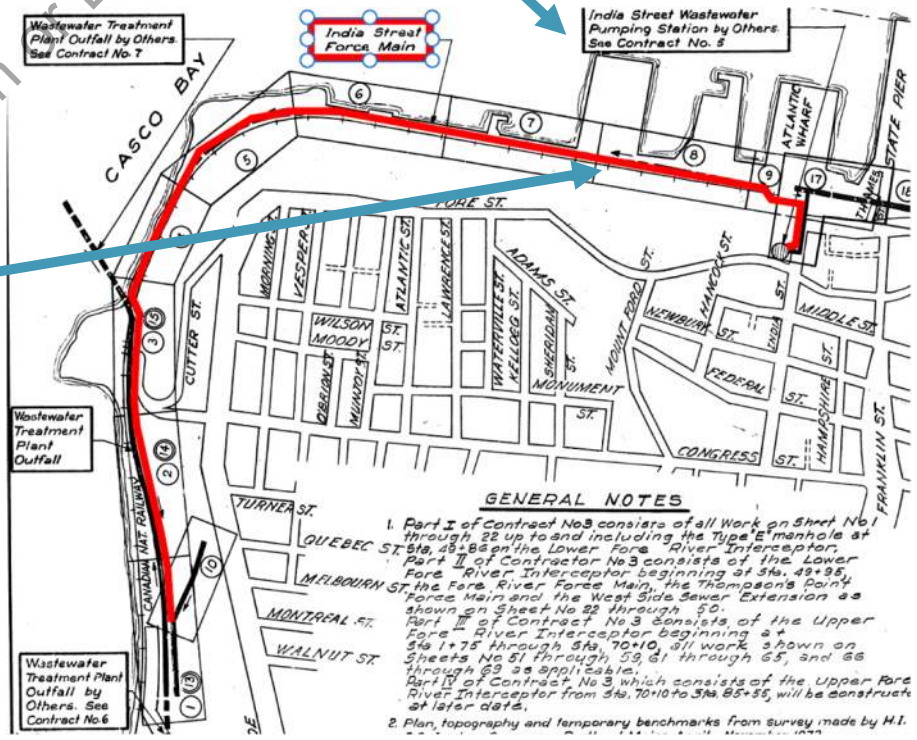
India Street Force Main Condition Assessment

2/28/2026

India Street Force Main

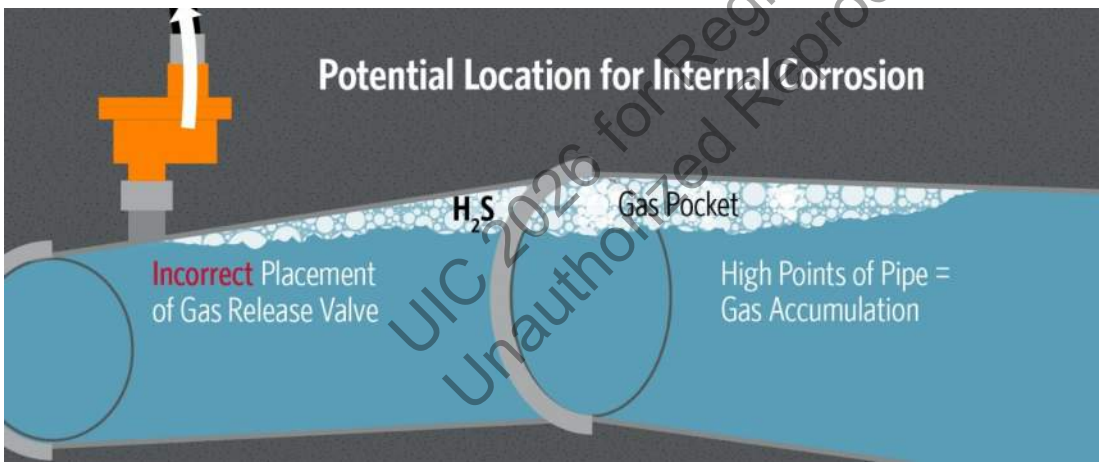
- High risk asset
- Pipe traverses downtown Portland and high tourism area (including cruise ship port)
- 7,024 feet of PCCP constructed in 1976
- 33” diameter lined cylinder pipe
- Interpace corporation, Hudson, NY plant (Class III wire)

