Evidence Based Asset Management of Aging Water Mains

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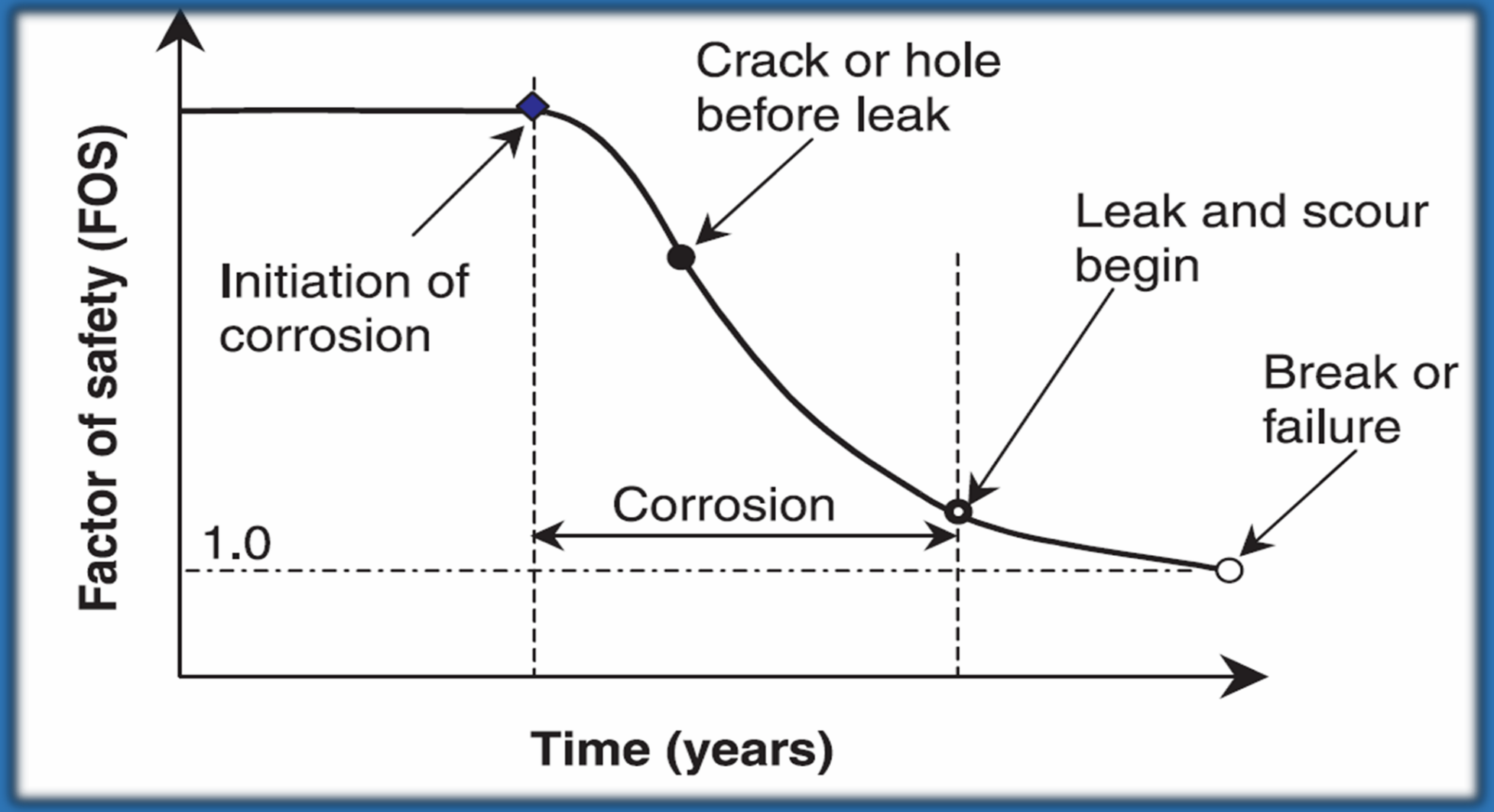
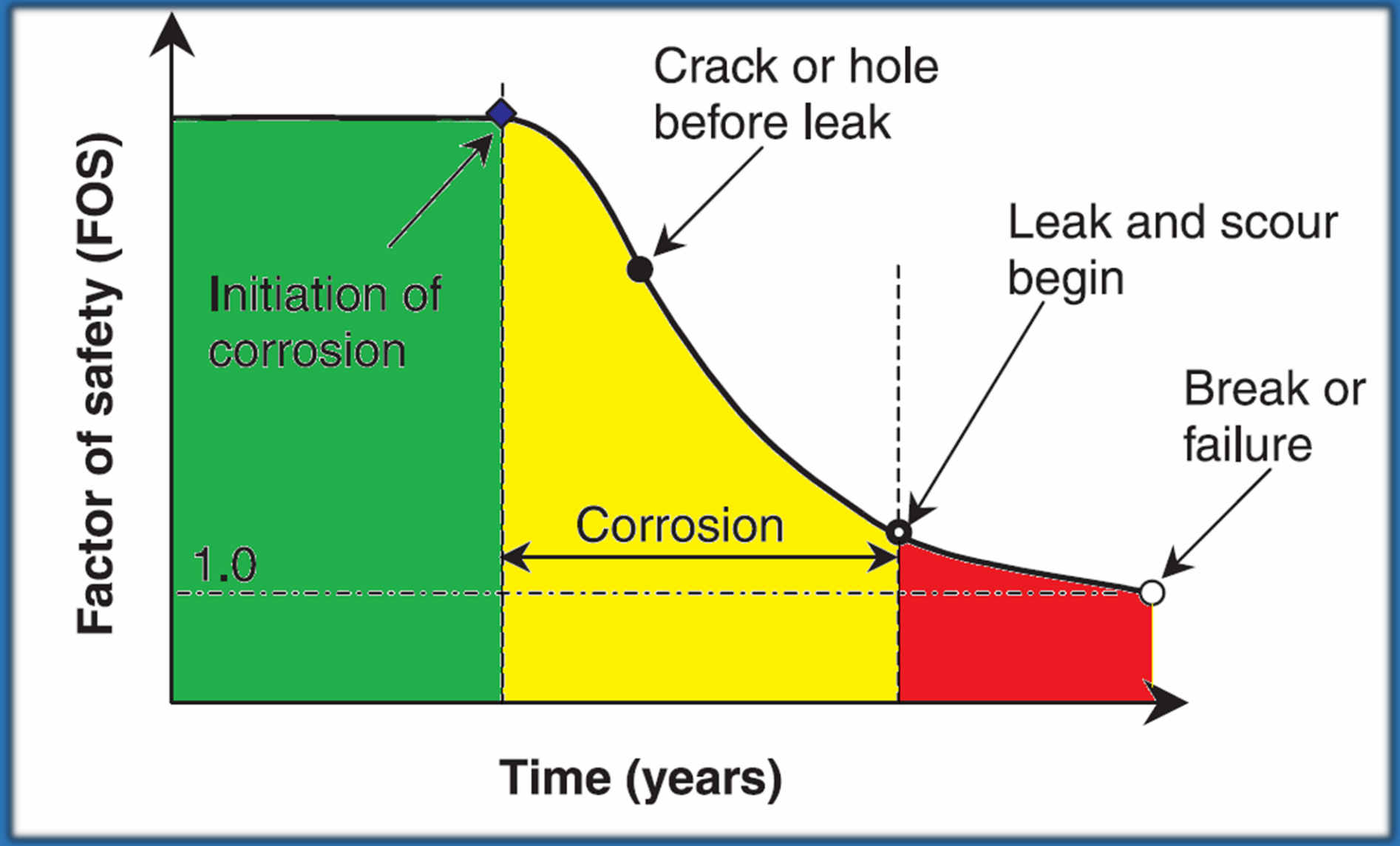
Our goal is show you how to achieve substantial cost savings using a new, innovative approach to water main asset management and renewal through our Clean, Evaluate, Line and Protect (CELP) program.

