

Lead and Copper Rule Improvements Webinar



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Housekeeping

- ✓ Please mute all microphones.
- ✓ Use the Chat Box if you have any questions or comments.
- ✓ Type Questions into Chat Window or Email directly to richbrown@electroscan.com.
- ✓ A Link to this Presentation Will be Available at the end of the Webinar.

Question #1

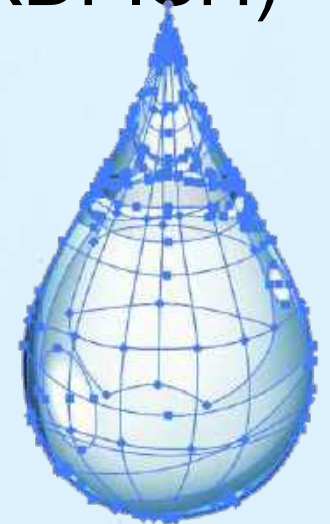
True or False

The LCRI now requires flushing of all water lines after Potholing and Customer Notification.



Agenda

1. Turning 'Unknowns' Into 'Knowns'
2. Validating Existing Service Line Inventories
3. Moving from Prediction to Certainty:
Focusing on Pipe Verification Before You Dig
4. DC Water's Benchmark (Test Pit, Electro-Magnetic, SWORDFISH)
5. Lead Replacement Strategies
6. Case Studies in Lead Detection
7. Wrap-Up / Q&A

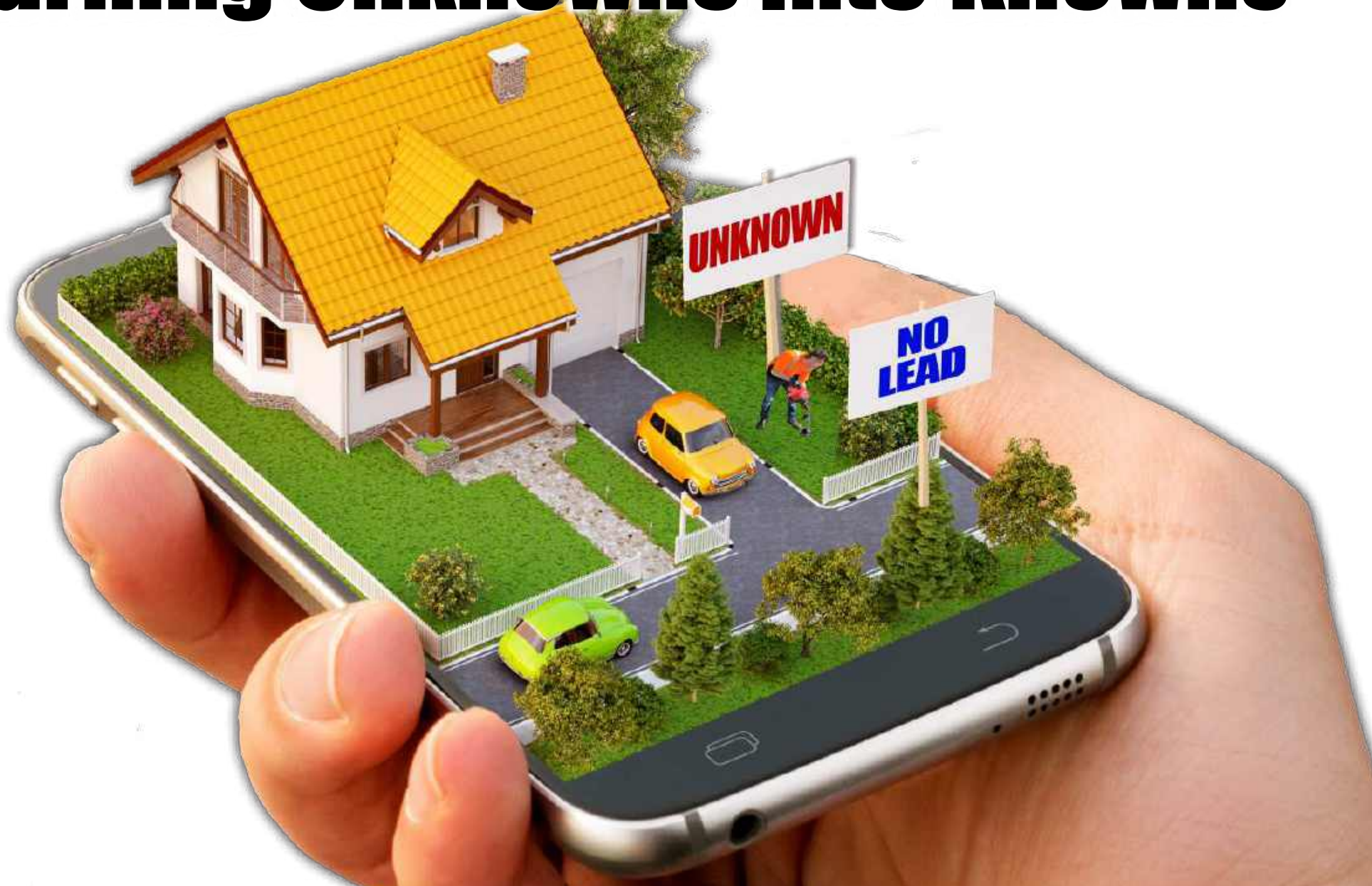


Part 1

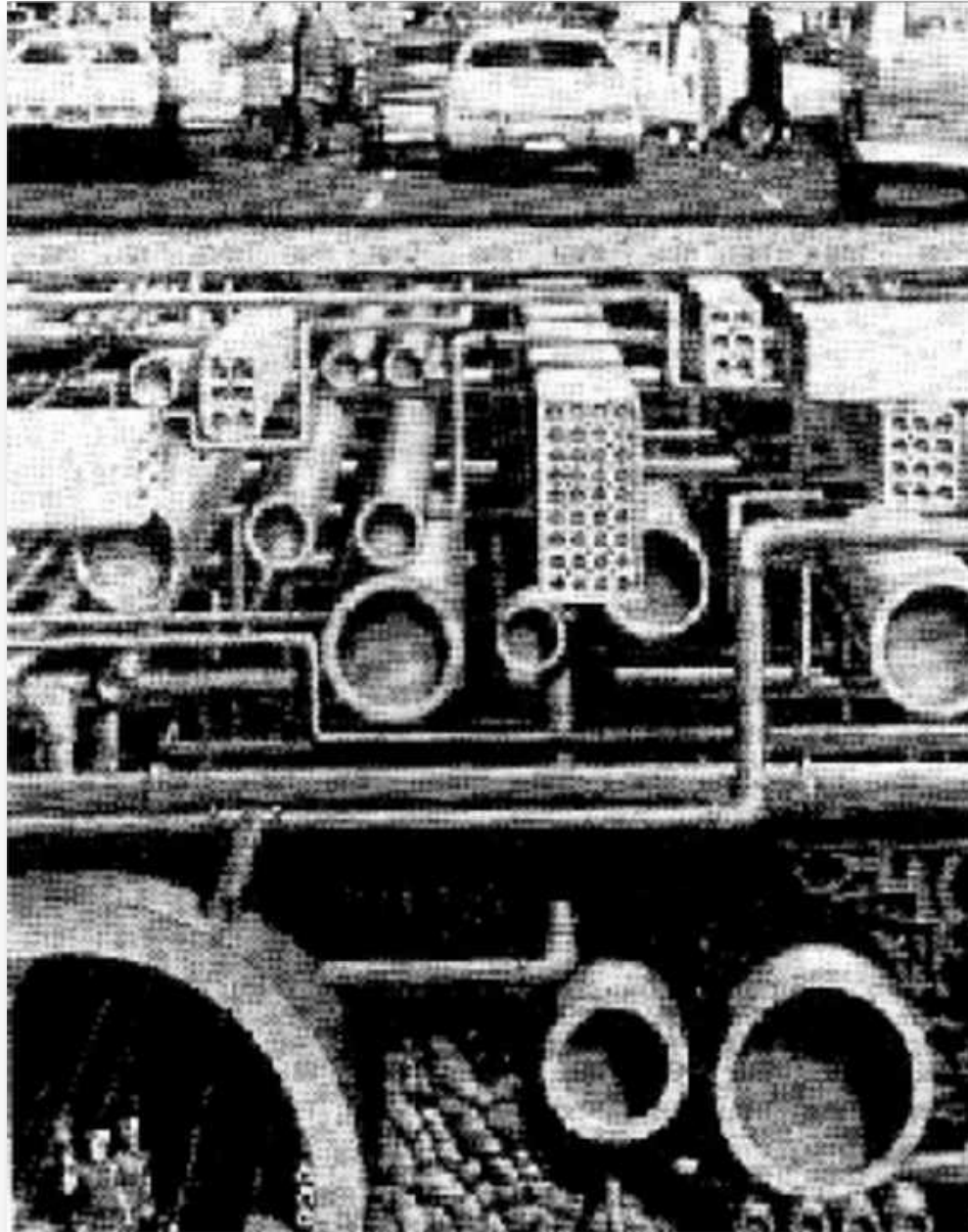


Chuck Hansen
Sacramento, CA

Turning Unknowns Into Knowns



What's Underground?



SPOILER ALERT!

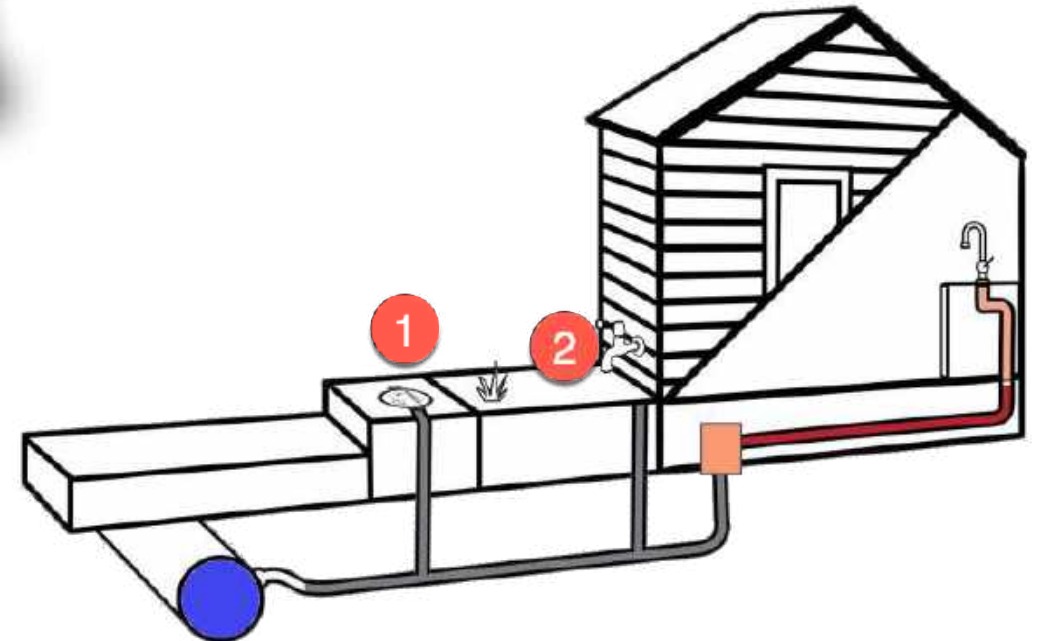


■ How Does Underground Infrastructure Work?

METER BOX BOX + FAUCET / HOSE BIB



“TWO POINT” INSPECTION



■ Going Back to the Drawing Board

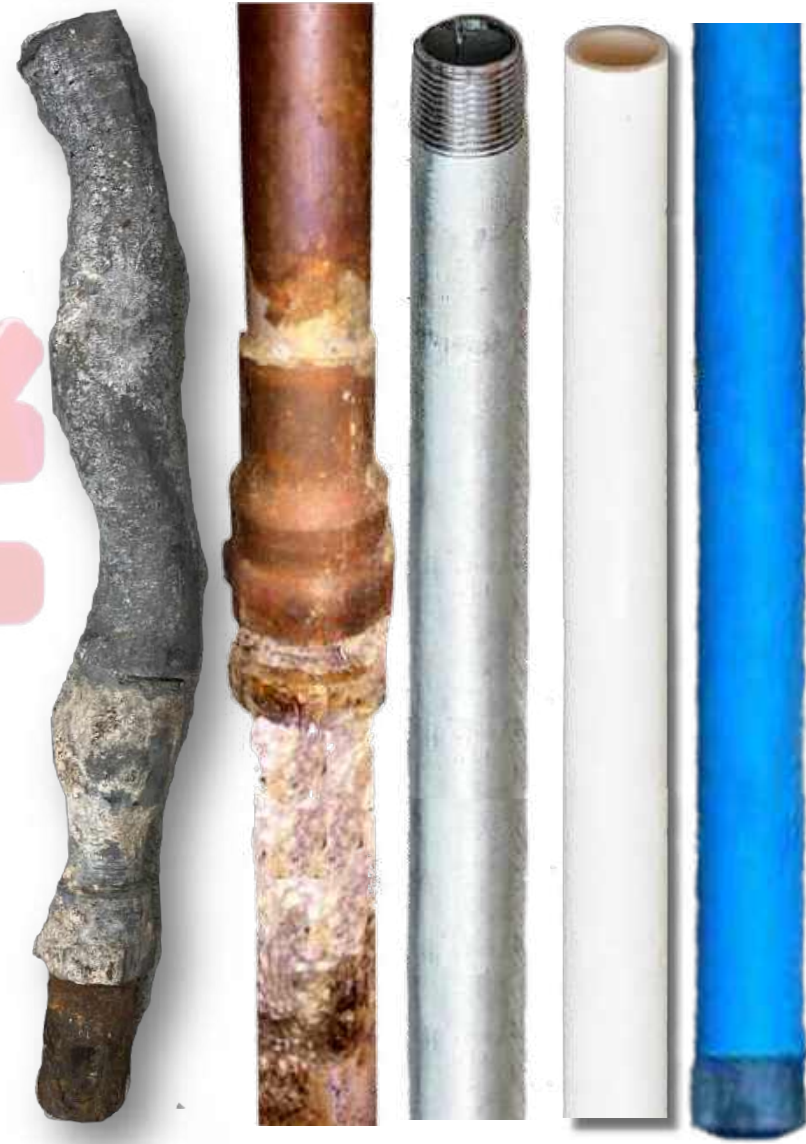
METER BOX BOX + FAUCET / HOSE BIB \neq UNKNOWNs