Eastern Promenade Walking Trail



Common PCCP Force Main Failure Modes

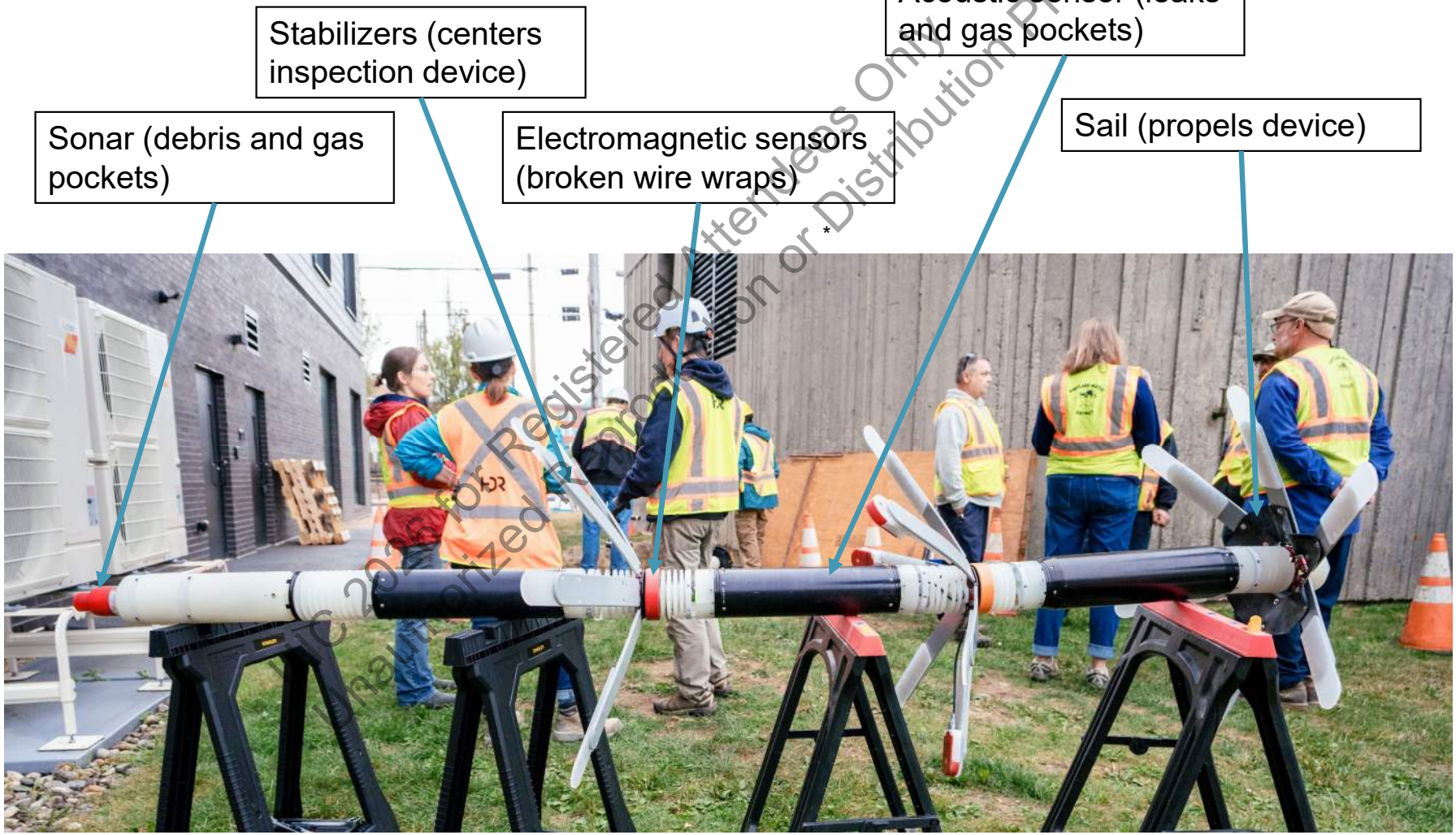
- External deterioration: Corrosion and hydrogen embrittlement related damage of prestressing wire (wire breaks)
- Internal corrosion: H2S corrosion at gas pocket locations
- Overloading: Excessive overburden or excessive pressure loading
- Debris: Debris up constricts pipeline flow



