7,743.25	\$85,175.75
14b	Remove and Replace (8-in thru 12-in) existing VC sewer (9'-12' deep) up to 8 linear feet	8	Each	\$7,924.38	\$63,395.04
14c	Remove and Replace (8-in thru 12-in) existing VC sewer (13'-16' deep) up to 8 linear feet	4	Each	\$10,867.50	\$43,470.00
14d	Remove and Replace (8-in thru 12-in) existing VC sewer (17'-20' deep) up to 8 linear feet	1	Each	\$12,075.00	\$12,075.00
15a	Remove and Replace (8-in thru 12-in) existing VC sewer (0'-8' deep) beyond 8 linear feet specified in Item 14a	20	Linear Foot	\$370.75	\$7,415.00
15b	Remove and Replace (8-in thru 12-in) VC Sewer (9'-12' deep) beyond 8 linear feet specified in Item 14b	16	Linear Foot	\$370.75	\$5,932.00
15c	Remove and Replace (8-in thru 12-in) existing VC sewer (13'-16' deep) beyond 8 linear feet specified in Item 14c	8	Linear Foot	\$302.40	\$2,419.20
15d	Remove and Replace (8-in thru 12-in) VC Sewer (17'-20' deep) beyond 8 linear feet specified in Item 14d	4	Linear Foot	\$302.40	\$1,209.60

# Development of Specifications

- Spot Replacement of Sewers
  - Include Detailed Language in Measurement and Payment
    - Restoring Private Property
    - Removing Trolley Tracks
    - Restoring Sidewalks and Curbing
    - Disposing of Unsuitable/Contaminated Soils