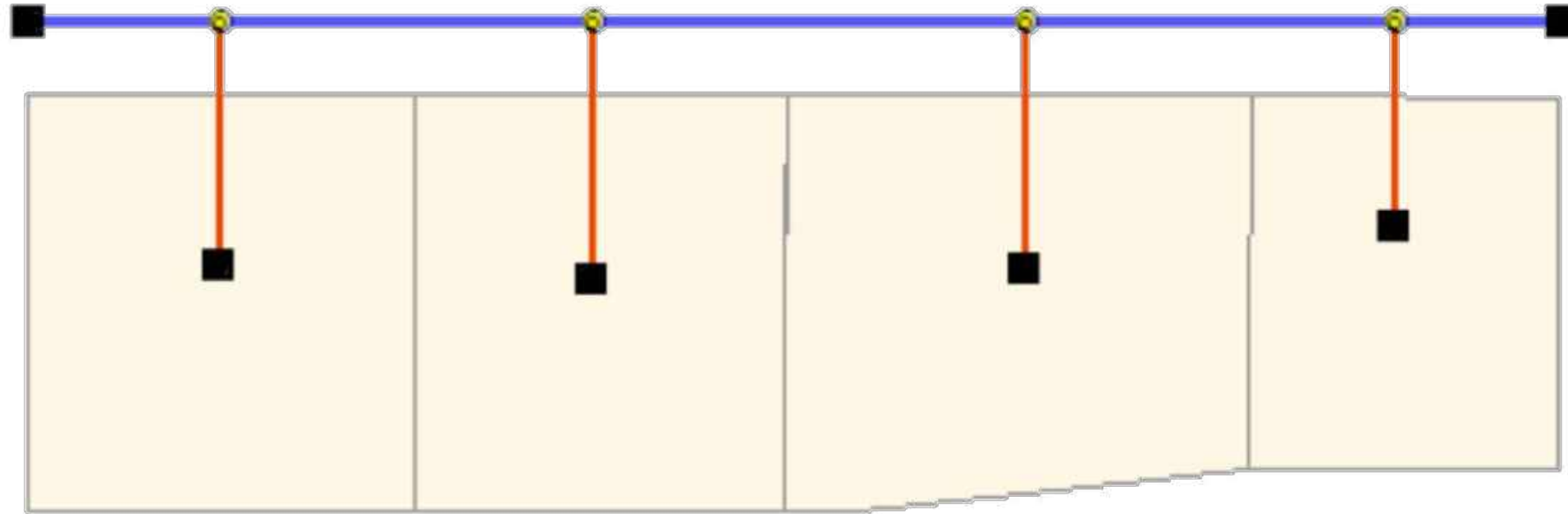
■ Going Back to the Drawing Board

METER BOX BOX + FAUCET / HOSE BIB

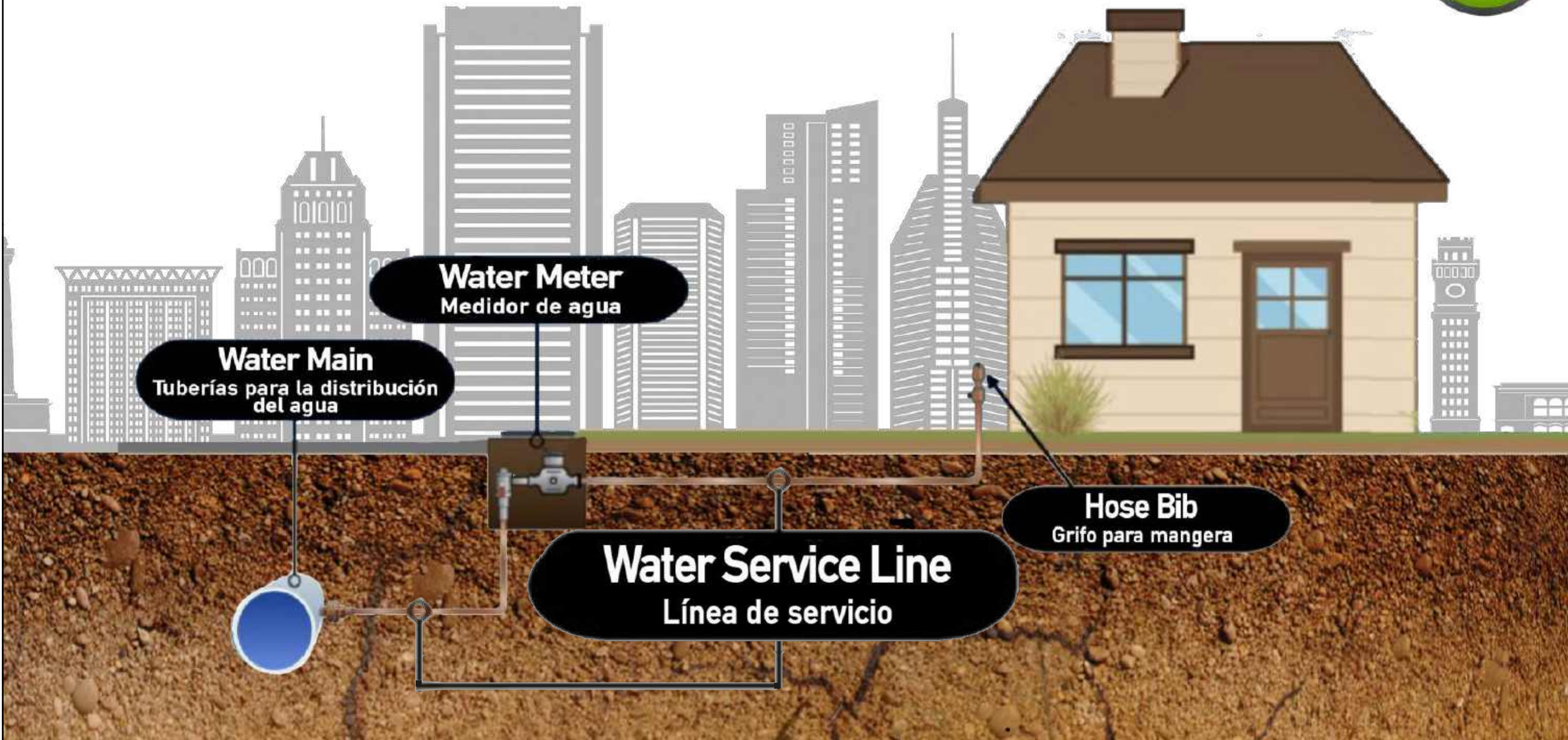
UNKNOWNs



Desktop GIS & Predictive Models



Lead Water Service Inspection



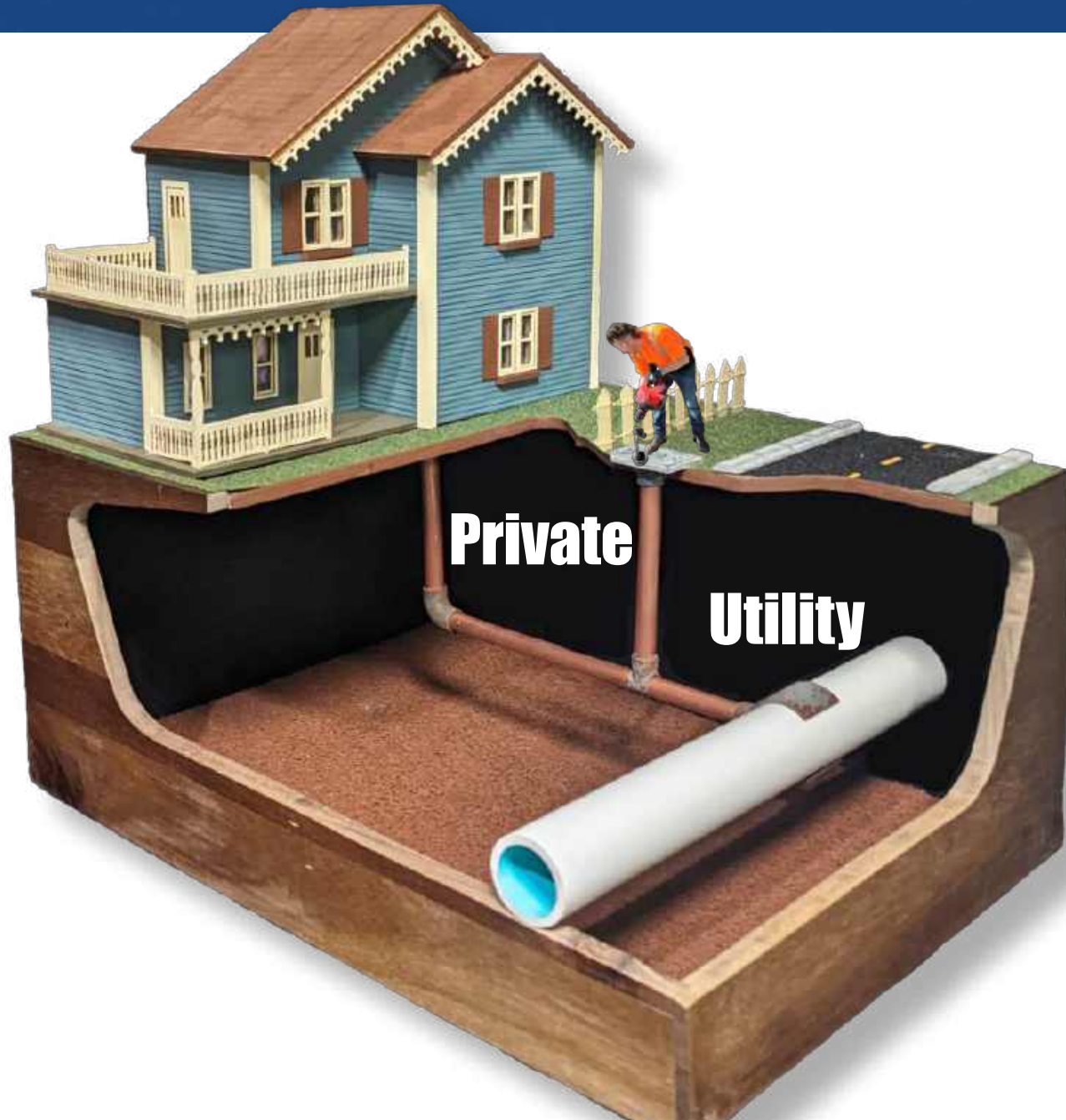
Water Meter
Medidor de agua

Water Main
Tuberías para la distribución
del agua

Hose Bib
Grifo para mangera

Water Service Line
Línea de servicio

LCRR and LCRI



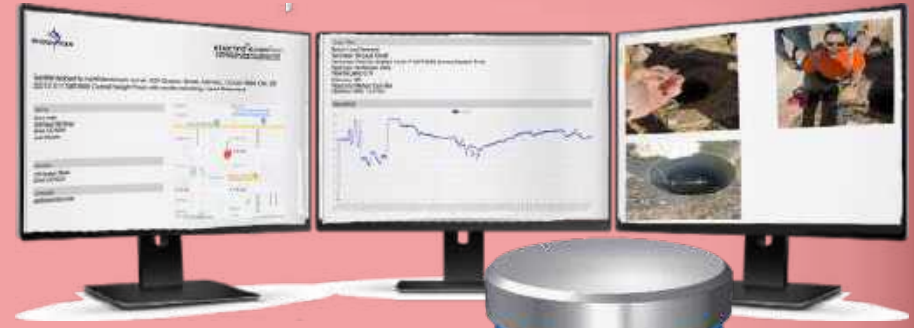
PRIVATE and UTILITY SERVICES

- Lead, Lead
- Lead, Non-lead
- Lead, No information
- Non-lead, Lead
- Non-lead, Non-lead
- Non-lead, No information
- No information, Lead
- No information, Non-lead
- No information, No information

Finding Lead: Is All About a Home's Year of Construction



Data Processing & Storage



Reporting



electro scanning.
1215 Mariposa Road, Stockton, CA 95205
Direct: 916-779-0900 Fax: 916-779-6181



electro scanning.
1215 Mariposa Road, Stockton, CA 95205
Direct: 916-779-0900 Fax: 916-779-6181

Swordfish deployed by thomas@electroscan.com at 94 South Cottage Road, Sterling on Thu Sep 08 2022 14:39:26 GMT-0500 (Central Daylight Time) with results indicating: No Lead

Agency
Loudon water
44865 Loudon water way
Ashburn Va 20147
Kathleen whitten
Kwhitten@loudonwater.org
5712917933

Worksite
94 South Cottage Road
Sterling Va 20164

Contractor
thomas@electroscan.com



Lead Test
Result: No Lead
Test Used: 3M Lead Check
Performed: Thu Sep 08 2022 14:39:26
Pipe Type: Copper (COP)
Pipe Diameter: 0.75
Max Load: 89
Pipe Entry Method: Curb Box
Operator Notes:

Lead Test
Result: No Lead
Test Used: 3M Lead Check
Performed: Thu Sep 08 2022 14:39:26
Pipe Type: Copper (COP)
Pipe Diameter: 0.75
Max Load: 89
Pipe Entry Method: Curb Box
Operator Notes:

NO LEAD

Reporting



electroscan inc.
1745 Merritt Way, Sacramento, CA 95822
Elect: 916-750-0020 Fax: 916-750-0110



electroscan inc.
1745 Merritt Way, Sacramento, CA 95822
Elect: 916-750-0020 Fax: 916-750-0110

Swordfish deployed by matt@electroscan.com at 1625 tamarac street, Denver on Thu Oct 27 2022 10:08:54 GMT-0500 (Central Daylight Time) with results indicating: Lead Detected

Agency

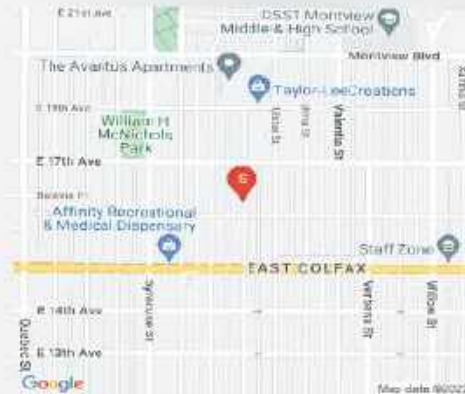
Denver water
1600 west 12th street
Denver Co 80204
Austin Steckler

Worksite

1625 tamarac street
Denver Co 80220

Contractor

matt@electroscan.com



Lead Test

Result: Lead Detected
Test Used: 3M Lead Check
Performed: Thu Oct 27 2022 10:08:54
Pipe Type: Not Known (XXX)
Pipe Diameter: 0.75
Max Load: 96
Pipe Entry Method: Curb Box
Operator Notes:

Lead Test

Result: Lead Detected
Test Used: 3M Lead Check
Performed: Thu Oct 27 2022 10:08:54
Pipe Type: Not Known (XXX)
Pipe Diameter: 0.75
Max Load: 96
Pipe Entry Method: Curb Box
Operator Notes:

LEAD

■ Electro Scan's Objective: **Certify Test Results to Homeowners**

UNKNOWN



NO LEAD



Most Cities Refuse to Certify their Lead Pipe Inventories.

Question #2

How many days will water systems have to respond to a Customer that disagrees with their initial pipe inventory?