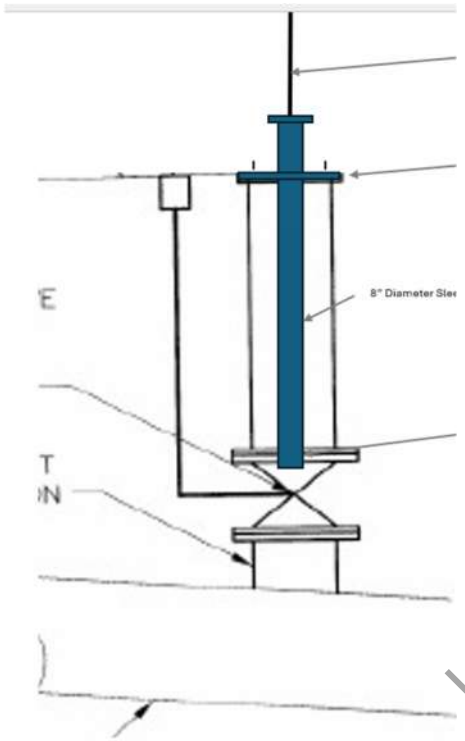
Project Criteria

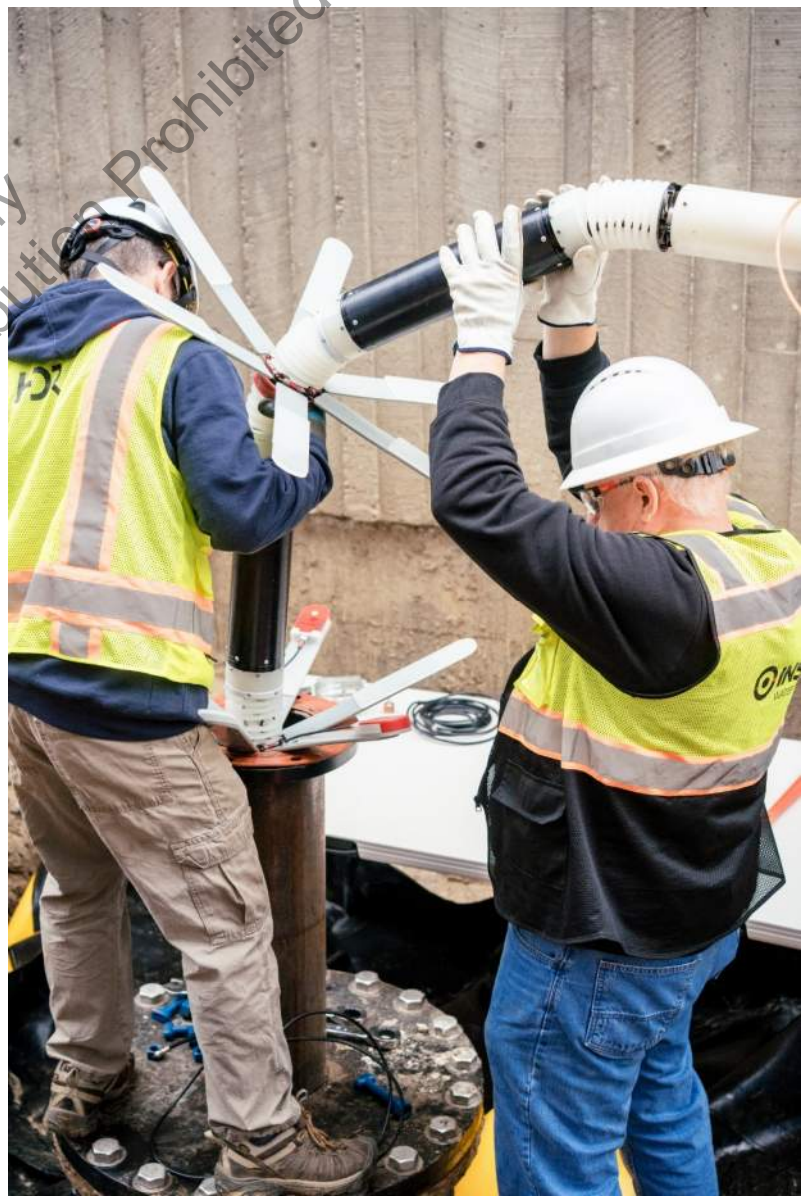
- Determine pipe reliability
  - Pipe wall assessment
  - Sonar profiling- debris
  - Acoustic survey- leaks and gas pockets
  - Pressure monitoring- C Factor, loading
- **Pipe must remain in service at all times**
- Condition Assessment Solution:
  - XK1- free swimming multi sensor inspection
  - High frequency pressure monitoring
  - Visual inspection of discharge chamber