Failure curve for 90% of metallic pipe in North America

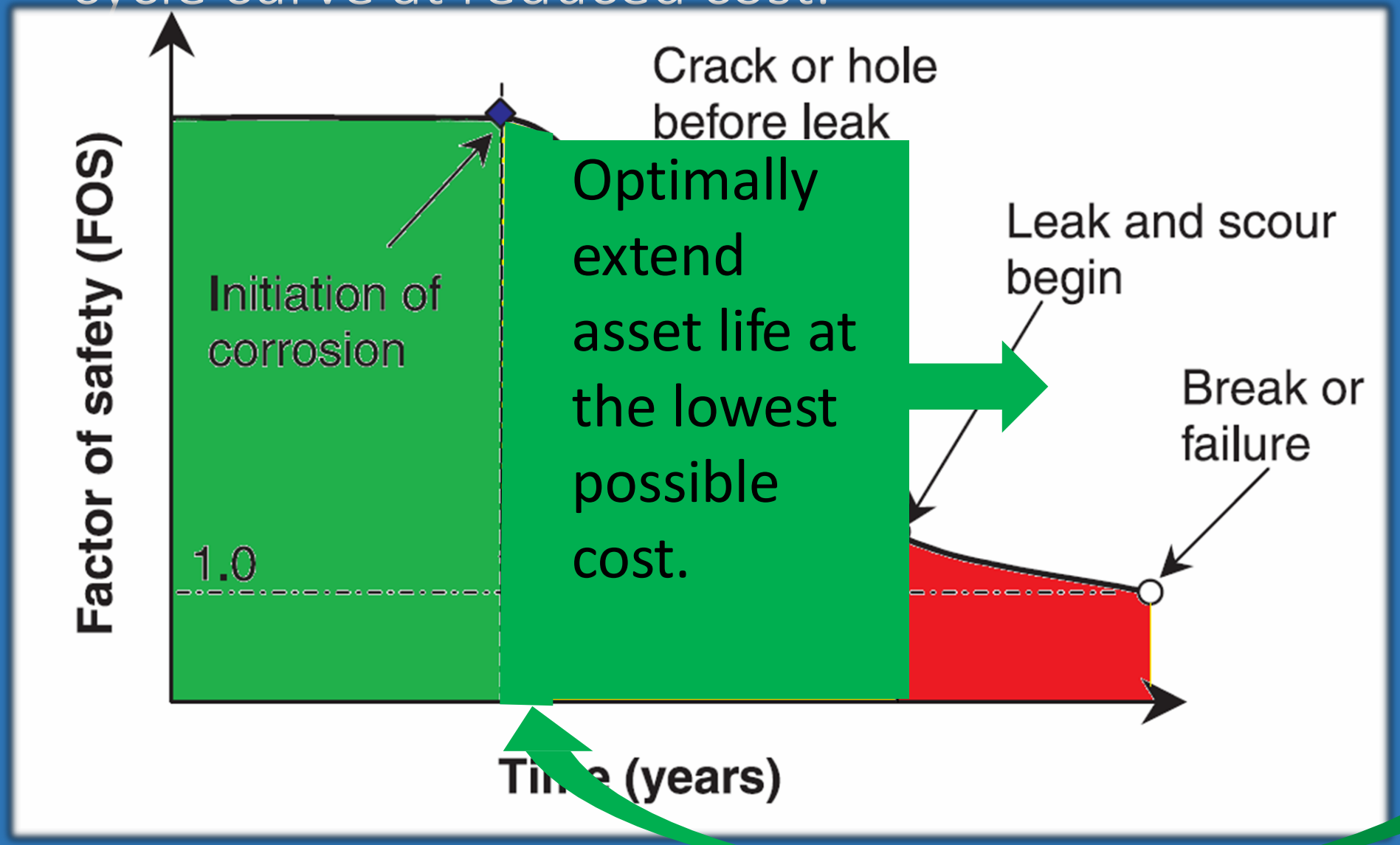


- Rajani et al, NRC, 2004

This is also a life-cycle asset management curve.



CELP extends the asset life by intervening earlier in the life-cycle curve at reduced cost.



✓Significant savings can be achieved with earlier intervention to stop pipe deterioration.

Starting earlier in the life-cycle requires screening of assets (e.g. break histories, and leak surveys) to establish priorities and ensure that we are not including end-of-life, structurally compromised pipes.

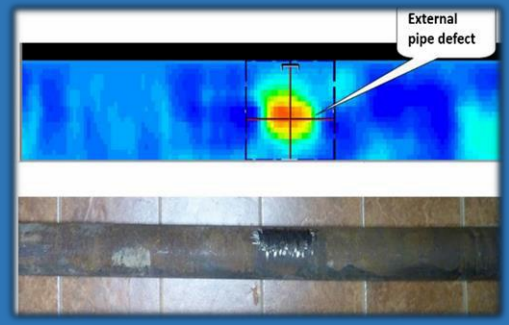
Optimizing Rehabilitation with CELP – Four Step Program:

1 Clean

- Airborne stone cleans corroded pipe to bare metal.

2 Evaluate

- Live-streaming wall thickness measurement finds defects.



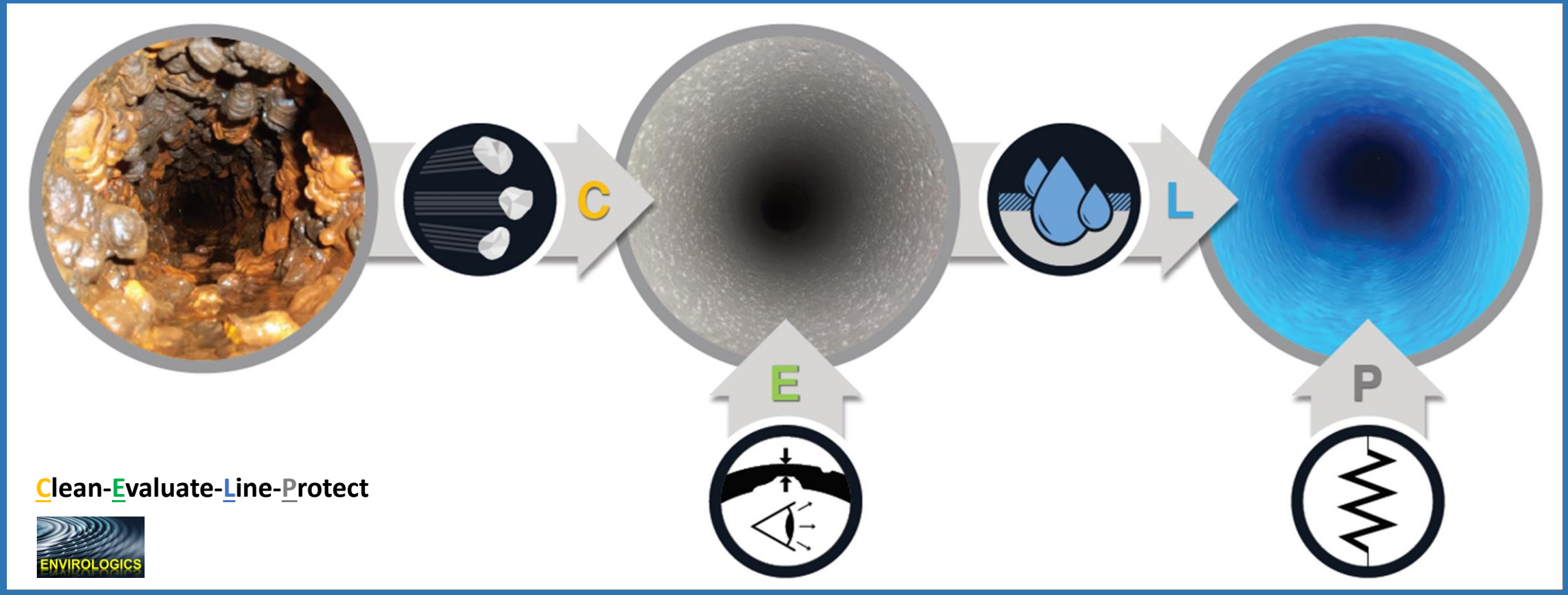
3 Line

- Lining selected for pipe condition; stops interior corrosion.