- A. 5 Days
- B. 10 Days
- C. 30 Days
- D. 60 Days
- E. Water Systems are not required to follow up once the EPA has accepted their inventory.



Part 2

Validating Existing Service Line Inventories



Mike App, EVP
Executive Vice President
Electro Scan



To Dig...



...or Not to Dig?

Utility
Service

Private
Service

Inside the April 2024 E-Zine of Municipal Sewer & Water

Acoustic wave analysis

Acoustic wave analysis is simple, nonintrusive (nothing in the service line), easy to deploy and can inspect the pipe within minutes without disrupting service. Two acoustic sensors are used to “bracket” the portion of the supply line to be screened for lead, with one placed on the external curb stop or meter box and another sensor placed on the internal shut-off valve. In some cases, the second sensor can be placed outside a customer’s residence, such as on an external customer meter near the dwelling wall or

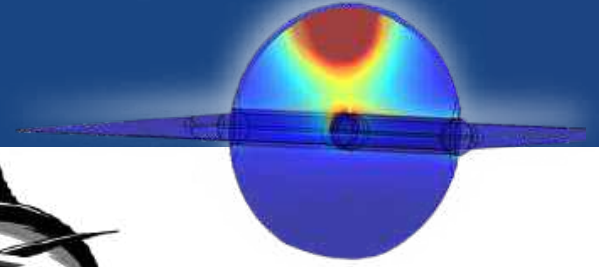
Acoustic Wave Analysis WITHDRAWN



Two Options to Locate Lead

To Dig or

Not to Dig



EXPOSE PIPE



82
Pb
Lead
207.2

29
Cu
Copper
63.546



**Customer-Owned
House-to-Meter**


**Utility-Owned
Meter-to-Main**



UNKNOWN ← **EPA REQUIREMENT** → **KNOWN**

MAGNET TEST





Sticks → 
Steel


Doesn't Stick

SCRATCH TEST



Color of a Penny → 
Copper

No Shine → 
Plastic

Silver Streaks → 
Lead



Potholing Disturbance



'Vibration' from Potholing Creates Pipe Disturbances



TRUVAC APEX™ UP TO 3,000 PSI



X-CAVATOR™ UP TO 4,000 PSI



BRAVO UP TO 5,000 PSI



11:03:03 11-15-2022

100.6ft

723

254

69743

8181

681

838

638

555

480

837

Potholing Disturbance

AWWA C810-17 – Replacement and Flushing of Lead Service Lines



American Water Works
Association
Dedicated to the World's Most Important Resource®

ANSI/AWWA C810-17
(First Edition)

AWWA Standard

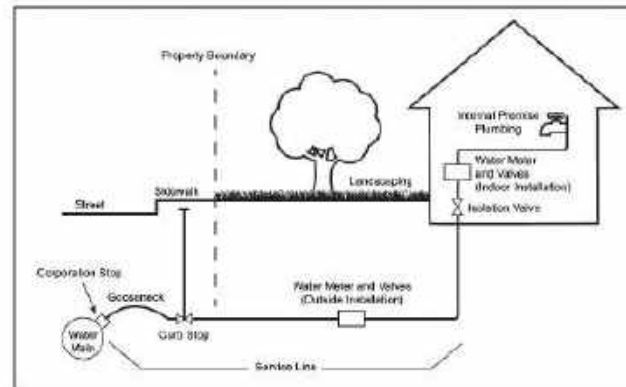
Replacement and Flushing of Lead Service Lines

Effective date: Nov. 1, 2017.
First edition approved by AWWA Board of Directors June 11, 2017.
This edition approved by AWWA Board of Directors June 11, 2017.
Approved by American National Standards Institute Sept. 1, 2017.



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REPLACEMENT AND FLUSHING OF LEAD SERVICE LINES 3



SECTION 5: VERIFICATION

Sec. 5.1 Documentation of Construction Activities

Documentation of construction activities for each service line work activity may support verification that the lead service line has been fully or partially replaced. The following information shall be documented and recorded:

- Picture of home with house number
- Picture of test pits and meter pit showing new pipe or pipe ends and old lead pipe if in same location
- Length and material type of new pipe installed
- Type of pipe material the new pipe is connected to inside home
- Method of installation (trenchless, hand-excavation, etc.)
- Length and location of any abandoned lead service line pipe left in the ground

Flushing time and location(s) (for example, an outside hose-bib) shall be recorded. Some homes may not have an outside hose-bib turned on or other situations may arise that do not allow for postflushing by the utility. These situations shall be documented in field reports along with any communication attempted with the customer.

Sec. 5.2 Water Testing Following Replacement

Testing the water following the replacement shall be done to determine if appreciable lead is still present in the drinking water. Lead may still exist inside home plumbing (lead solder, redeposited lead in scale of plumbing, and brass components) and could be disturbed during service line work. Therefore, lead present in the water following a full replacement does not mean the lead service has not been replaced. This condition should be explained to the customer. Flushing recommendations described in Sec. 4.4 can help remove released particles.

5.2.1 *Testing initiation.* Testing the water shall commence at least one month after the replacement to allow for sufficient in-house flushing and a period of normal use of water to occur. Utilities may consider initiating testing within the one-month period if supported by performance data. When only a partial replacement is completed and the lead service line replacement was mandatory as part of compliance with the Lead and Copper Rule (LCR), testing shall be conducted within 72 hours after the completion of the partial replacement of the service line per the requirements of the LCR.

5.2.2 *Test samples.* Testing shall include first-draw and second-draw samples. First-draw sample shall be the initial draw from the tap when it is turned on. Second-draw sample shall be collected with the objective of collecting water that stagnated in the service line, generally the fourth to seventh liter depending on site-specific conditions. Utilities may be able to omit the second draw sample if supported by documentation that the construction activities completely removed the lead service line and by acceptable first-draw lead data. Samples shall be collected from a frequently used tap inside the home, preferably the kitchen tap as the residents' consumption would likely be from the kitchen tap. Samples shall also be collected with the aerator on. Samples should be collected at the maximum flow rate of the tap and should be collected in wide-mouth bottles.

5.2.3 *Profile sampling.* Lead levels higher than expected from full lead replacements may occur and the utility or homeowner could investigate further with profile sampling. A profile is a series of bottles filled continuously following the stagnation period. The trend of lead concentrations coupled with measurements of the inside plumbing and service line will show which portion of plumbing or service contributes the highest lead by the liter number.

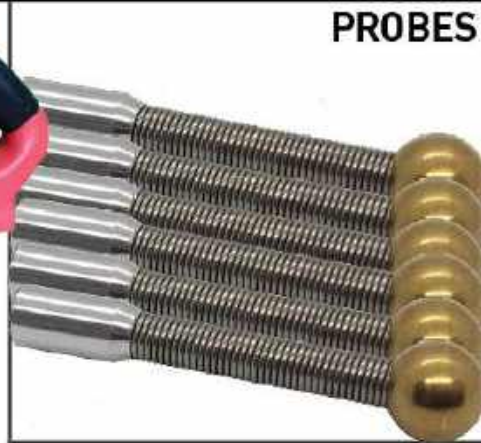
SWORDFISH: Total Solution



BASE UNIT



PROBES



SURFACE LAPTOP



INSERTION TUBE
Plus, Chlorination Chamber

GROUNDING STAKE



LITHIUM BATTERY



WI-FI



LEAD TEST

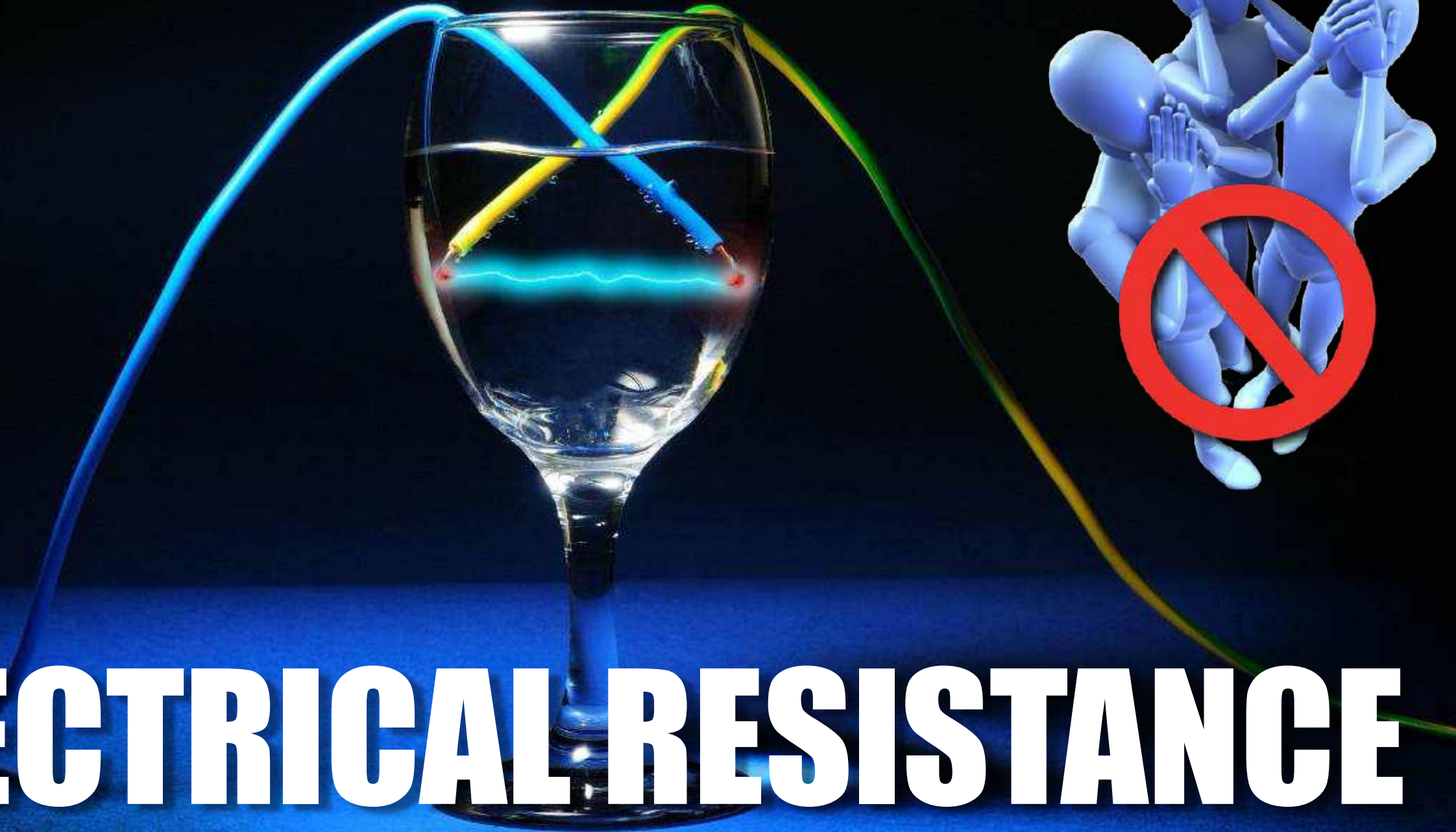


CRITICAL H₂O CLOUD REPORTING



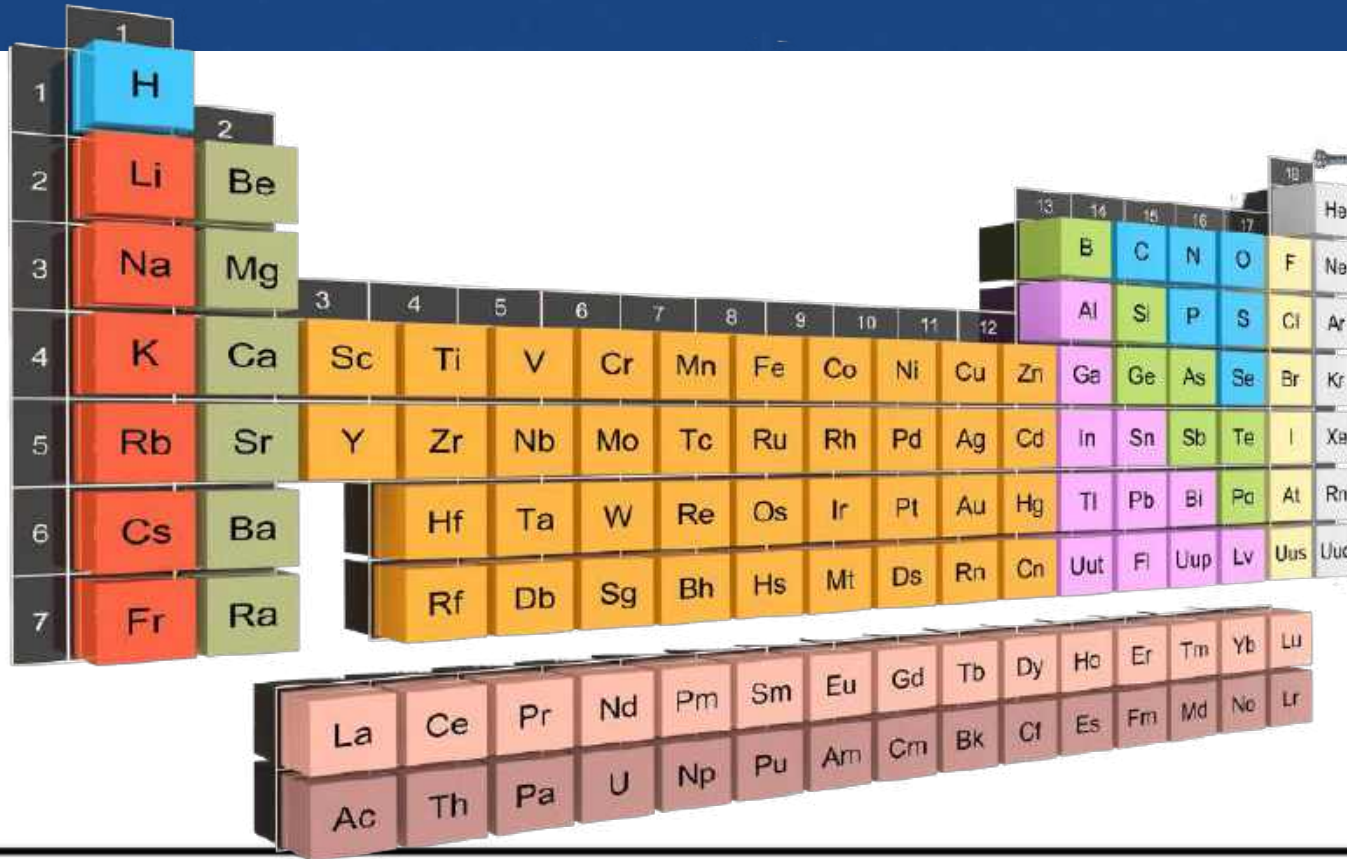
S W O R D F I S H

What is Electrical Resistance?



