Rail Yard Case Study:
Aging Subsurface Infrastructure and Environmental Issues

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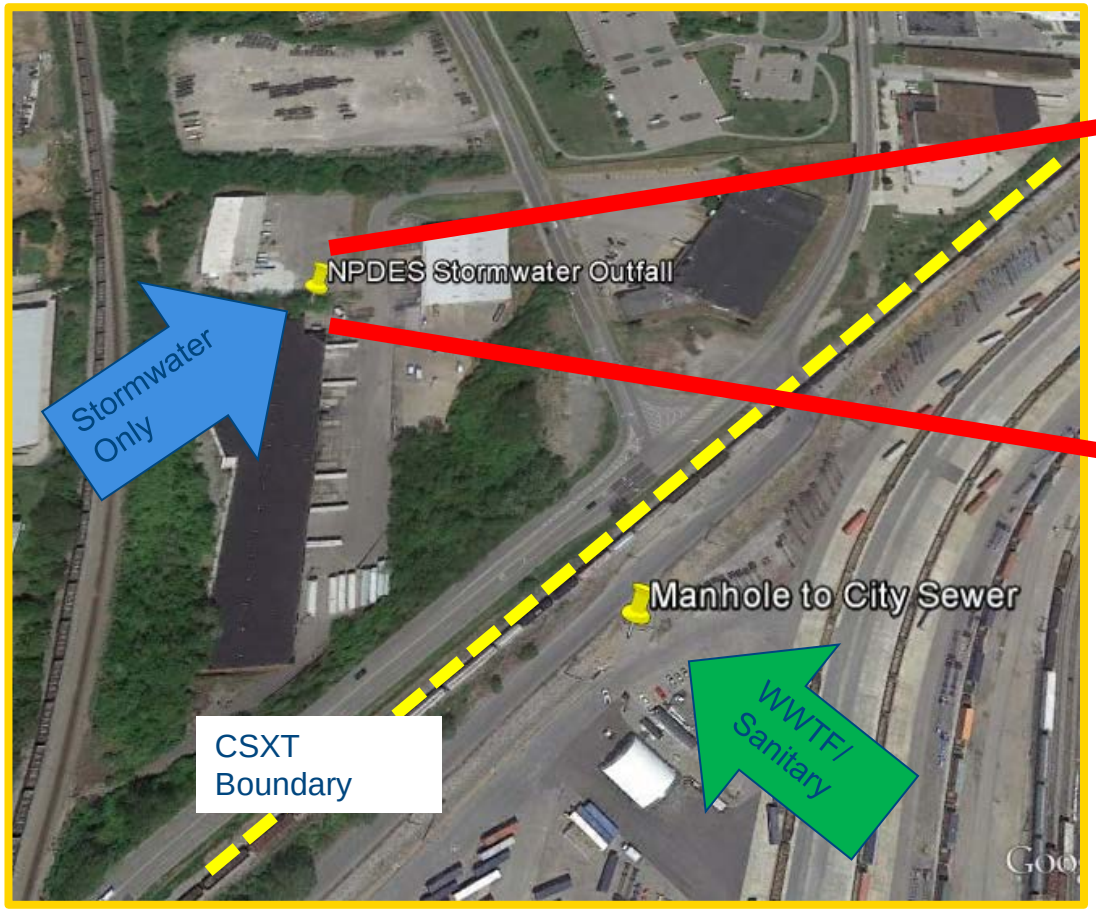
HOW TOMORROW MOVES

Aging Rail Yard Infrastructure Across the US

- Many rail yards over 100 years old
- Non-standardized documentation
- Disjointed growth and connectivity of infrastructure
- Limited access to aged underground infrastructure