4 Protect

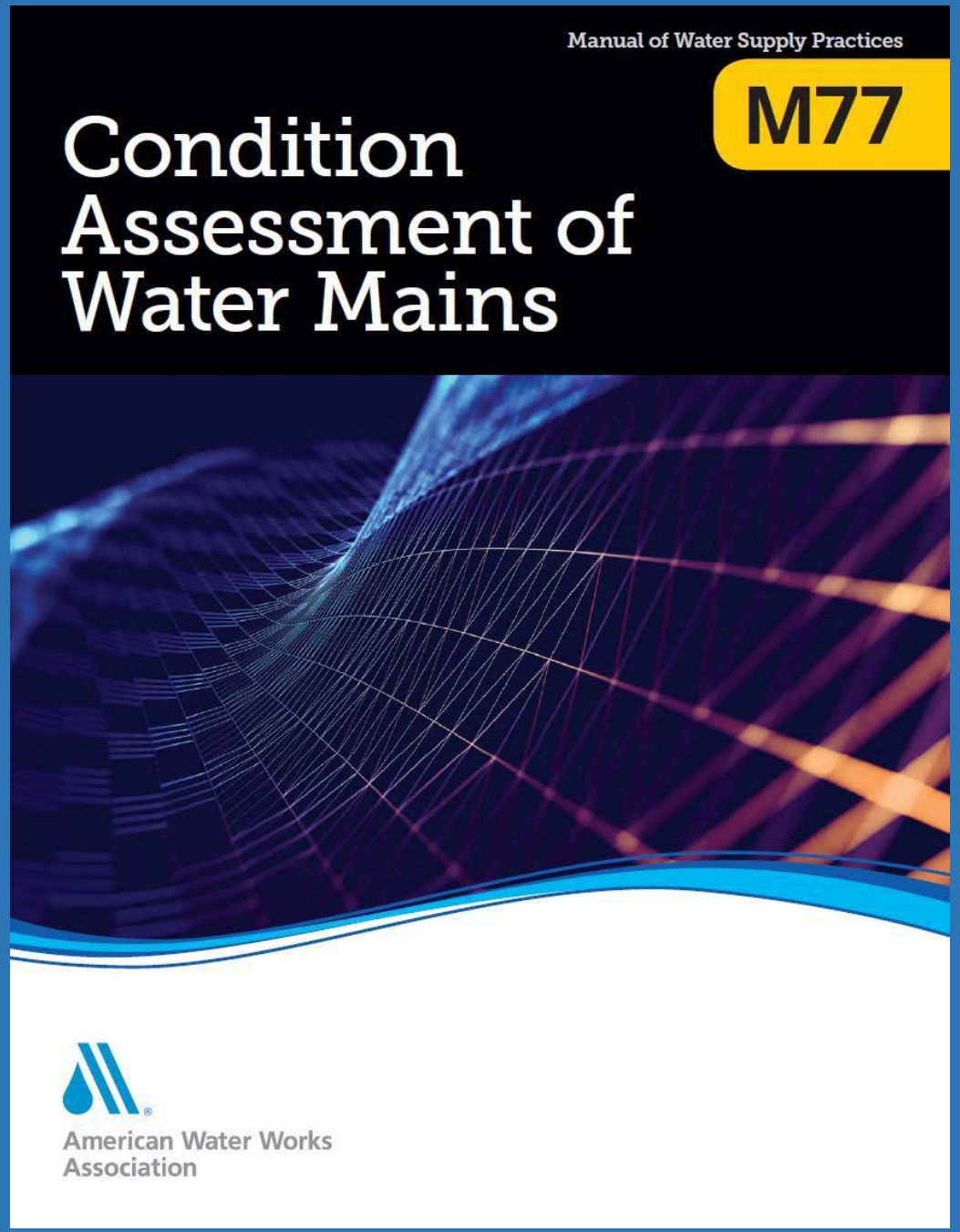
- Anodes protect exterior pipe from future corrosion.

Envirologics has developed the Clean-Evaluate-Line-Protect (CELP) program to identify those pipes that do not need replacement and structurally stabilize them by stopping all corrosion.

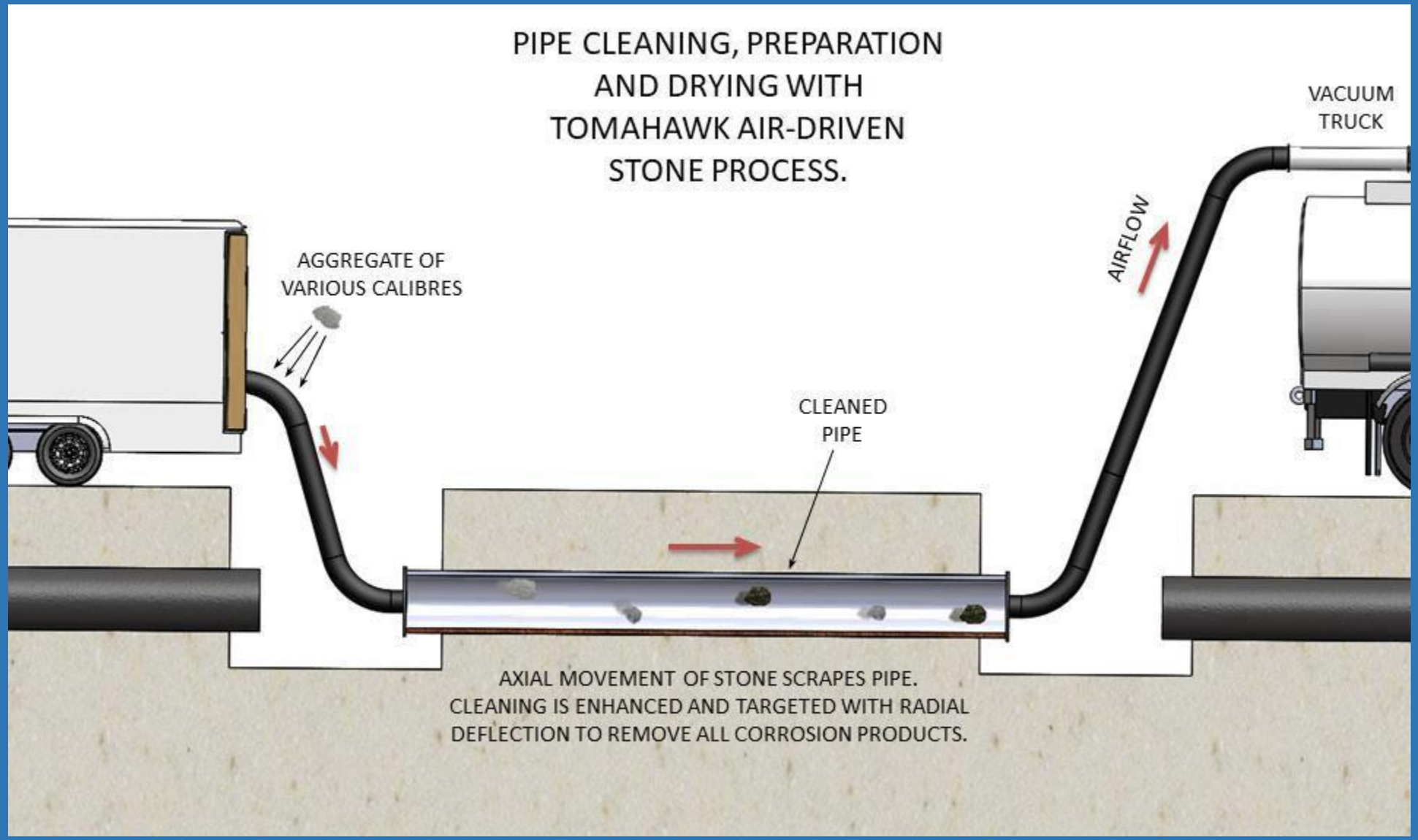


CELP meets the requirements of the new AWWA M77 Manual of Practice.