# Restoring Private Property



# Cobbled Streets



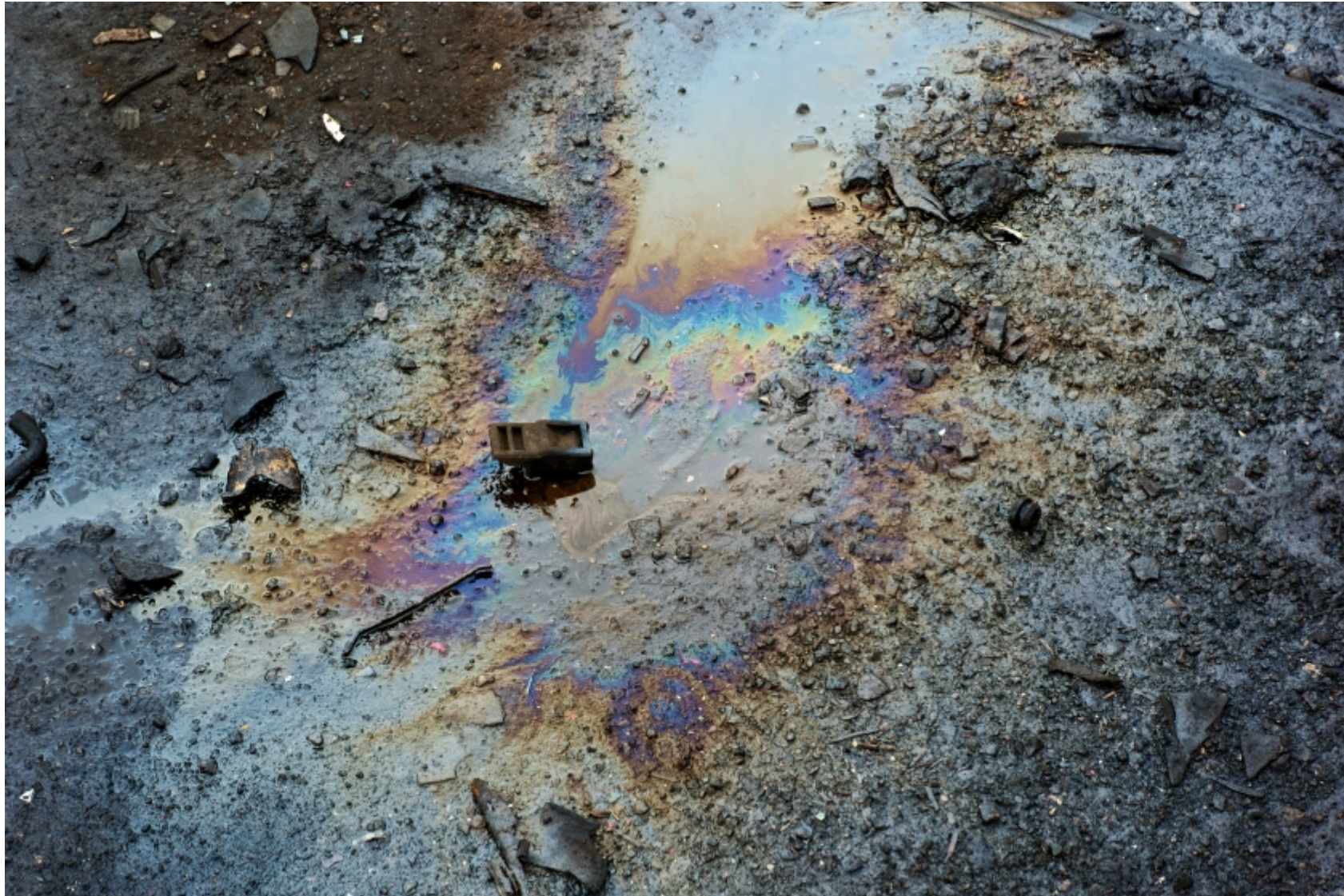
# Trolley/Streetcar Tracks



# Sidewalks and Curbing



# Contaminated Soils



# Development of Specifications

- Spot Replacement of Sewers
  - Digging in State Owned Roadways or Easements
    - Permit Requirements
    - Reduced Working Hours
    - Difficult Access



# Spot Replacement Bid Items

Item Number	Description	Estimated Quantity	Unit	Unit Price	Total
21	Remove and Replace (8-in thru 12-in) existing VC sewer (0'-8' deep), in State Highway, up to 8 linear feet	2	Each	\$8,223.25	\$16,446.50
22	Remove and Replace (8-in thru 12-in) existing VC sewer (0'-8' deep), in State Highway, beyond 8 linear feet specified in Item 21	10	Linear Foot	\$400.75	\$4,007.50
23	Remove and Replace (8-in thru 12-in) existing VC sewer (9'-12' deep), in cross-country areas, up to 8 linear feet	1	Each	\$8,500.00	\$8,500.00
24	Remove and Replace (8-in thru 12-in) VC Sewer (9'-12' deep), in cross-country areas, beyond 8 linear feet specified in Item 23	5	Linear Foot	\$375.50	\$1,877.50

# Development of Specifications

- Previously CIPP Lined Sewers
  - If Service Lateral Lining is Part of Scope
  - Include Bid Items For:
    - Additional Service Lateral Reinstatement/Brushing
    - Installation of Short Liners
    - Grinding Down Protruding Taps





# Development of Specifications

- Multiple Protruding Taps
  - Cannot Be Cut With Rotary Cutter
    - Changed Condition
  - Include Bid Item For Grinding Down Protruding Tap with Lateral Reinstatement Equipment

Item Number	Description	Estimated Quantity	Unit	Unit Price	Total
8	Grind-down Multiple Protruding Taps Using Lateral Reinstatement Equipment	12	each	\$442.50	\$5,310.00

# Development of Specifications

- Dye Testing
  - Status of All Service Connections Will Not Be Known
    - Risk in Reinstating or Not Reinstating Services
  - Include Bid Item For Dye Testing of Services



# Development of Specifications

- Dewatering/Bypass Pumping
  - Sewers Could Be Surcharged
    - Must be Cleaned and Inspected
  - Include Bid Item For Dewatering/Bypass Pumping/Heavy Cleaning

Item Number	Description	Estimated Quantity	Unit	Unit Price	Total
48	Dewater/Bypass Pump and Perform Television Inspection of Sewer Pipe - 8" -24"	5,271	Linear Foot	\$3.00	\$15,813.00

# Development of Specifications

- Additional Trenchless Alternatives
  - Spot Replacement of Sewers Not Always Possible
    - Utility Conflicts
    - Depth of Repair
  - Include Bid Item For Pipe Bursting
    - Detailed Language with Assumptions on Pipe Size

# Conclusions

- Find & Fix Method is “Design/Build” for Trenchless Rehabilitation
- Can Save Money and Time
- Allow Municipalities to Rehabilitate Large Portions of their Sewer System
- Detailed Specifications are Crucial to Limit Change Orders

# Contact us!



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