ELECTRICAL RESISTANCE

How Does It Work?



SWORDFISH

29
Cu
Copper
63.546

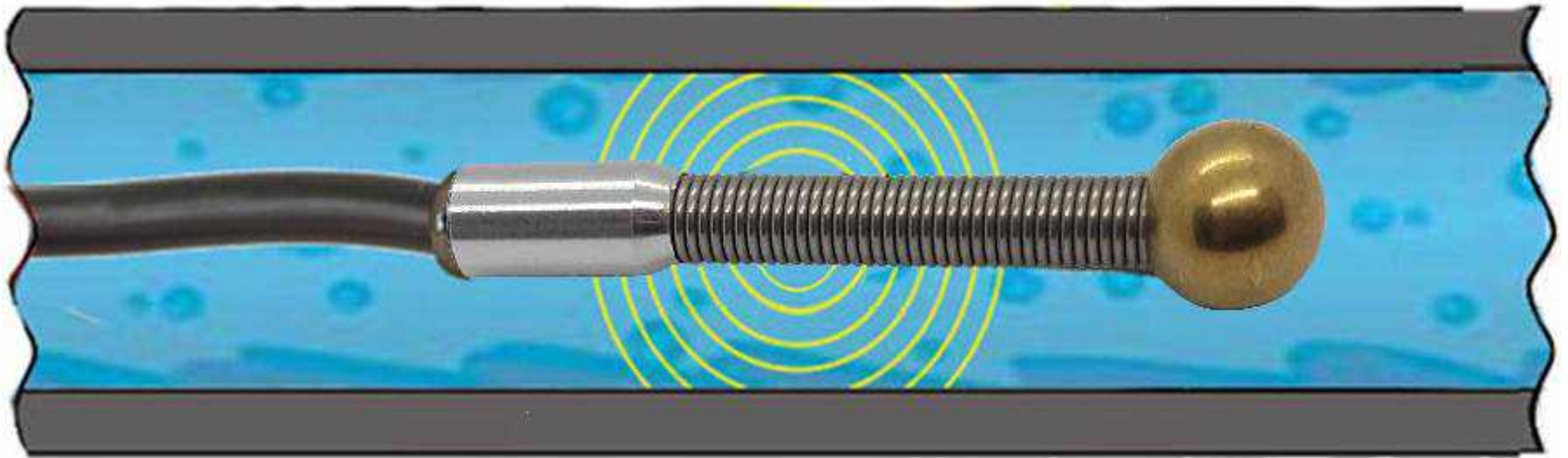
82
Pb
Lead
207.2

International Annealed Copper Standard (IACS)	100%	7%
Electric Conductivity (10.E6 Siemens/m)	58,7	4,7
Electric Resistivity (10.E-8 Ohms.m)	1,7	21,3
Thermal Conductivity (W/m.K)	386	35

■ Customers Understand Multiple Pipe Materials



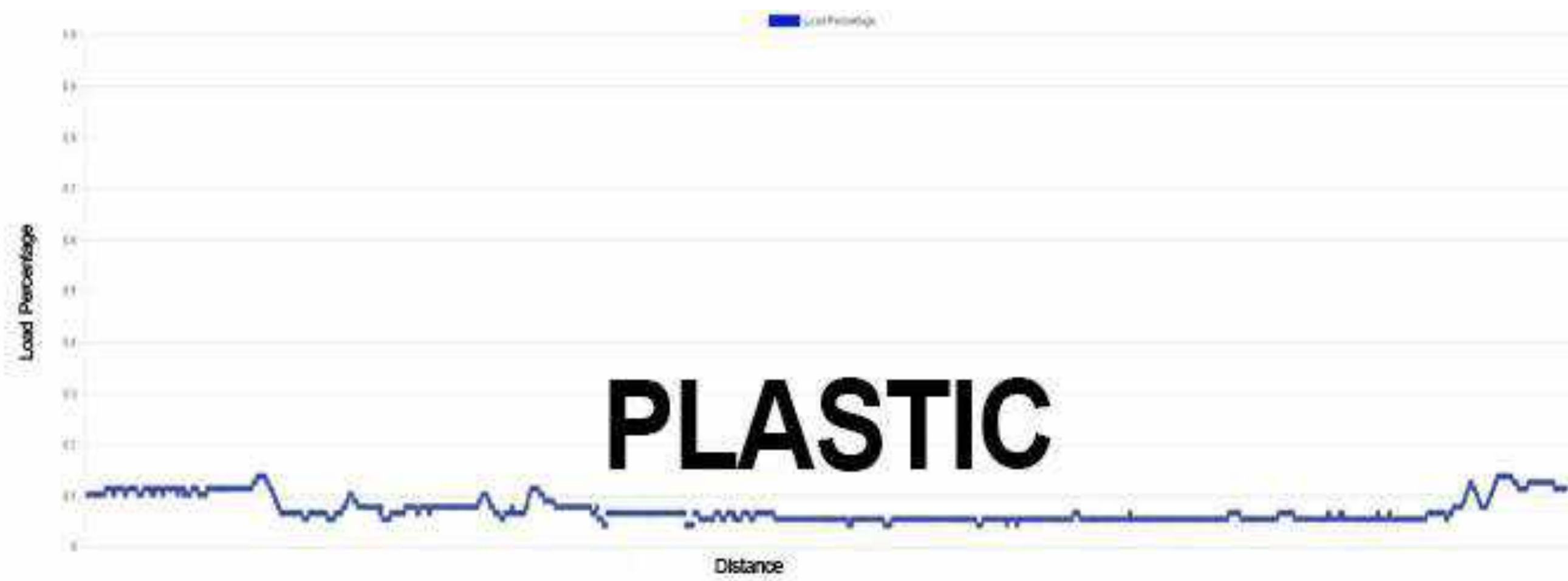
Automatically Identifying Pipe Materials



■ Pipe Material Reporting



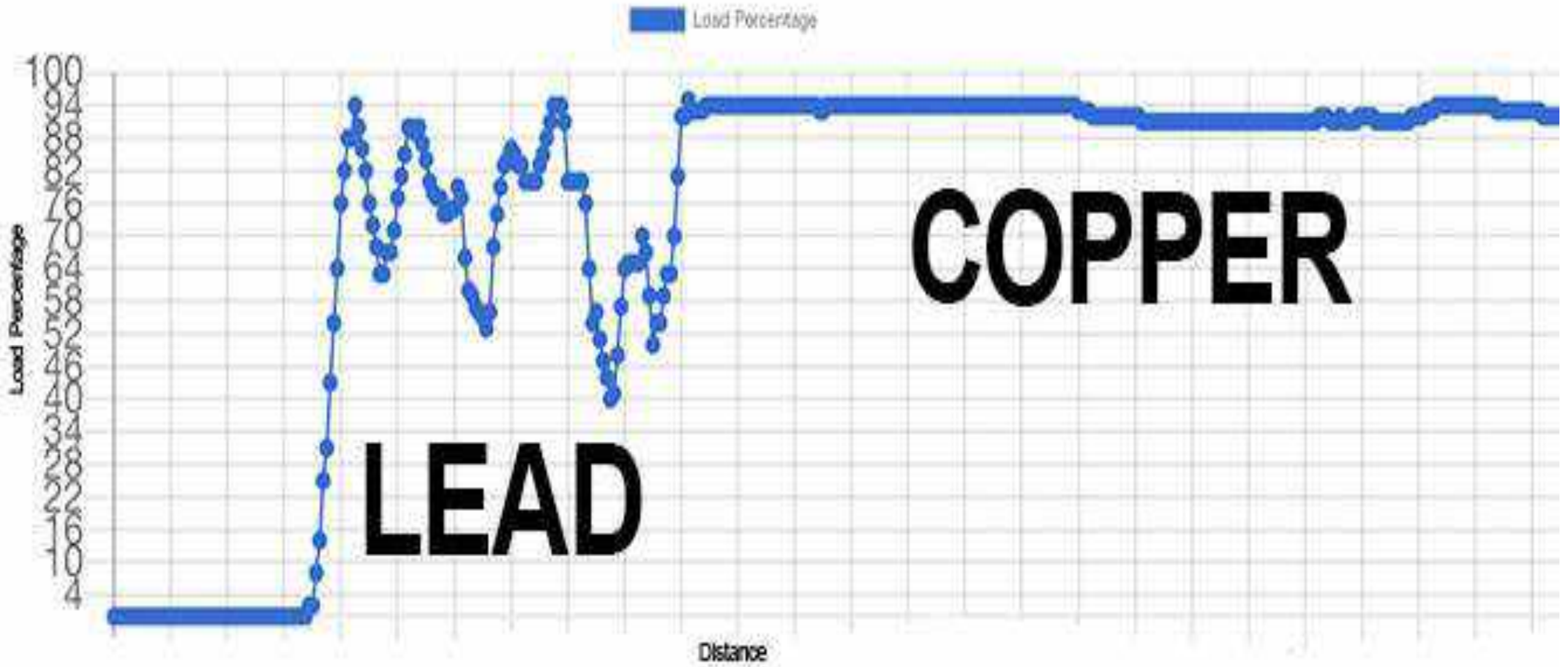
■ Pipe Material Reporting



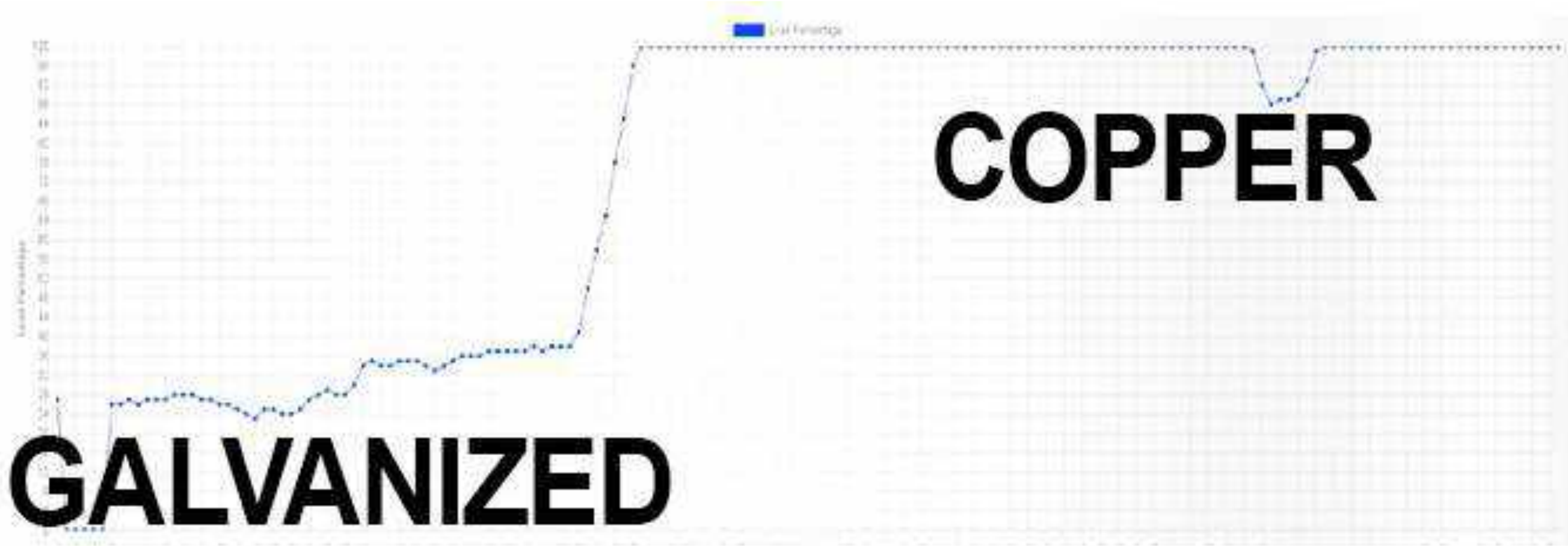
■ Pipe Material Reporting



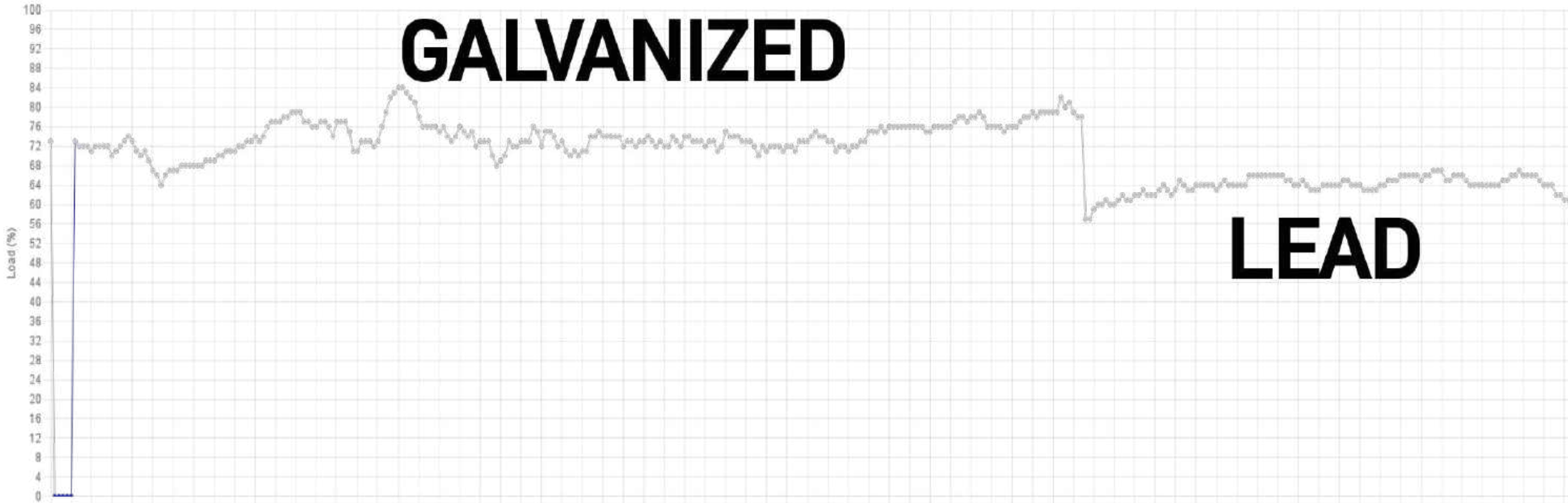
■ Pipe Material Reporting



■ Pipe Material Reporting



Pipe Material Reporting



■ Pipe Material Reporting



Water Lines By Material



Multiple Lead Connectors



■ Lead Soldered Joints





POSITIVES

- Accurately detects multiple pipe materials.
- No digging or excavation required.
- National sales and services.
- Backed by industry water veterans.
- Instant reporting of results.
- Handles inventory, validation, and certification.