Chapter 15: The Assess-And-Fix Approach for Water Main Rehab.



CELP Step 1: Clean pipe to bare metal using minimal-to-no water



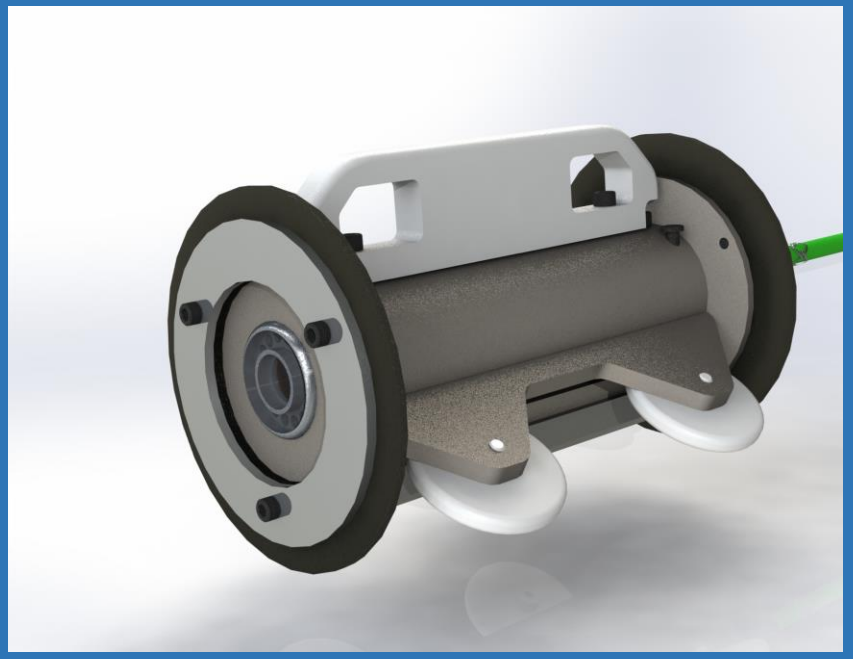
“Best in Class” cleaning results in as little as two hours.

Loose graphitic corrosion is removed from pipe wall to ensure excellent liner adhesion

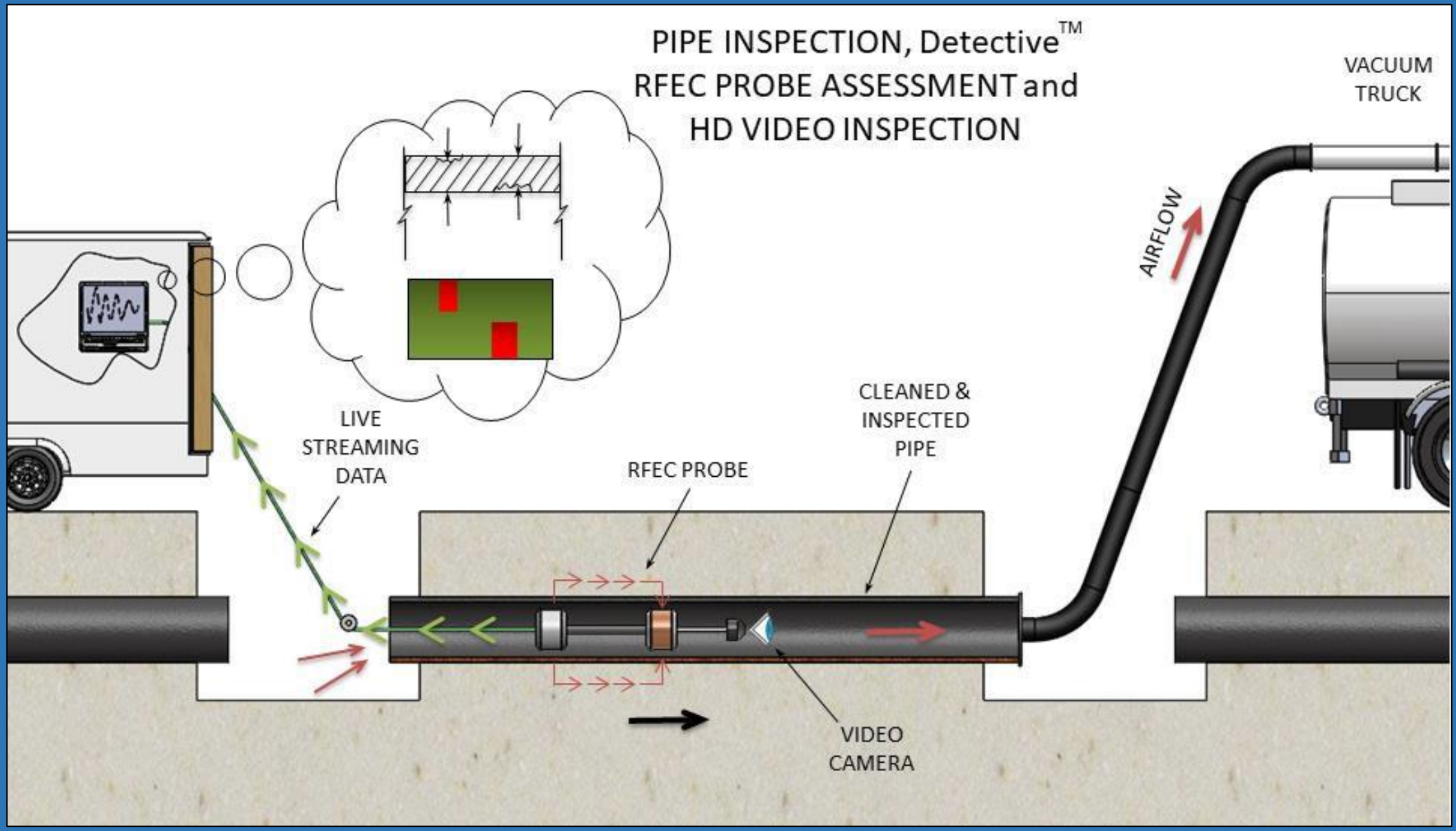

Click here for video

Pipe Preparation, Inspection and Evaluation

- Tomahawk Scout™, air-driven inspection CCTV camera that vacuums and dries the pipe, joints and service connections.
- Cracks and leaks are also exposed by Scout as part of the Evaluation process.
- Surface preparation exceeds ASTM F3182, and services are cleaned to a SSPC-SP6/NACE No. 3 condition for superior sealing at all crucial locations.