Case Study: A Tale of Two Outfalls



NPDES OUTFALL

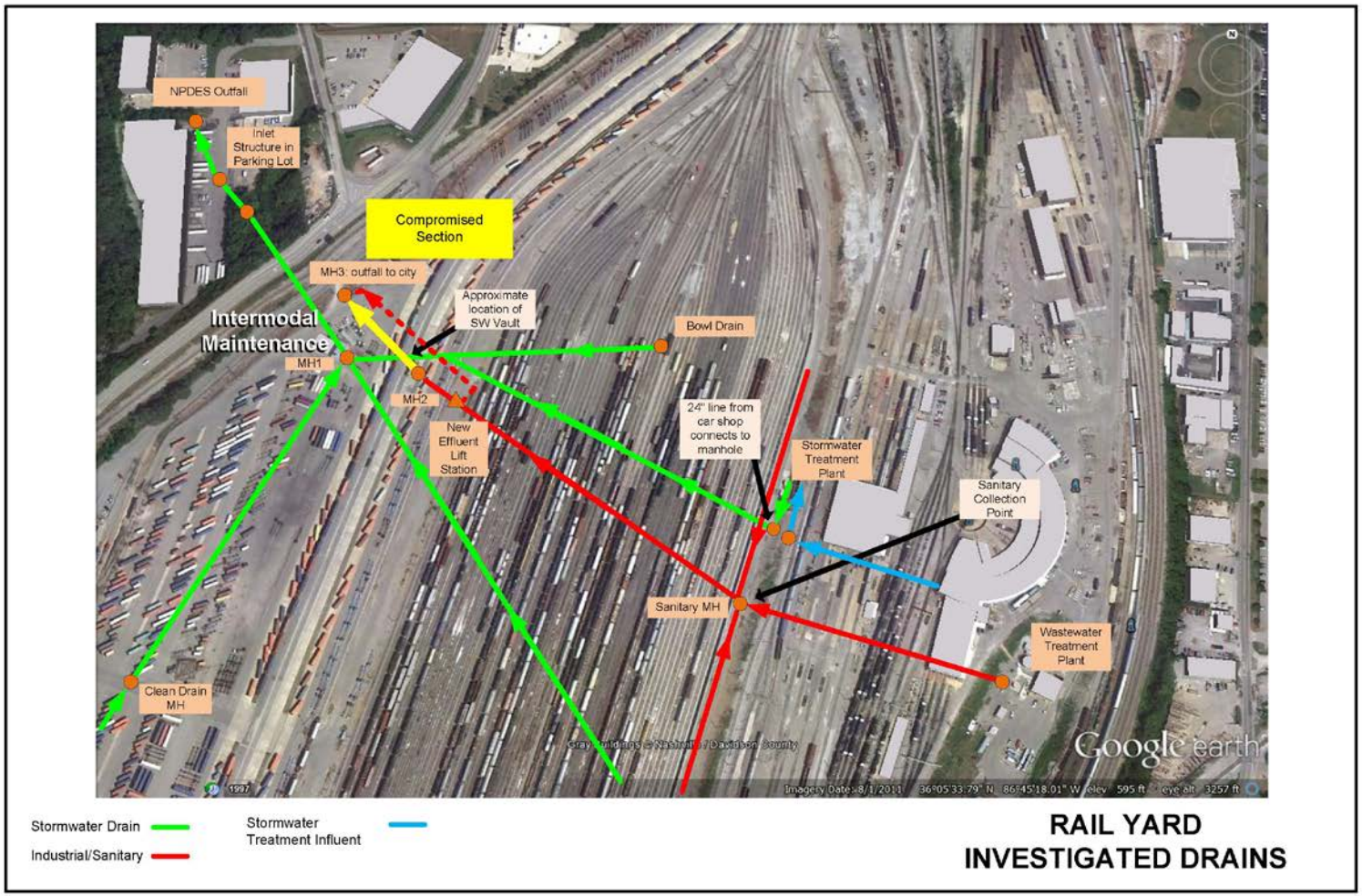
Late February 2014, a sheen was identified at NPDES Outfall, not at SW plant

Case Study: A Tale of Two Outfalls

- There was no visible source of sheen from stormwater system
- Investigate outside CSXT property
- Reduced known flow to stormwater outfall
- Inaccurate/incomplete documentation led to involved investigation