XK1 Inspection Device



Insertion of Inspection Device





Ready for Launch!

Tracking the Inspection Devices

Capturing Inspection Device

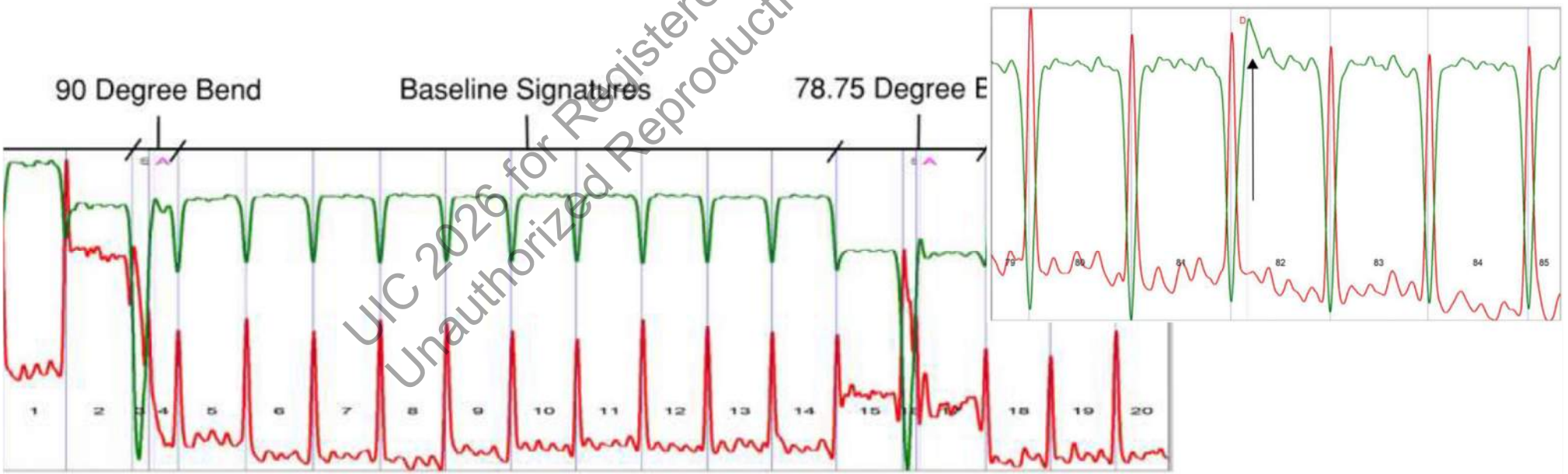
Safety top priority

Custom built extraction rack

Inspection device arrives at extraction

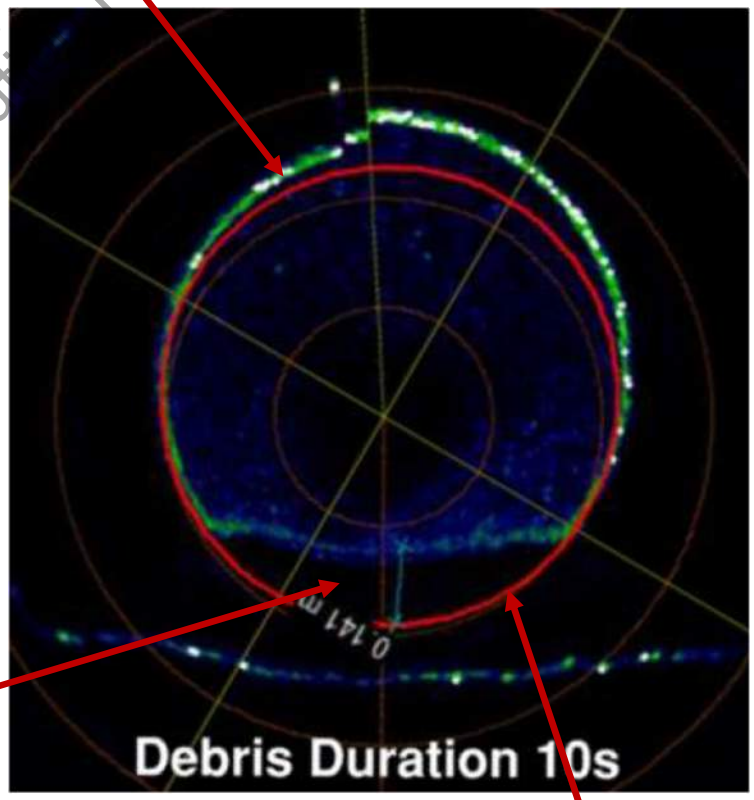
Electromagnetic Signals

- Pipes without damage provided consistent repeatable signal
- One pipe reported with broken wire wraps (est. 5 BWW)



Findings of Sonar Profiling

- 14 locations with debris build up
- Largest debris pile was 30 feet long with maximum depth of 5.6 inches
- Small debris pile reported was 2-inches deep, 2 feet long
- No gas pockets detected



Findings of High Speed Pressure Monitoring

- Pressure monitoring:
  - Operating and transient transients were within allowable limits
  - Two surges detected, (below allowable limit)

Table 7: Pressure Data Summary

Design Working Pressure	85 psi
Maximum Allowable Transient Pressure	119 psi
Average Dry Weather Pressure	16.1 psi
Average Wet Weather Pressure	37.6 psi
Maximum Recorded Pressure	76.7 psi

Other Condition Related Data

- Pipe designed for E-80 (rail loading) but loading is vehicular or foot traffic
- Although pipe constructed in 1970s, Class III prestressing wire was utilized
- Operating pressure (wet weather) 38 psi; design operating pressure 80 psi

Variables contributing to improved structural performance

Table 3. India Street Force Main Design Specifications (Original Contracts)

Contract Number	5	3	
Manufacturer	Interpace	Interpace	
Year Constructed	1976	1976	