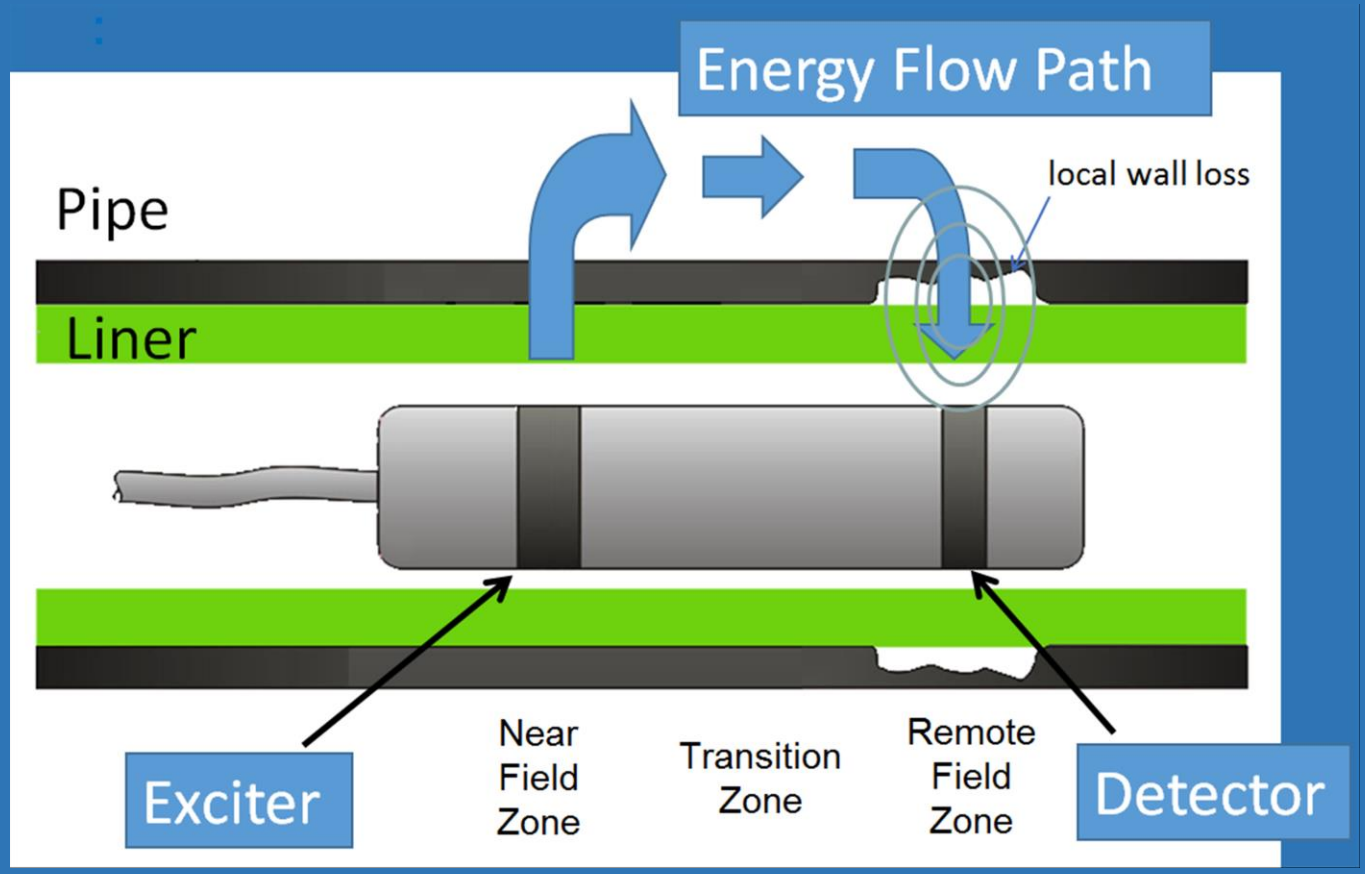


CELP Step 2: Evaluate pipe using RFEC with HD video



Remote Field Eddy Current (RFEC)

- Equipped with an exciter module that emits an AC electromagnetic field.
- Energy field passes through the pipe wall, travels along the exterior of the pipe, re-enters the pipe and is received by a detector array.
- Computer analyzes exciter versus detector signal strength change and phase angle shift to determine wall loss.

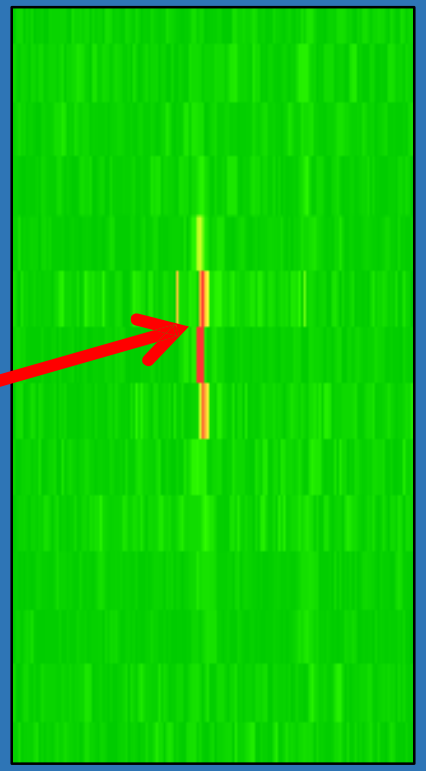


Detective™ Overview

- The Envirologics Detective™ uses RFEC to determine remaining wall thickness
- Designed to be a “quick audit of pipe health” for immediate decision making as to next steps
- Live streamed data displayed on computer screen using a colour coded pallet:
  - Green is good pipe wall
  - Yellow is cautionary
  - Red are areas where there is greater than threshold value, ie. 50% through wall defect, further investigation warranted

Visual Inspection with HD Camera

Corrosion defect (50% wall loss)



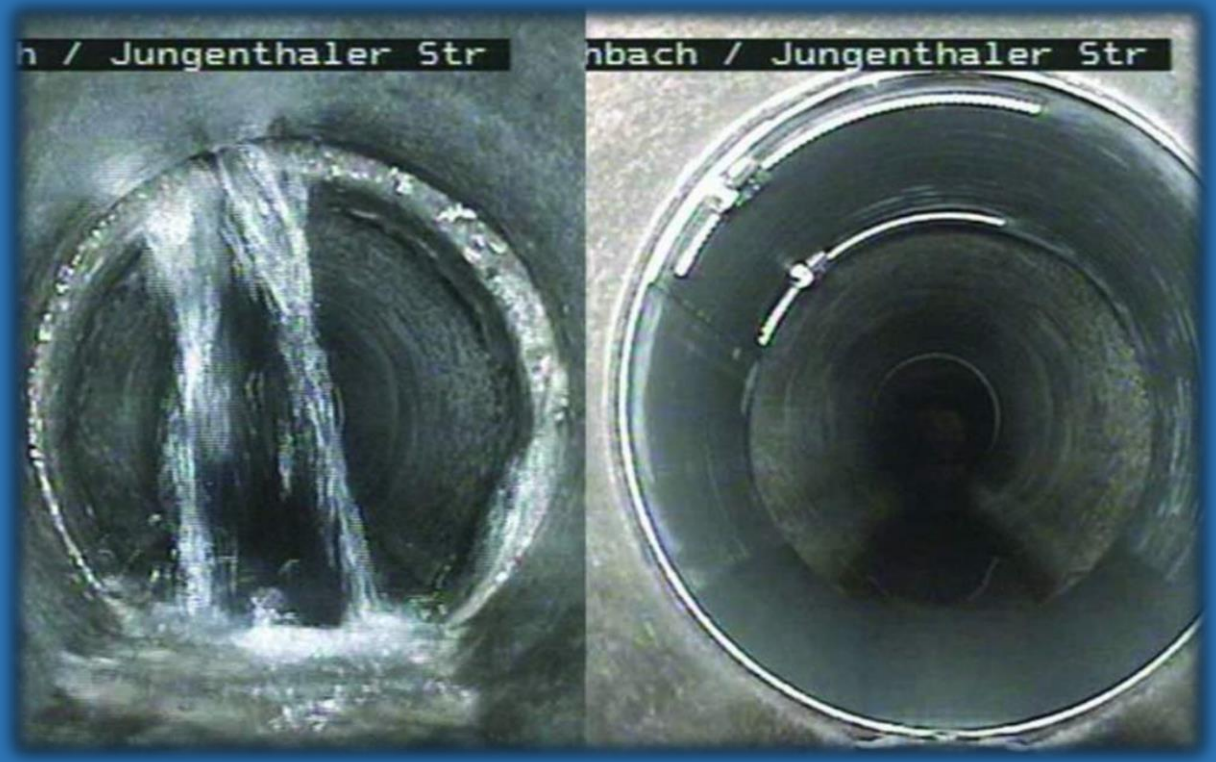
RFEC Streaming Colour Assessment

- Concurrent visual inspection and defect scan.
- Alarm (red) locations are synchronized with HD video to better determine corrosion condition and location.

Sherbrooke, QC – 83 meter long section
Percentage of Wall - Thickness Loss

Potential for structure repair in short section of pipe with 75% through wall defects

Structural point repairs can be installed internally.