Identified compromised sanitary sewer pipe
50 feet below ground

Case Study: A Tale of Two Outfalls



Case Study: A Tale of Two Outfalls

The only pipe to city sewer was inoperable

- Divert flow away from collapsed pipe
  - Sanitary wastewater- collected in frac tanks; discharge to city
  - WWTF effluent-diverted to stormwater treatment plant; discharge to NPDES outfall
    - Installed tertiary treatment at WWTF
- Flushed stormwater treatment plant upstream piping

Investigation and Risk Management

Investigation and Risk Management: Challenges

- Large drainage area covering non-CSXT properties
  - Hundreds of acres
  - Numerous adjacent Industrial property owners
- Inaccurate/incomplete documentation and maps
- Confined space
- Active rail lines
- Infrastructure limitations
- Significant depths
  - Limited to no accessibility

Investigation and Risk Management: Tools

- Investigated stormwater and sanitary manholes
  - Smoke testing
  - Dye testing
  - Camera investigation
    - Locator head attached to camera

Investigation and Risk Management: Findings

- Located previously unidentified influent and effluent piping
- Identified unique connections
- Identified properly labelled manholes
- **Identified compromised pipe**

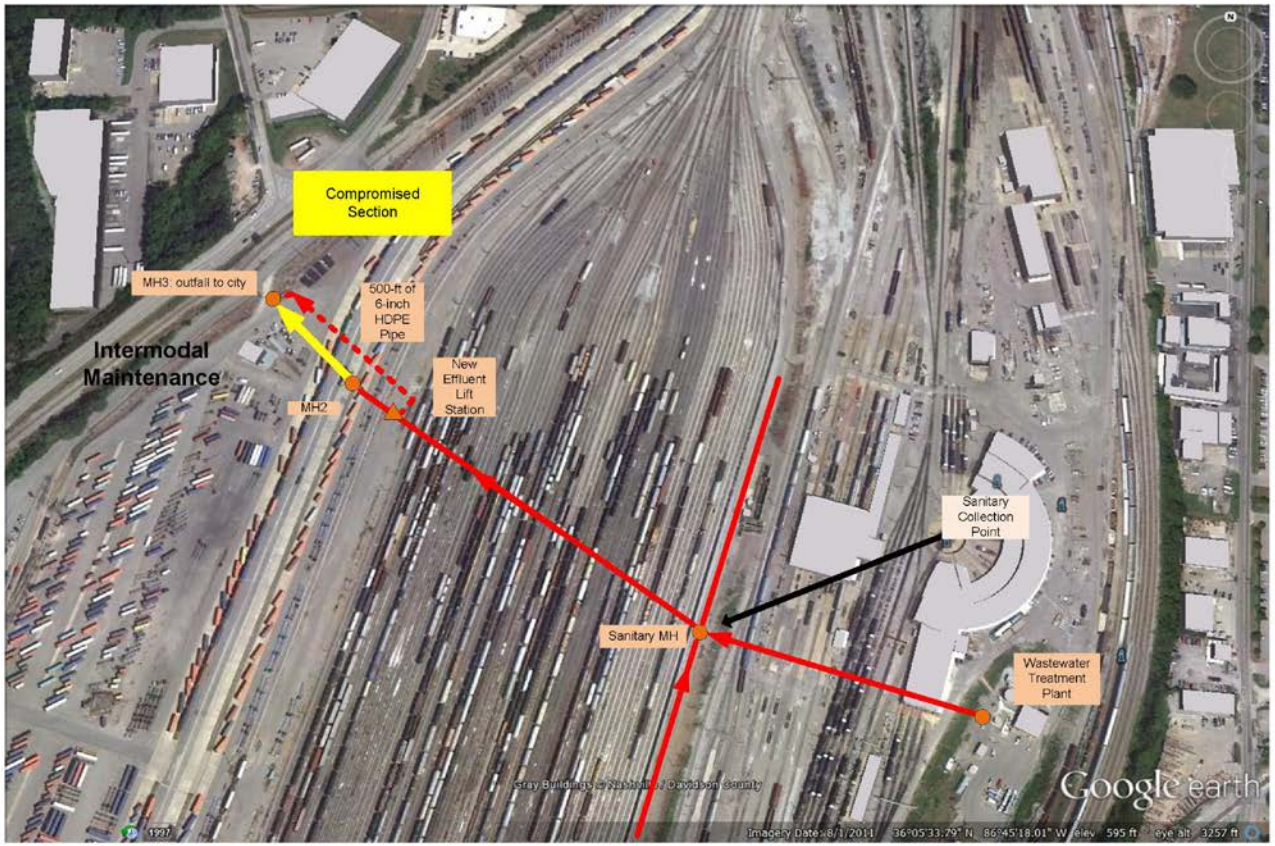
Long Term Solution

Long Term Solution: Implementation

Installed triplex pump station:

- Compromised pipe 50-ft deep under active tracks
- Pump station location
  - Near compromised pipe
  - Remote from WWTF
  - Accessible for construction and maintenance
- Remote location challenges:
  - Independent power and controls
  - Telemetry for remote monitoring and controls
  - **Redundant (Fail Safe) pump, power and controls**

Long Term Solution: Remote Location



New Triplex Pump Station and Forcemain

Long Term Solution: Construction Challenges

- Underground challenges: boulders, piping, cables, signal lines
- Active Rail Yard; (~50 feet between track and access road)
- Significant Depth (>40 feet)

Long Term Solution: Construction Challenges

- Personnel Safety
  - Caged access
  - Fall protection
- Non-Traditional Installation

Long Term Solution: Operational Challenges

- Fully automated PLC with alarms
- Fail safes
  - Triplex pump station (installed backup pump)
  - Emergency generator
  - Primary radar level control with backup float switches
  - PLC fails then backup float switches
- Communications
  - Cellular telemetry for remote access
- Accessibility
  - Active Rail Yard; (~50 feet between track and access road)

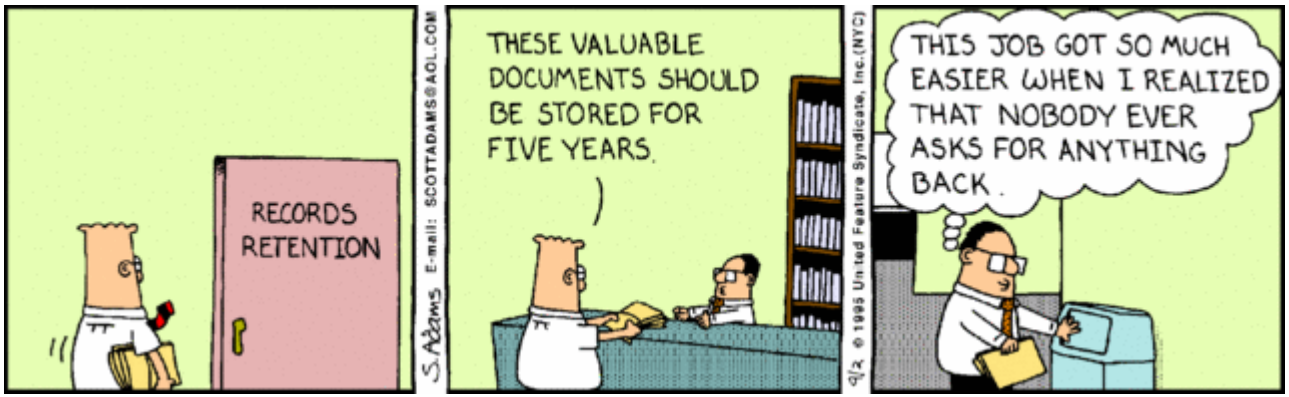
Lessons Learned

Lessons Learned to Apply Across Industry

- Almost all rail yards across the industry have aged infrastructure, including buried piping
- Update Pipe Maps
  - Confirm pipe is coming from and going to properly designated locations
  - Correct any concerns or improper cross connections
- Consider future maintenance as part of current design
- Project Implementation
  - Construction challenges
  - Operational challenges

Lessons Learned to Apply Across Industry

- Most Importantly…**Proper Documentation**
  - Update to correct any disjointed documentation from historical projects
  - Update all pertinent drawings and records with each new project
  - Store documentation in a location that is easily accessible and intuitive



Questions?

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