NEGATIVES

- Will not enter some fixtures.
- Requires flushing after testing.

Question #3

TRUE OR FALSE

The deadline for resolving all UNKNOWN pipe materials is 3 Years from the Date that the LCRI became effective (October 8, 2027).

The deadline for resolving all UNKNOWN pipe materials now matches the 10 Year Deadline for Lead Pipe Replacement.



Part 3



Matt Campos

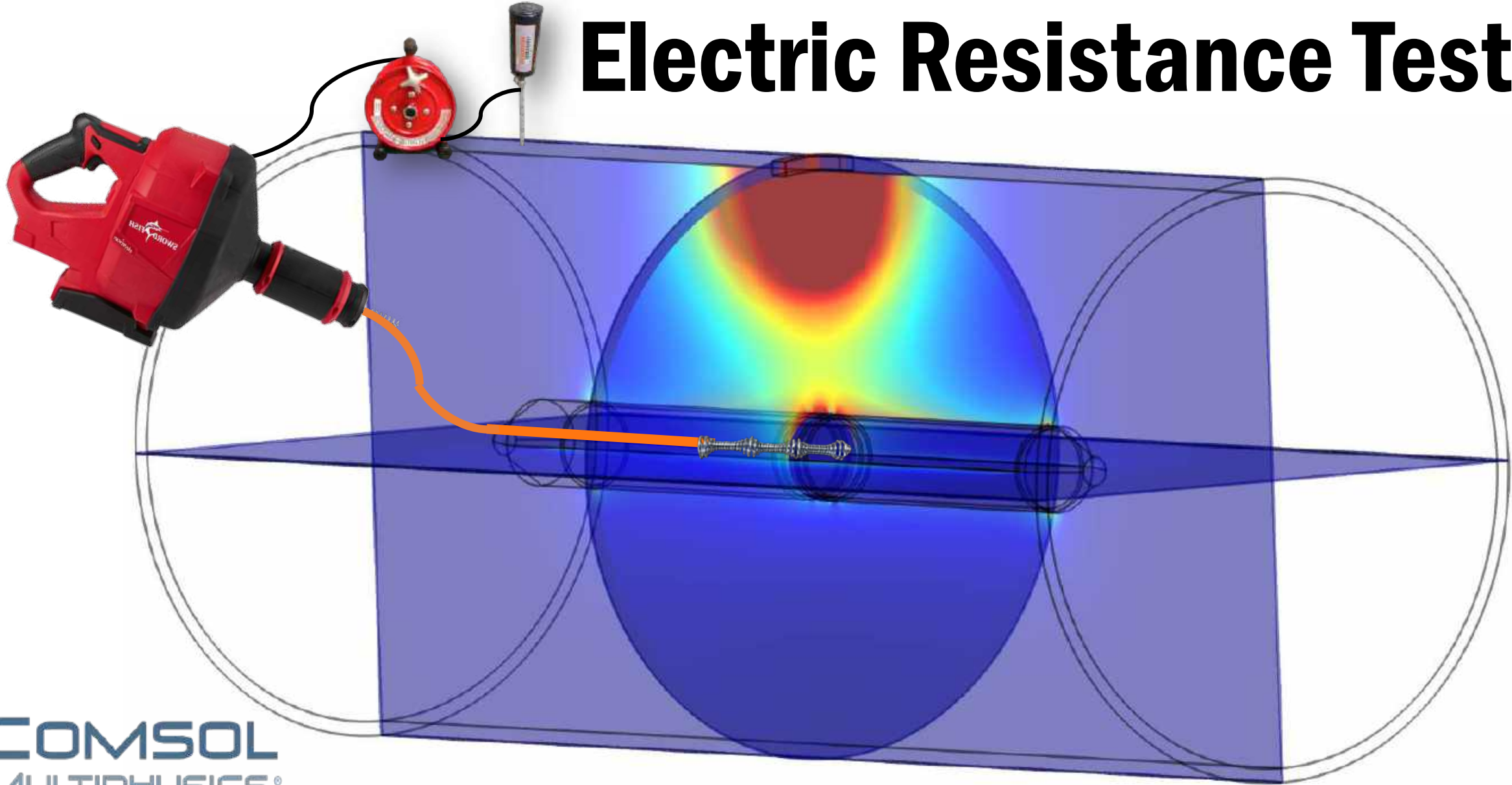
VP, Product Development
Electro Scan

Moving from Prediction to Certainty



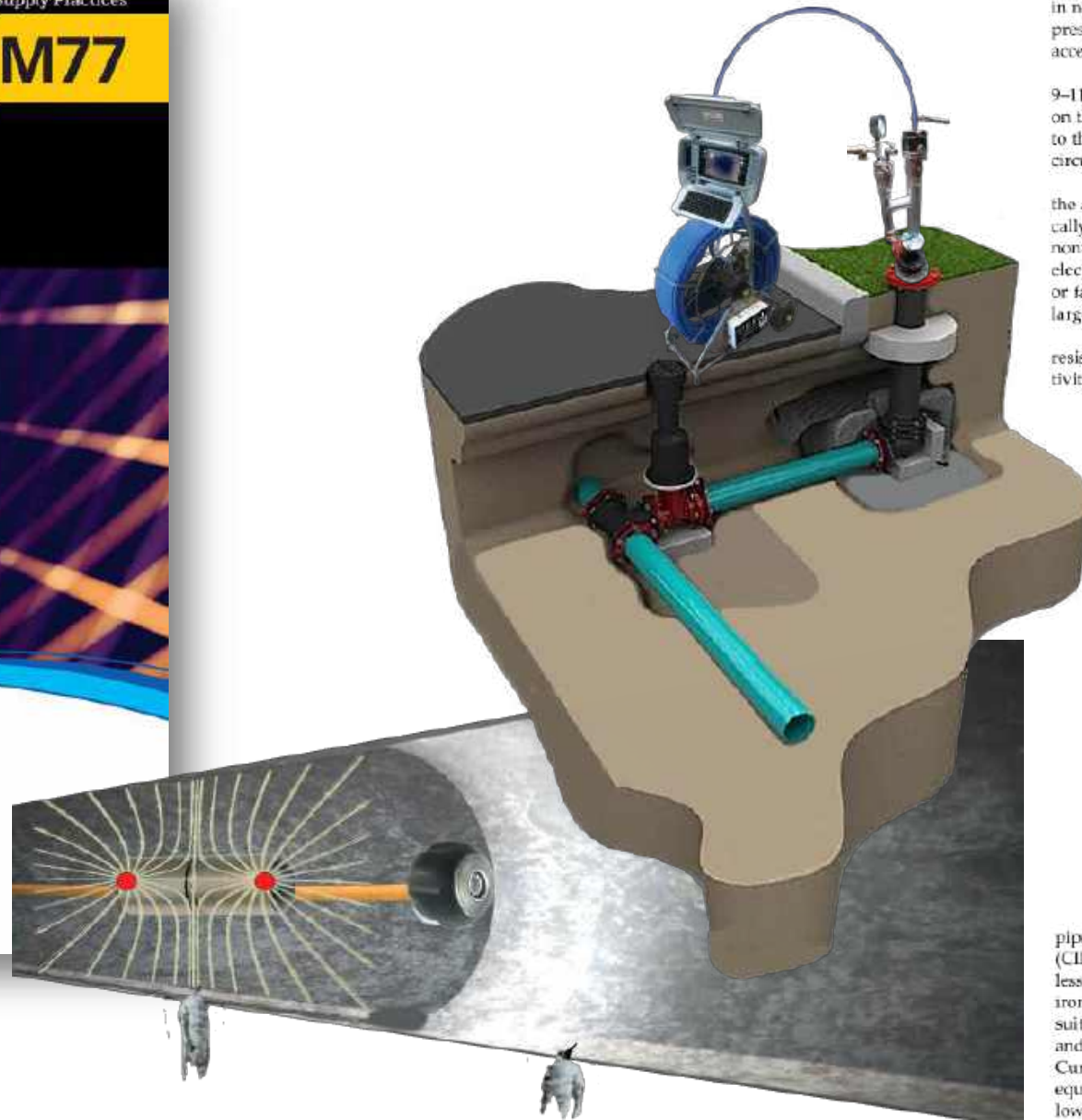
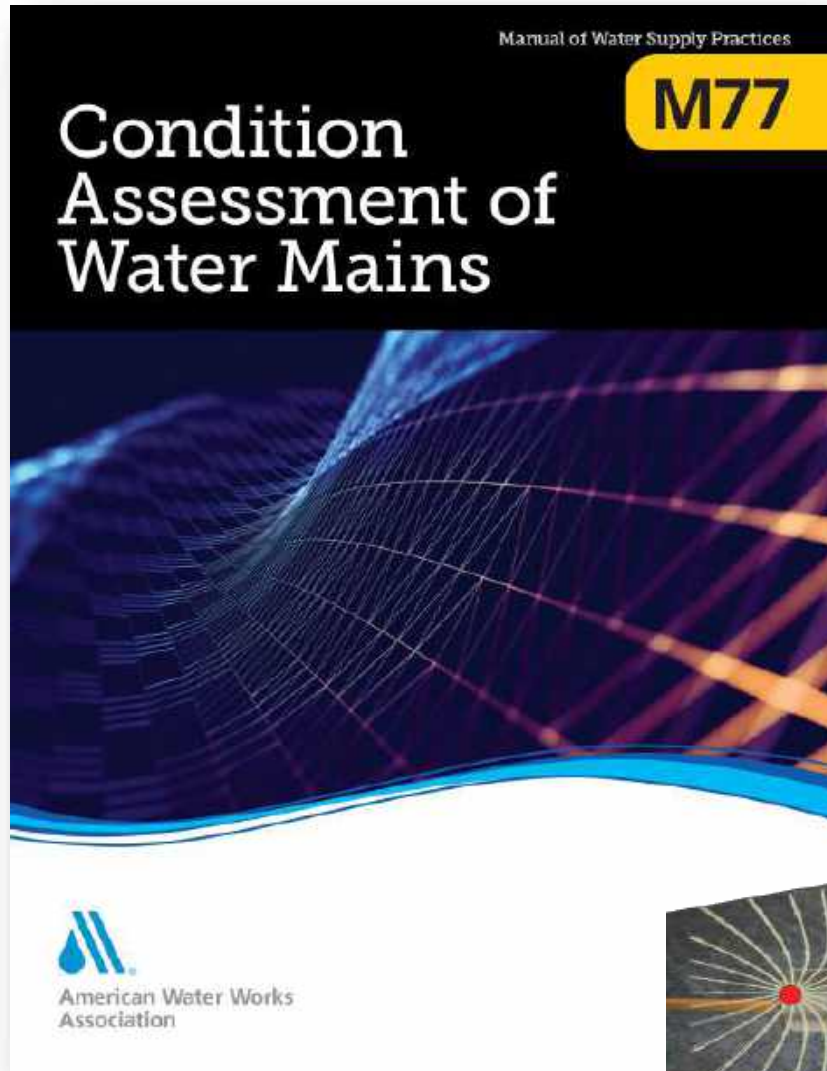
Technology Never Questioned

Electric Resistance Testing



COMSOL
MULTIPHYSICS®

AWWA M77 Acceptance of Low Voltage Conductivity



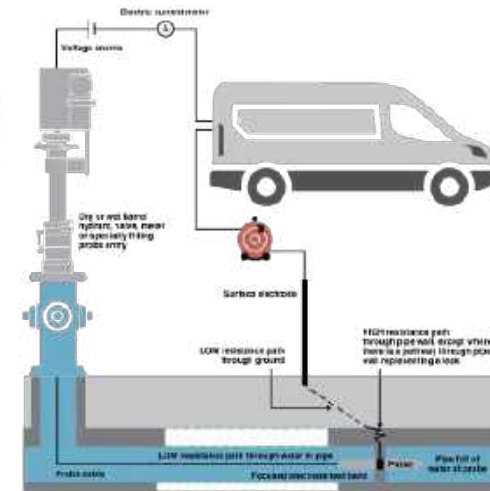
Low-Voltage Conductivity

Low-voltage conductivity testing is a technique that uses electric current to identify leaks in nonmetallic pipe. It is a tethered inspection method in which a probe is inserted into a pressurized water distribution pipe through a fire hydrant (wet or dry barrel) or another access point specifically prepared for launching the device.

The test is carried out by applying an electrical potential (typically in the range of 9–11 V with a frequency of 0.5–1.5 kHz) between an electrode in the pipe and an electrode on the surface. The exterior electrode can be anything that allows for electrical connection to the earth—such as a grounding rod, guy wire anchor, sign pole. A simplified electrical circuit for this procedure is shown in Figure 7-10.

As the electrode moves within the pipe, the location and sizes of leaks are found by the amount of electric current that is measured. Where water is leaking from the electrically insulating pipe, electrical current also leaks out. The high electrical resistance of the nonmetallic pipe wall allows only a very small electrical current to flow between the two electrodes unless there is a hole or void in the pipe wall, such as a crack, defective joint, or faulty connection. The greater the electric current flow through the pipe opening, the larger the size of the defect.