Inside Diameter (in)	33	33	
Pipe Classes	N/A	A	B
Core Thickness (in)	2-1/16	2-1/16	
Minimum Coating Thickness (in)	13/16	13/16	
Wire Size	#8	#8	
Prestressing Wire Class	III	III	
Wire Area (in^2/ft)	0.280	0.320	0.165
Wraps Per Foot	13.59	15.53	8.00
Ultimate Tensile Strength (psi)	262,000	262,000	
Gross Wire Wrapping Stress (psi)	196,500	196,500	
Dynamometer 1 wire (lb)	4,050	4,050	
Design Pressure (psi)	85	85	
Maximum Design Depth of Cover (ft)	15	15	6
Live Load	H-20	E-80	H-20
Concrete Strength at Wrapping (psi)	3,500	3,700	3,500
Cylinder Thickness (in)	0.0449	0.0449	

Findings

- Force main is in good condition with little evidence of deterioration. Should have long remaining life.
- One pipe identified with broken wire wraps.
  - 0.3% of project pipe
  - National average is 3.9% (pipe is performing better than average)
- Loading conditions well under design
- No gas pockets or leaks
- 14 locations with debris build up

Recommendations

- Investigate root causes of surge and mitigate
- In the future, if debris build up affects hydraulics, remove debris
- If pipeline modifications are performed, sample wire and mortar coating
- Reinspect in 7 years to evaluate growth in deterioration

Happy Project Team (Portland Water District, Insight Water Technologies, HDR)!

Portland Water District
From Sebago Lake to Casco Bay

INSIGHT

HDR

Questions

Please visit: India Street Wastewater Force Main Condition Assessment - Portland Water District

Or contact:

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- HDR's Project Technical Lead, Mike Higgins at mike.higgins@hdrinc.com