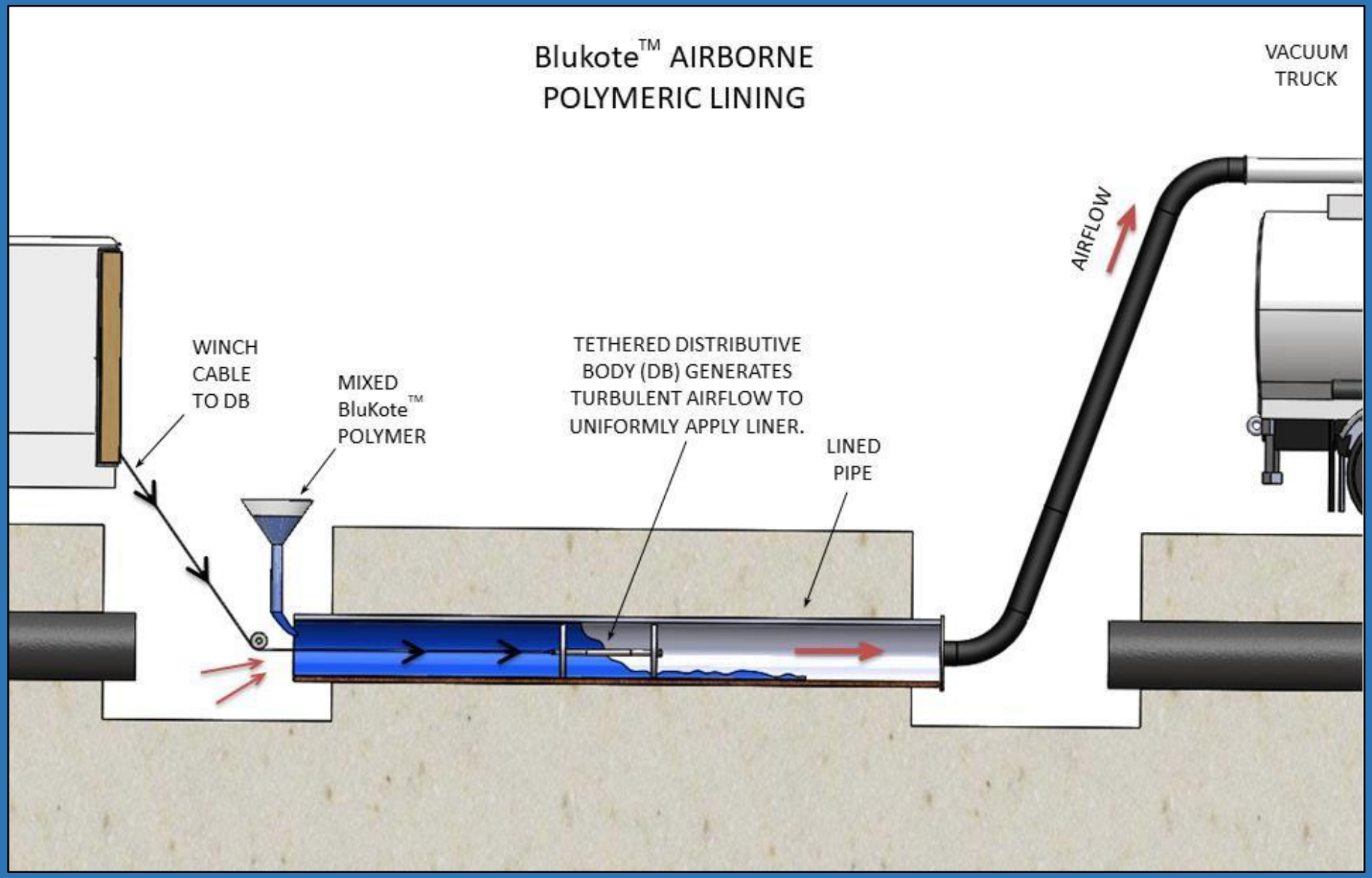


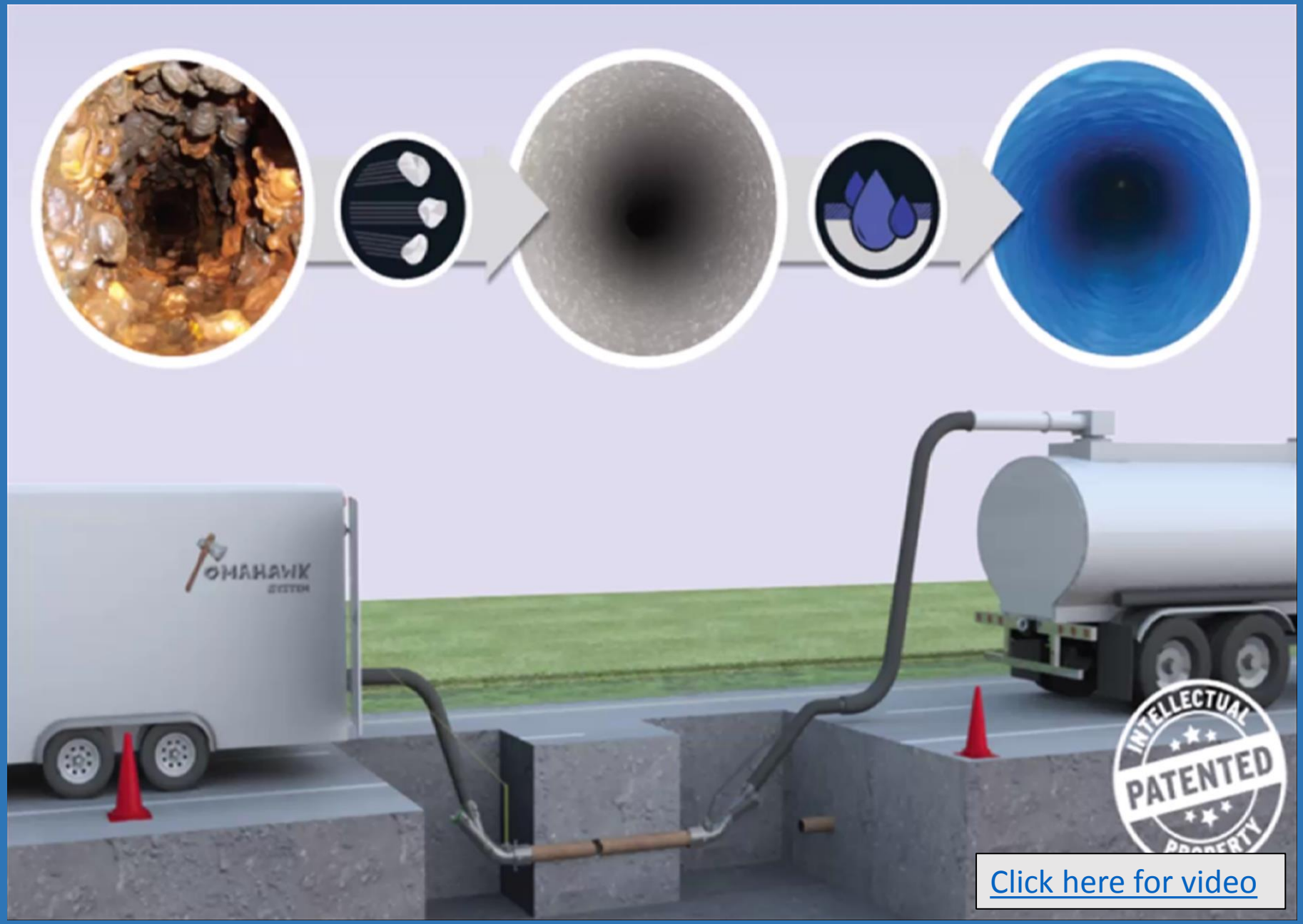
Point repair sleeves (e.g QuickLock) consist of a stainless steel sleeve and rubber gasket. Positioned remotely with Scout and installed using inflatable plug. Meets ASTM F3110 requirements, and supports 220 psi of water pressure.