Since low-voltage conductivity testing is based on the difference of the high electrical resistivity properties of the pipe walls (i.e., nonconductive) versus the low electrical resistivity of the earth surrounding the pipe, this test method works well on nonconductive

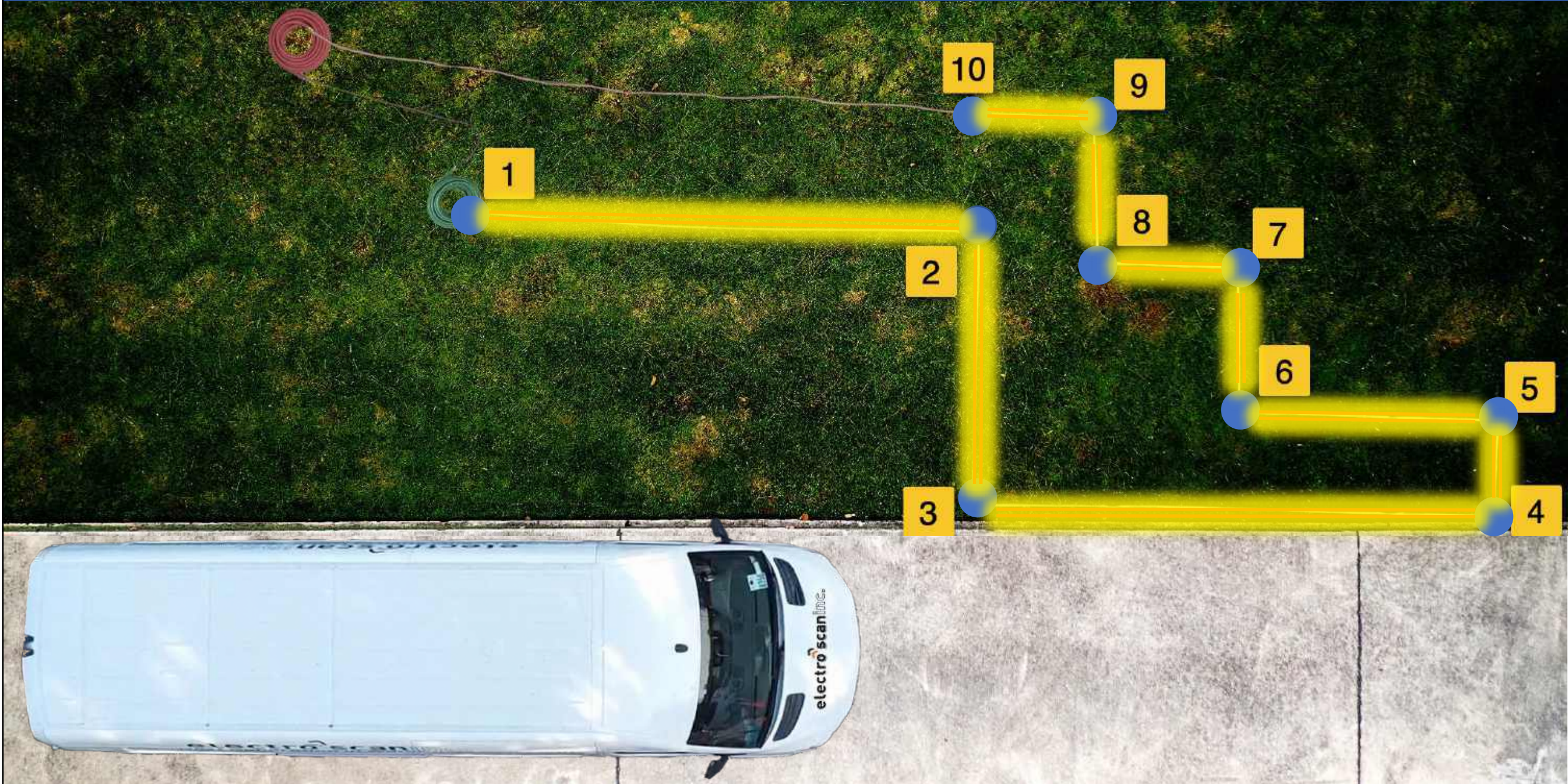


Adapted with permission from Electro Scan

Figure 7-10 Basic diagram of low-voltage conductivity circuitry

pipe materials such as plastic mains (PVC or PE), mains lined with cured-in-place pipe (CIPP) or fiberglass-reinforced pipe (FRP). Externally applied acoustic methods are often less effective on these types of pipe. On the other hand, metallic pipe materials (i.e., ductile iron, cast iron, and steel), which are excellent conductors of electrical current, are not well suited for low-voltage conductivity testing. Use on concrete pipe materials (AC, PCCP, and RCP) is less problematic—accurate results have been demonstrated on concrete pipes. Currently, this technology is only available through the services of a skilled and specially equipped service provider. Table 7-13 summarizes the capabilities and limitations of low-voltage conductivity testing.

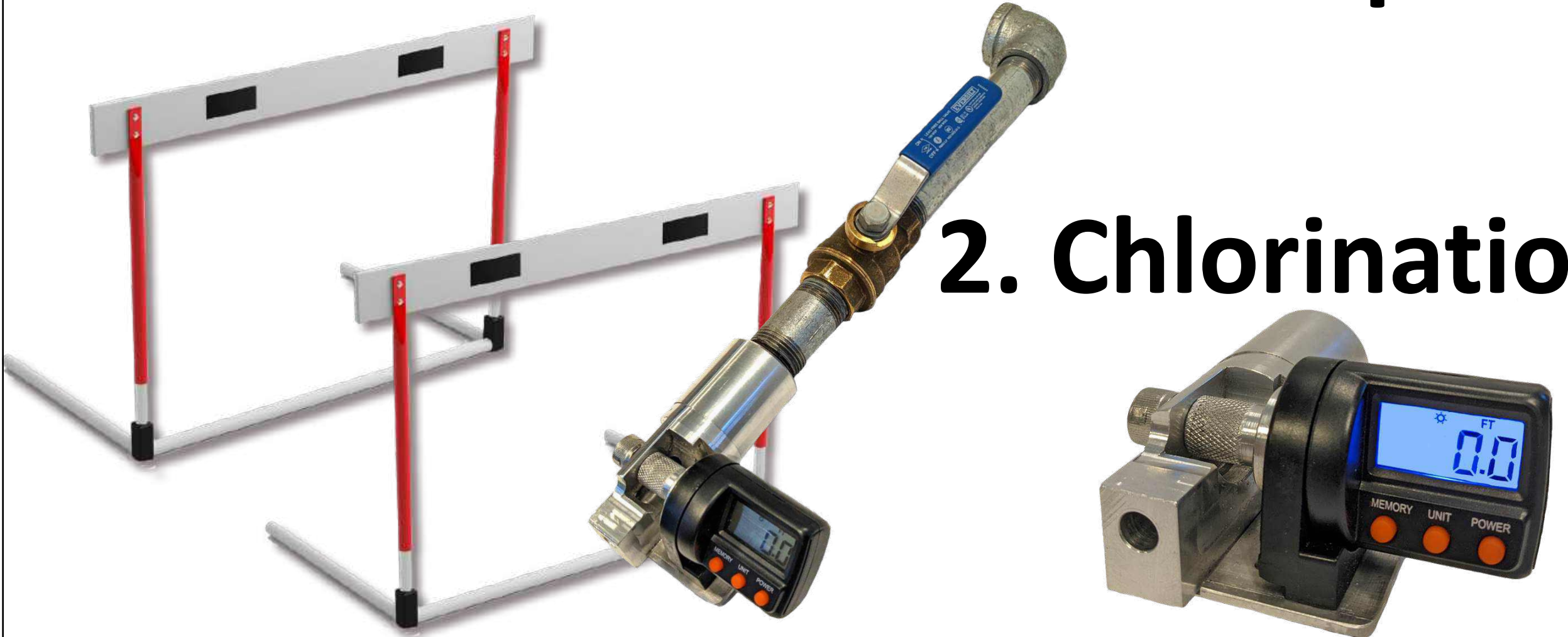
It's All About Navigating Buried Infrastructure



First Hurdles to Tackle.

1. Pressurized Pipes

2. Chlorination



Pressurized Pipe Assessments

Designed for Meter to Main & Basement Entries



Chlorination Chamber

***Electro Scan Inc.
Chlorination
Chamber***



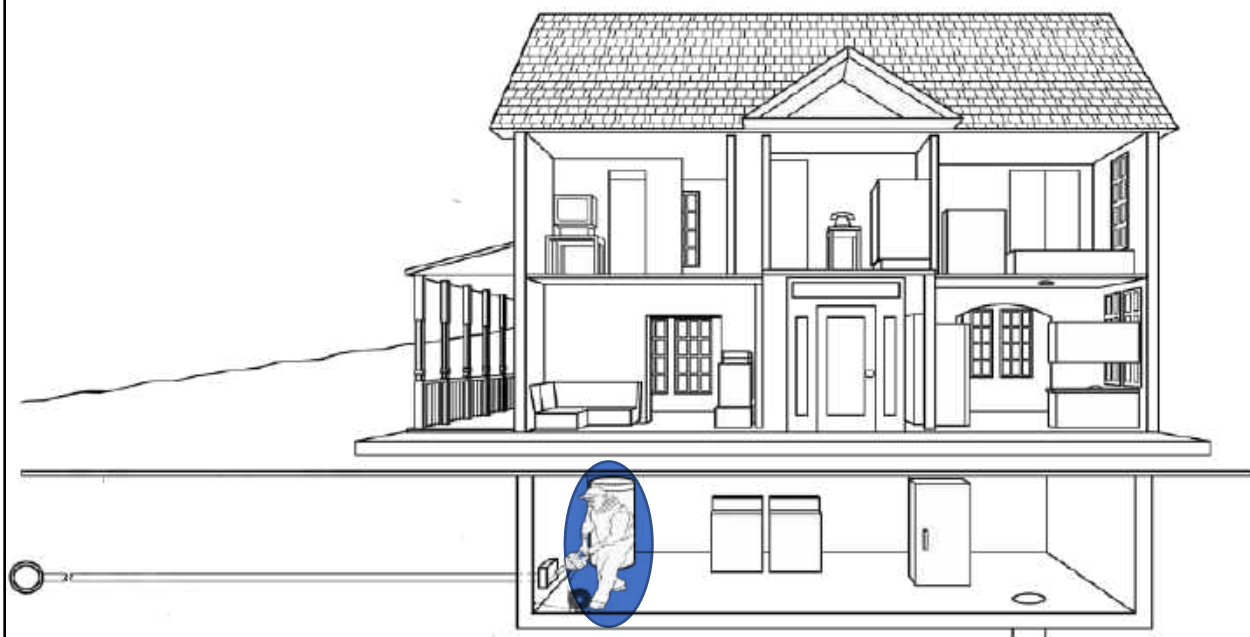
Footage Encoder



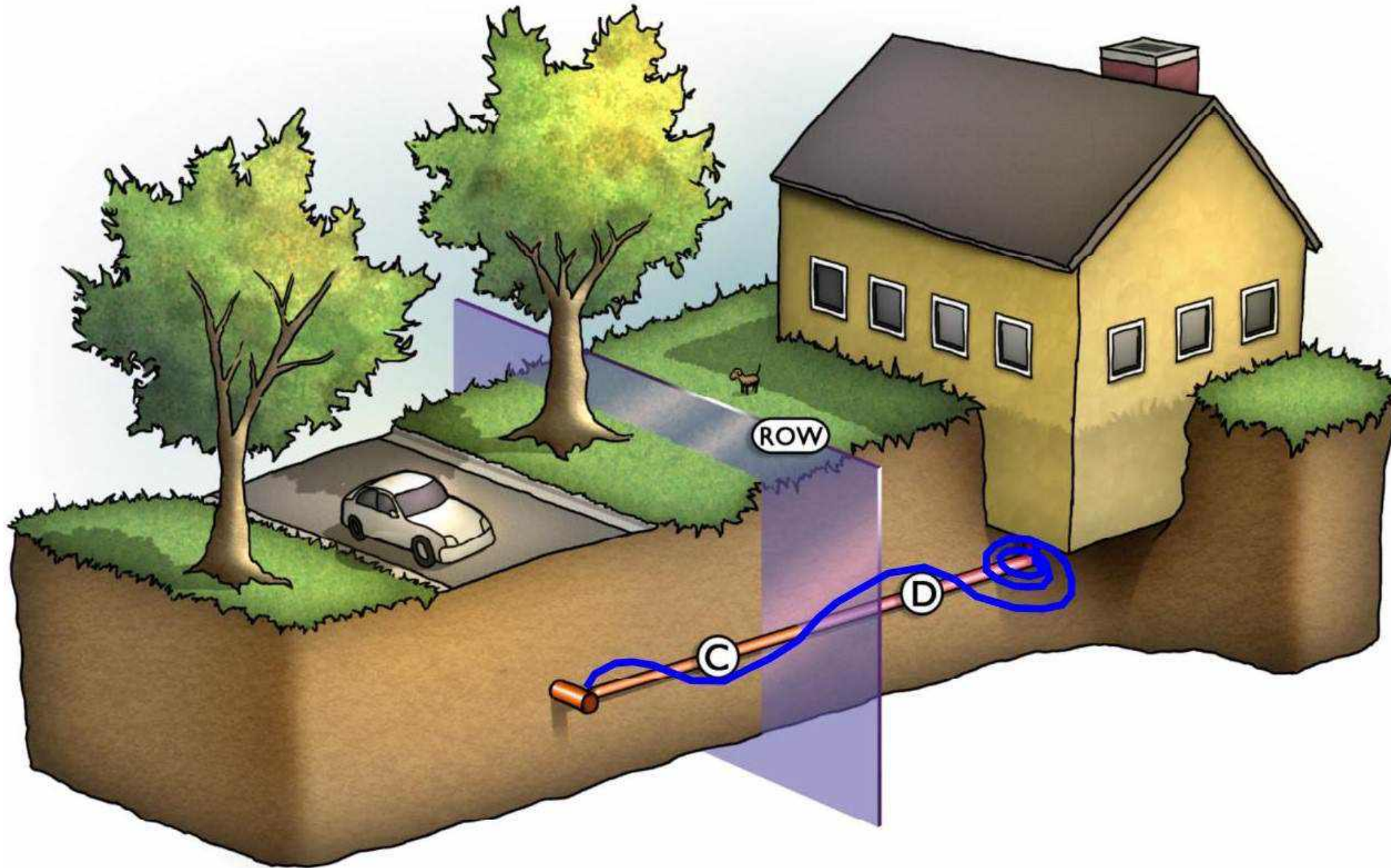
*Electro Scan Inc.
Distance Encoder
Display*



Basement or Curb Entry



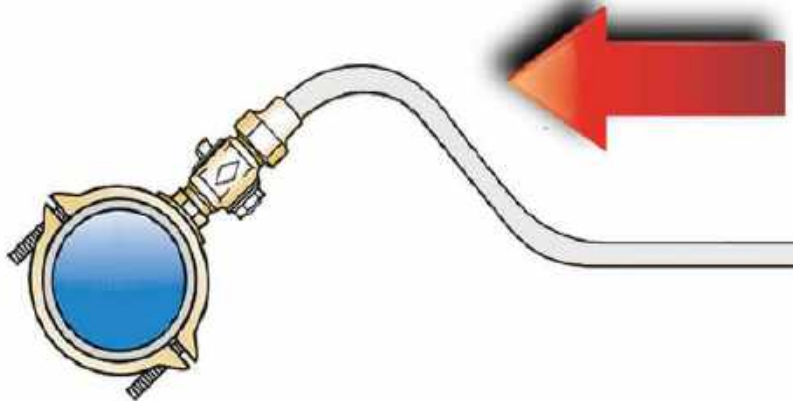
What is Expected v. What is Found?



Next Hurdles...