Evidence Based Pipe Health Evaluation Includes:

- Prior to deployment: Leak assessments, break or maintenance history of pipe
- Upon arrival: Cross section review of pipe cuts and review of pipe exterior exposed during excavation
- After cleaning: Scout CCTV video of cleaned pipe, corrosion removal from pipe wall, active leaks and vaculation of holes
- By end of CELP step 2: RFEC probe assessment and HD video

CELP Step 3: Line pipe interior with BluKote™ polymeric coating

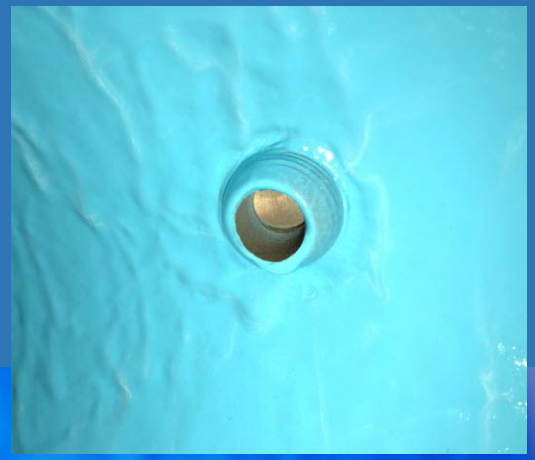


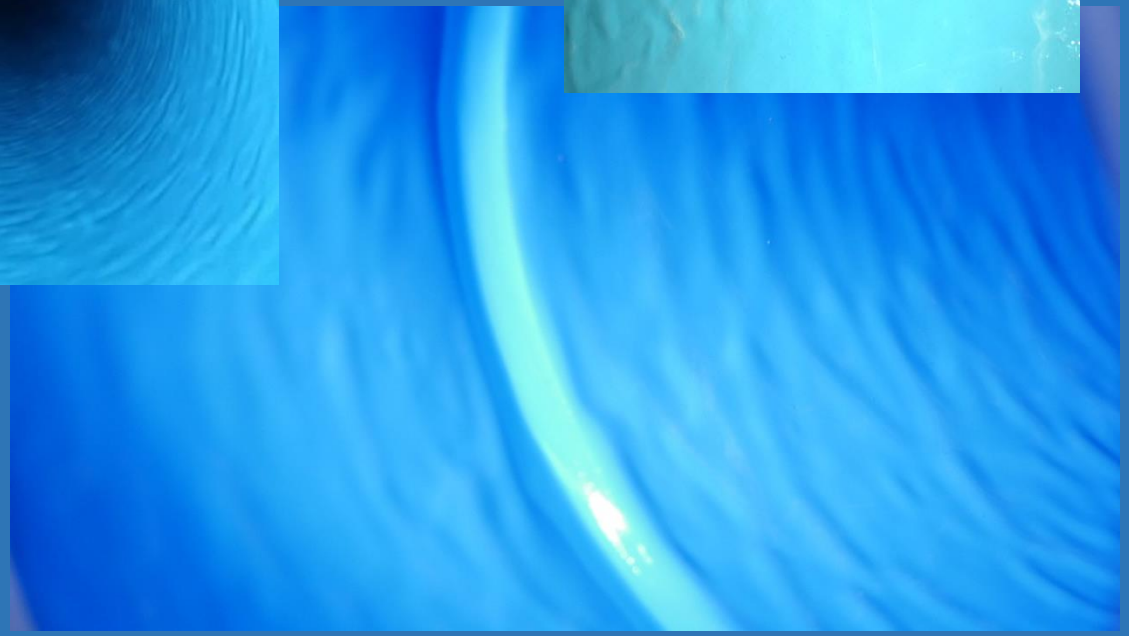

TOMAHAWK
INTELLECTUAL
PATENTED
PROPERTY
Click here for video

BluKote Airborne Lining

- Low-cost, NSF61, Class I, polymeric lining system for metallic and concrete pipes (not trialed on AC to date).
- Prevents future interior corrosion, deposit build-up and water quality problems.
- Deployed successfully on 100mm - 200mm pipes.
- Line up to 120 meters of pipe in one segment.
- Line 22.5° bends, one per pipe section.
- Fast lining application, 4-hours tack-free, as little as 24 hour return to service following lining.

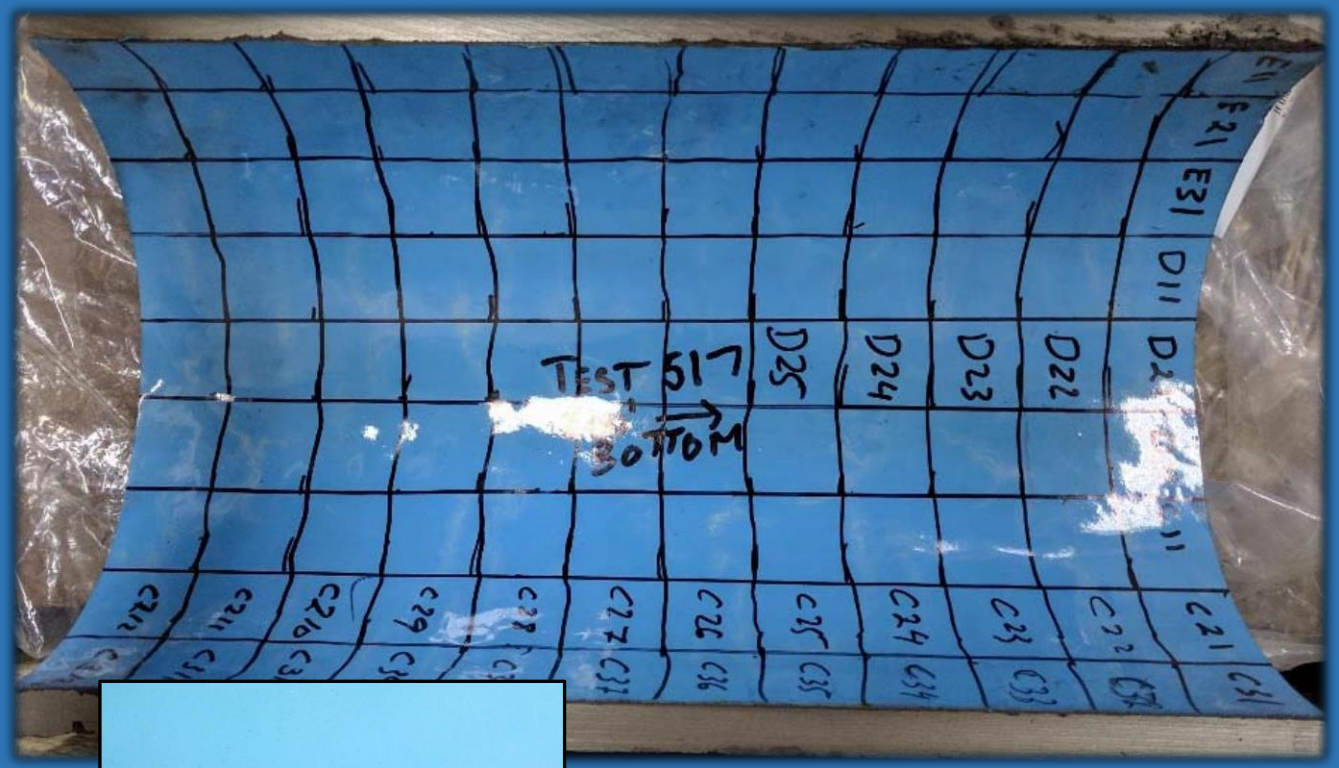
Continuous lining thickness of 0.75 – 1.0 mm per coat. Minimum bond strength of 500 psi, average of 1,500 psi. Full coverage at service connections, clamp repairs and pipe joints.
No plugging of services.