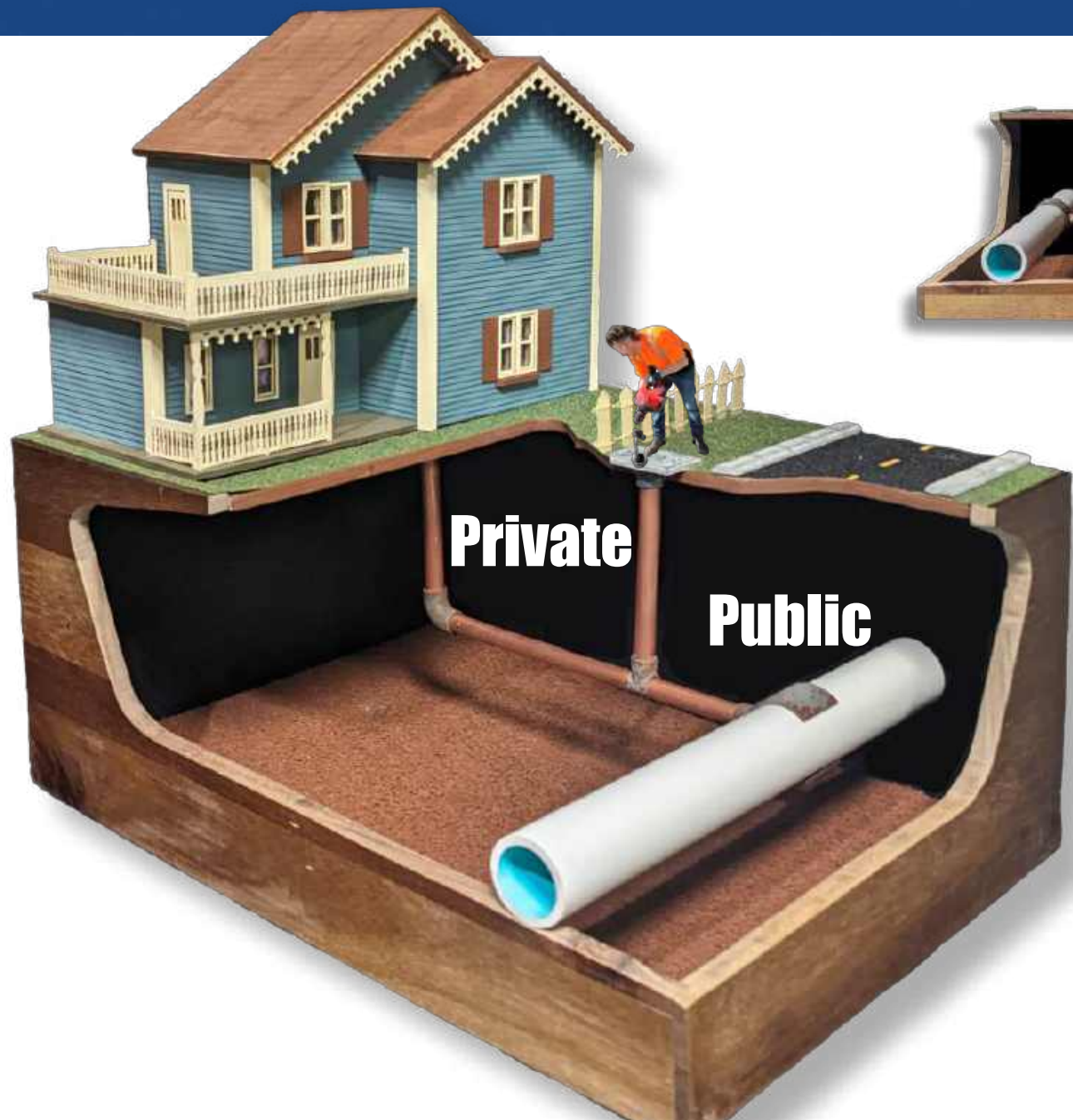
**Utility-Owned
Meter-to-Main**



**Customer-Owned
Meter-to-House**



■ Access Through Multiple Fixtures

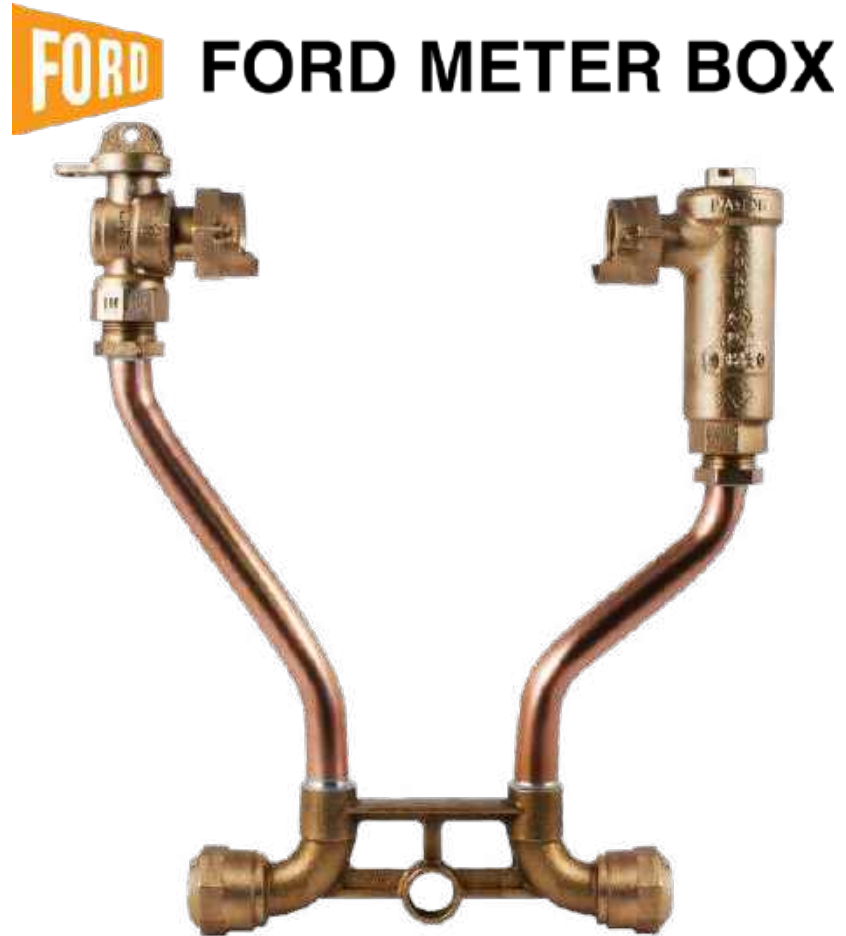


Standard Meter Settings

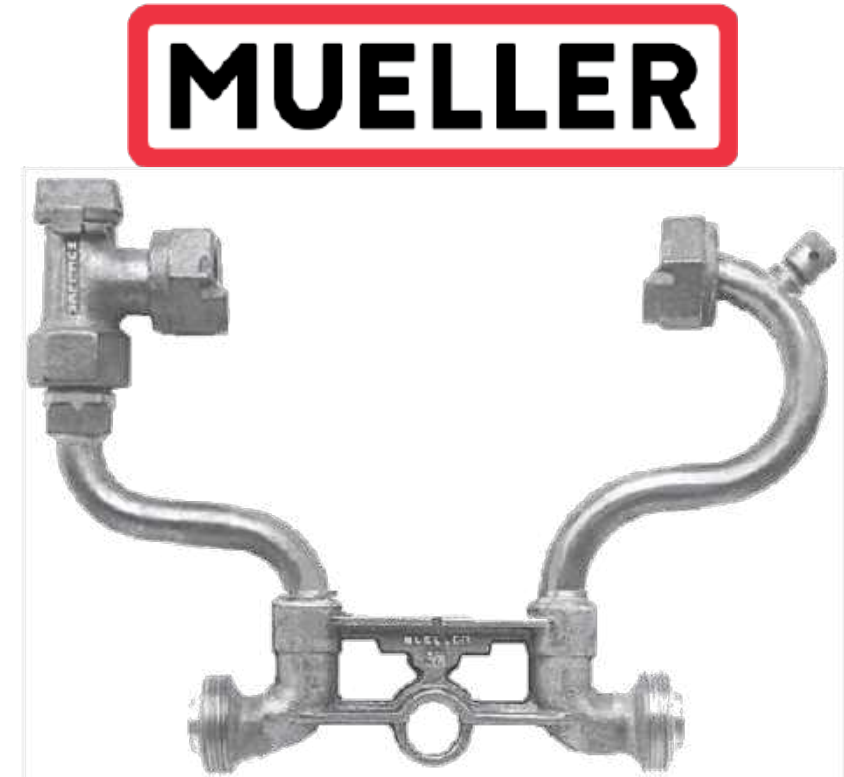
A.Y. McDonald



Ford



Mueller



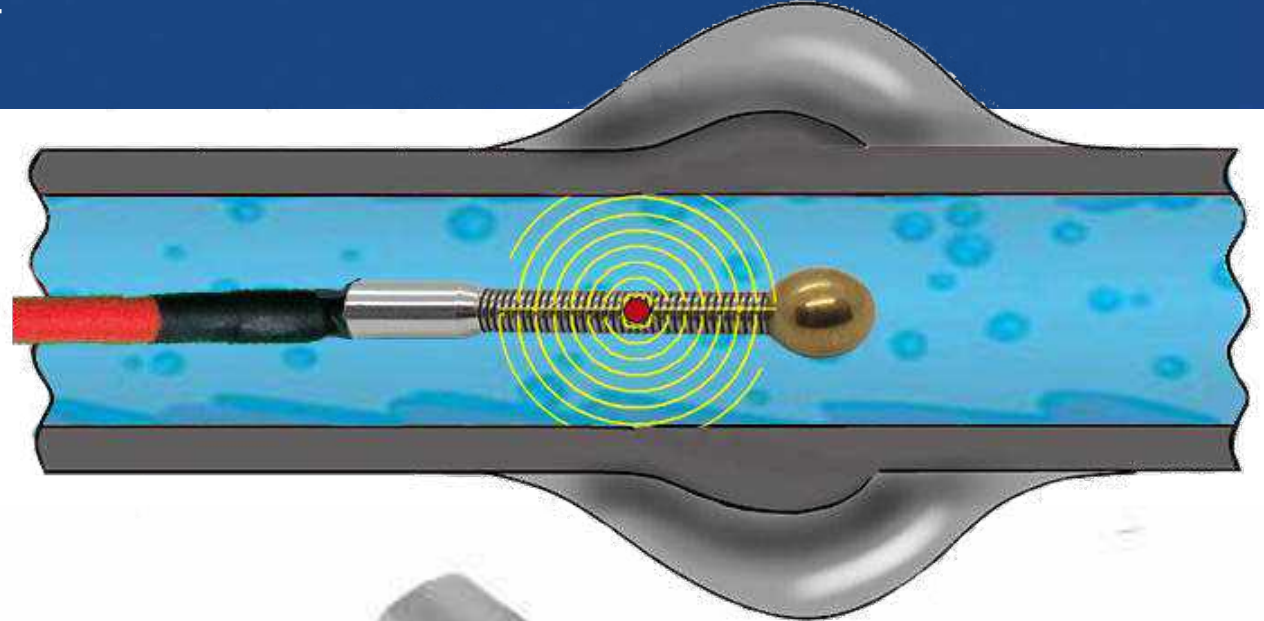
More Meter Settings



Standard Meters – BASEMENT ENTRY

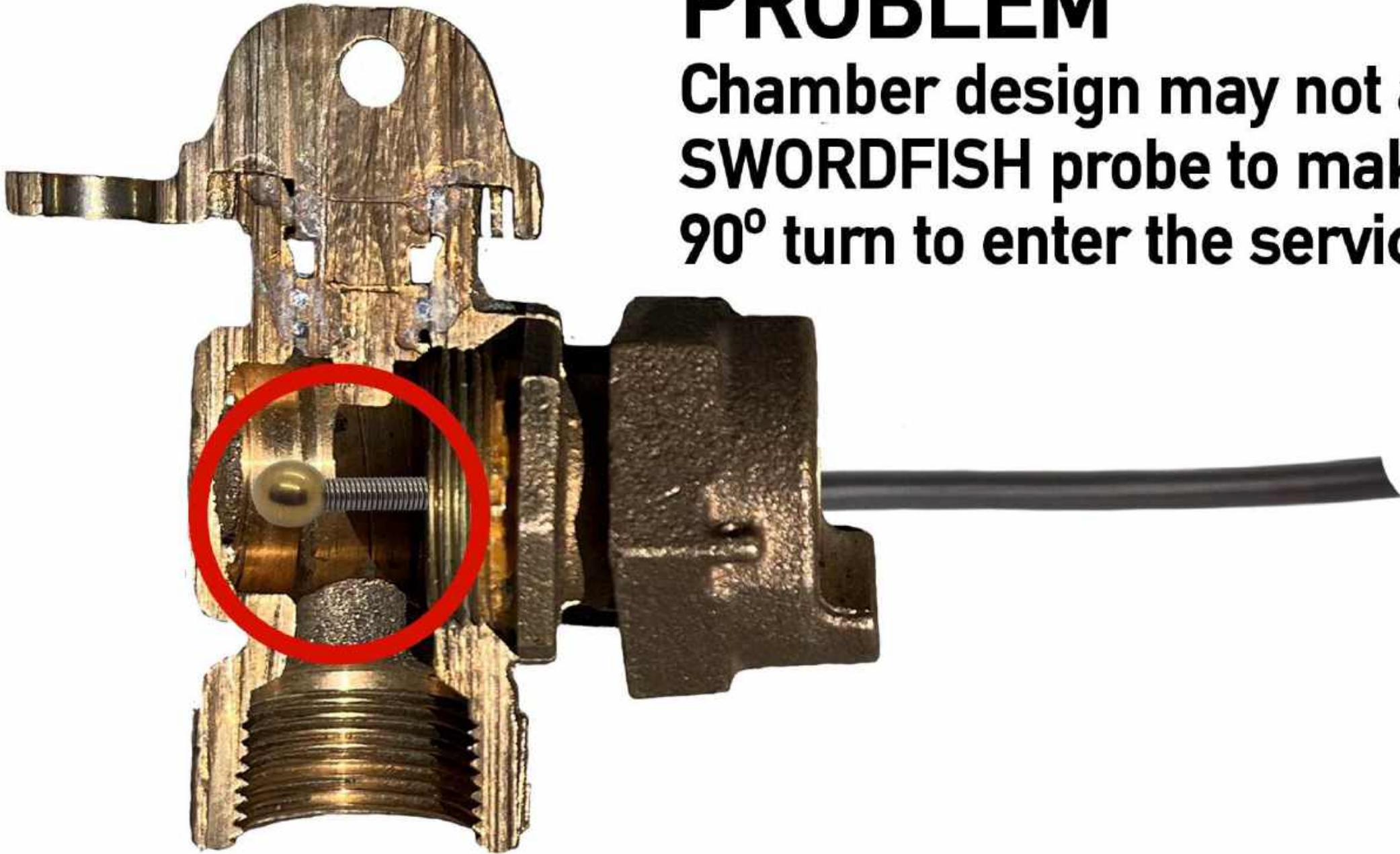


■ Probe Evolution – 2021 to Present



PROBLEM

Chamber design may not allow
SWORDFISH probe to make the
90° turn to enter the service line.



SOLUTION

SWORDFISH Re-Direct Tube to assist in navigating first 90° turn.





ADVANTAGES

- Tested on Hundreds of Meter Set-Ups.
- Pressurized Entries up to 150 psi with Chlorination Chamber
- No need to dig.
- Proven technology.