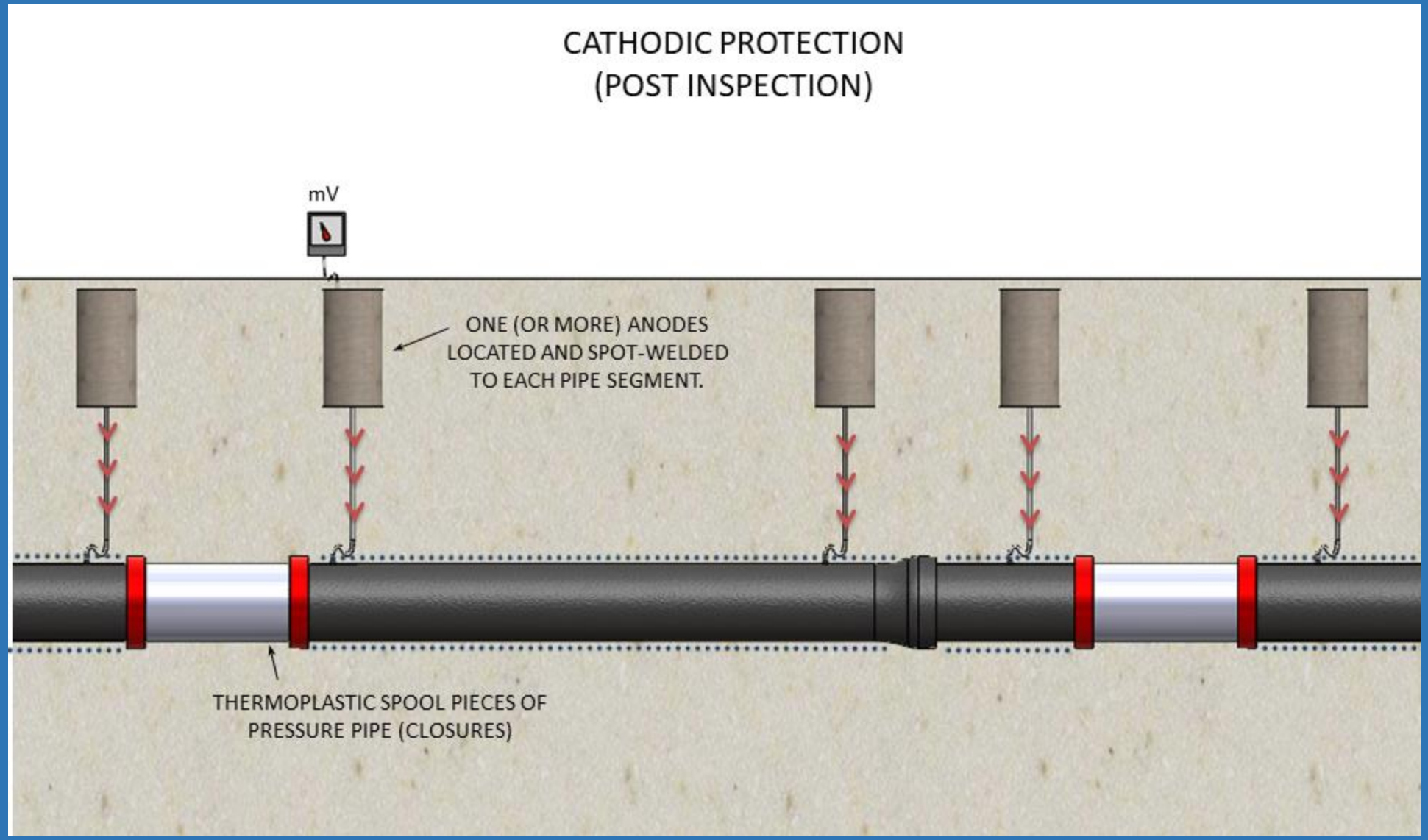


BluKote Lining Tests

- Adhesion
- Holidays
- Immersion
- Service Tapping



CELP Step 4: Protect exterior using cathodic protection



Cathodic protection stops exterior corrosion.

- Cathodic protection uses zinc or magnesium anodes to protect pipe exterior (AWWA M27 Manual).
- Anodes are accurately placed using Vac-Ex and results from the RFEC/video inspection.
- Dissimilar metal corrosion between the service and pipe can be stopped.
- Anodes can be monitored and replaced at nominal cost.

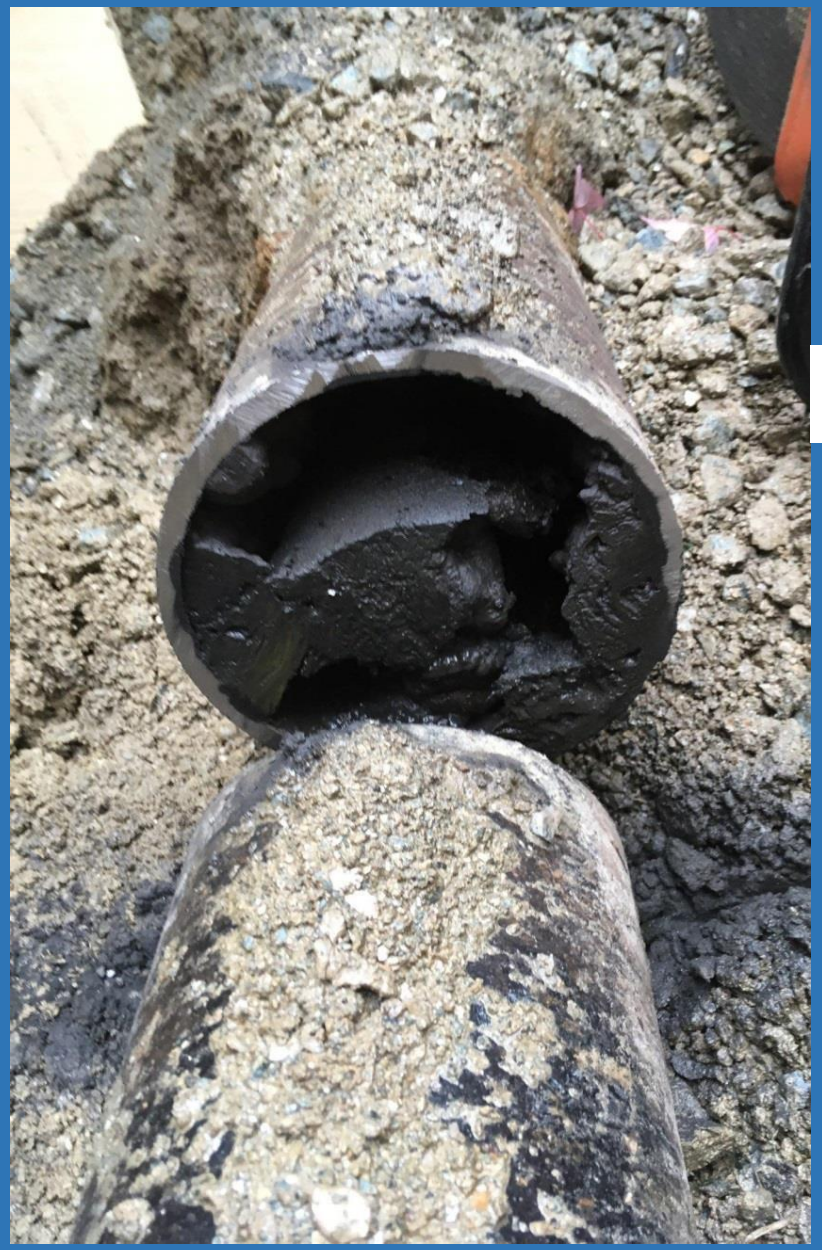
Cathodic Protection

Welding of anode wire to buried water main takes seconds.

Cathodic Protection

Anode is buried, protecting exterior of pipe ~ 20 years.

Field Results



Blanchard St.

Brouillette St.

Hazen-Williams Coefficients: **15 and 18**

BluKote Airborne Lining Results

Sherbrooke, QC
October 2018
500m, 150mm, CI Watermain

C-Factor improvement 15 to 111!

Advantages of the CELP Program Approach:

- Solves pipe capacity and water quality problems by removing all corrosion, sediment and biofilms, using the least amount of water and without damaging the host pipe.
- Provides structural stability by stopping internal and external corrosion.
- Provides a live-streaming, assessment of remaining pipe wall thickness; optimal lining and repair options are immediately known; and,
- Offers lowest life-cycle extension costs of any rehab approach.