DISADVANTAGES

- Can't get past bad joints or heavy debris.
- Some older meter settings are too fragile to be removed and re-installed.

Question #4

A major change in the LCRI was the addition of **LEAD CONNECTORS** to be replaced in a 10-Year Period.

- A. Lead Pipes Located Inside the Home.
- B. Lead Soldered Joints in Asbestos Cement Pipe.
- C. Lead Connectors
- D. Galvanized Pipes Regardless of Upstream Lead.
- E. All of the Above.

Part 4



Mike App
Executive Vice President
Electro Scan

DC Water's Benchmark





Service Line Identification Pilot - Update

Environmental Quality & Operations Committee

October 17, 2024

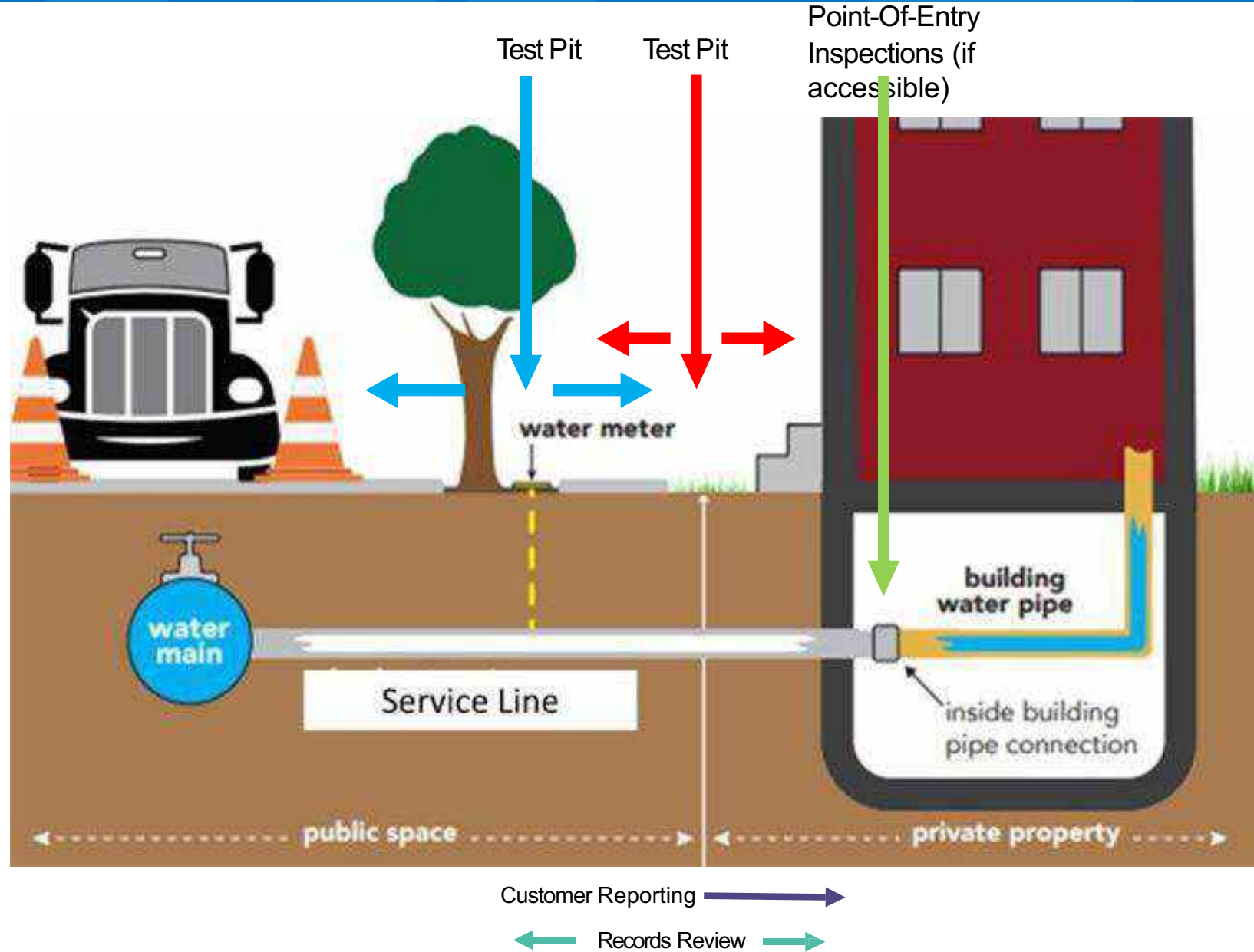
**Imagine a city
without lead.**



William Elledge, Director, Engineering & Technical Services

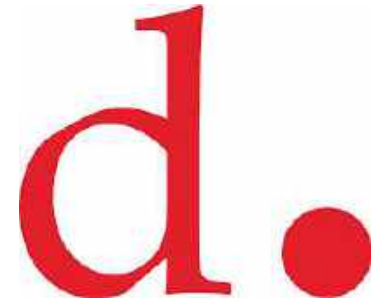
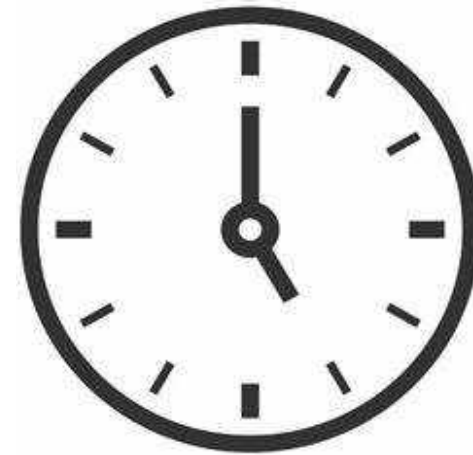
Verification of the Service Line:

1. Test pit at meter
 - Main to meter
 - Meter to property line (i.e. curb-stop)
2. Test pit at curb-stop
 - Water meter to property line (i.e. curb-stop)
 - Property line to building
3. Interior point-of-entry inspection



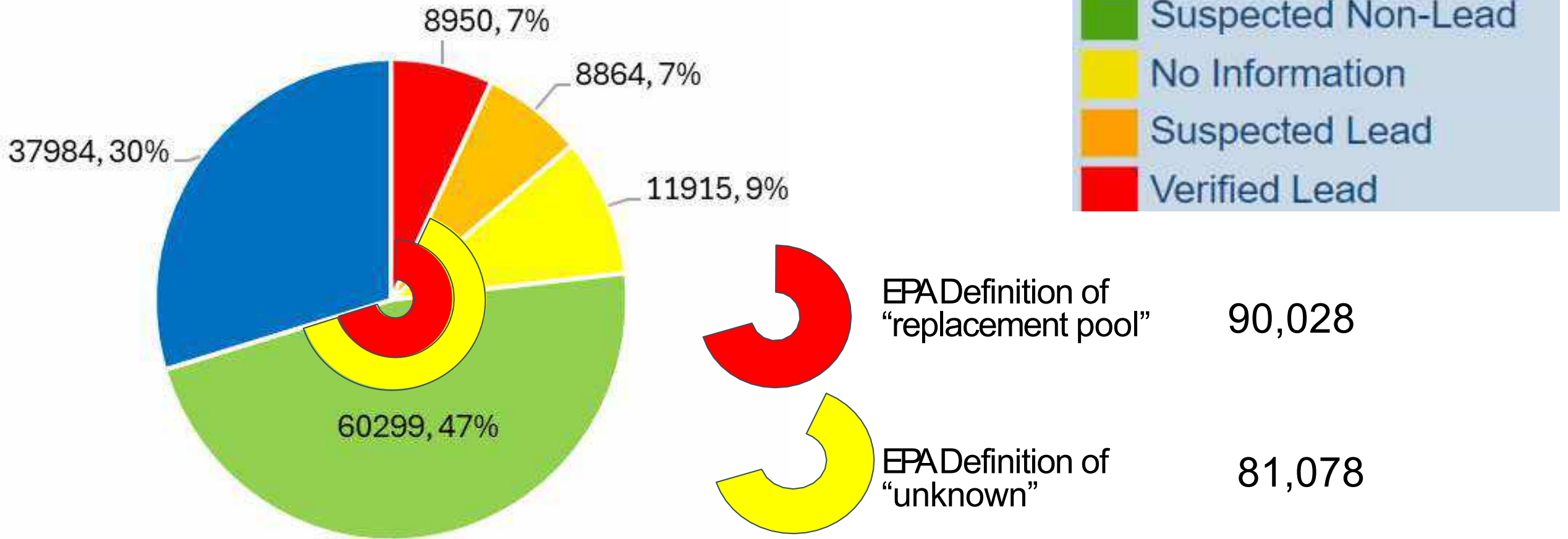


Disruptive



Currently there are no widely used, non-invasive, rapid, and cost-effective methods to determine buried service line material accurately.

DCW Material Inventory - October 2024



DC Water must reduce “replacement pool” (per EPA’s definition) by ~60k.

Possible contract for verification of less than 40k service lines.



Test Pit



EDT SMIT



Electro Scan
SWORDFISH



1 Remove water meter



2 Disinfect probes



3 Test public & private service line



4 Flush (external) for 30 mins w/o meter +5 mins w/ meter



5 Report results. Provide filters and flushing (internal) instructions.

Material Evaluation
Pipe Material: Copper
Pipe Diameter: 0.5
Max Load: 100
Total Distance Scanned: 8 ft
Pipe Entry Method: Meter To Home
Third Party Chemical Test:
Lead Test Status: Performed
Result: No Lead
Inspection Checklist: Completed
Post Flush: Completed
Operator Notes: 2 areas of concern ; 3m confirmed

Time to Test: 1-hr

- Swordfish staff have high confidence on service lines tested
- Swordfish cannot make it through all plumbing configurations
- EDT needs additional calibration

- Obtain remaining results from both technologies
- Confirmatory test pits
- Compare results with findings from test pits
- Make recommendation for a potential alternative to test pitting
- LCRI Final Rulemaking
- We have until Oct 2027 to reduce “replacement pool” (per EPA’s definition) by ~60k
- Possible contract for verification of less than 40k service lines

Question #5

TRUE OR FALSE

Validation of the Service Line Inventory
DOES NOT INCLUDE non-lead pipes.

The preliminary LCRI was modified and now requires all non-lead pipes, prior to 1986, to be validated.



Part 5



David Kinsella

President

Element 82 & PE Pipelines



Inspection-to-Remediation

Innovating For A Better Future

Nasdaq: CRKN



Who is Element 82 & PE Pipelines?



Value = reduction in community impact



2018: Open Cut (75%) vs Trenchless Technologies (25%)
2028: Open Cut (25%) vs Trenchless Technologies (75%)

TRENCHLESS REDUCES THE FRICTION IN OUR DAILY LIVES.

Engineering

- GIS for design
- No utility relocates
- No easement issues
- Reduction in time/expense
- Limits change orders
- Less project oversight (inspectors)

Construction

- 92% less digging
- Reduces noise and dust
- Open traffic lanes
- 90% reduction in carbon outputs
- Reduction in social costs
- 30% to 50% less time

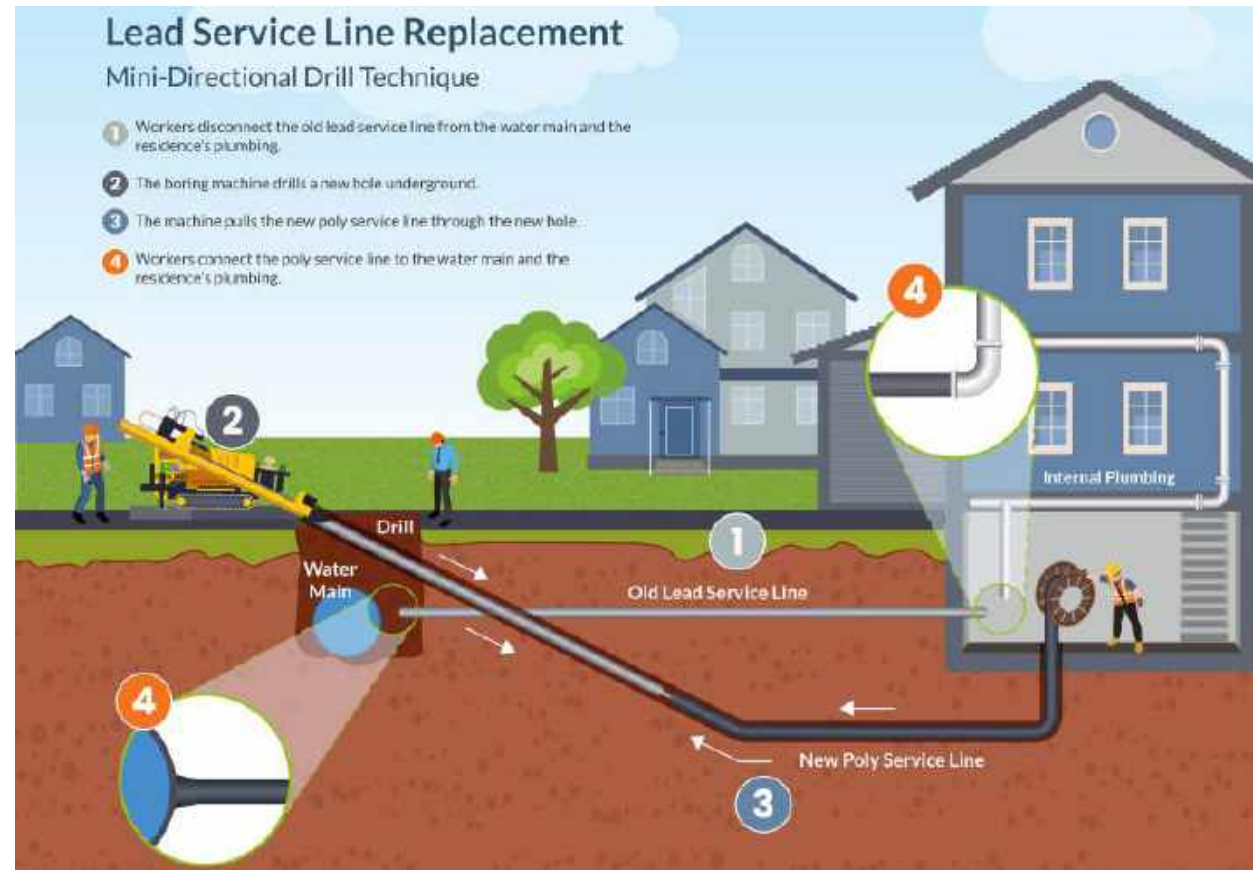
Our Services

Horizontal Drilling



Specializing in the replacement of lead service lines leveraging 4 techniques.

- Disconnect the old lead service line from the water main and the residence's plumbing
- Use boring machine to drill a new hole underground
- Machine pulls the new poly service line through the new hole
- Connect the poly service line to the water main and the residence's plumbing



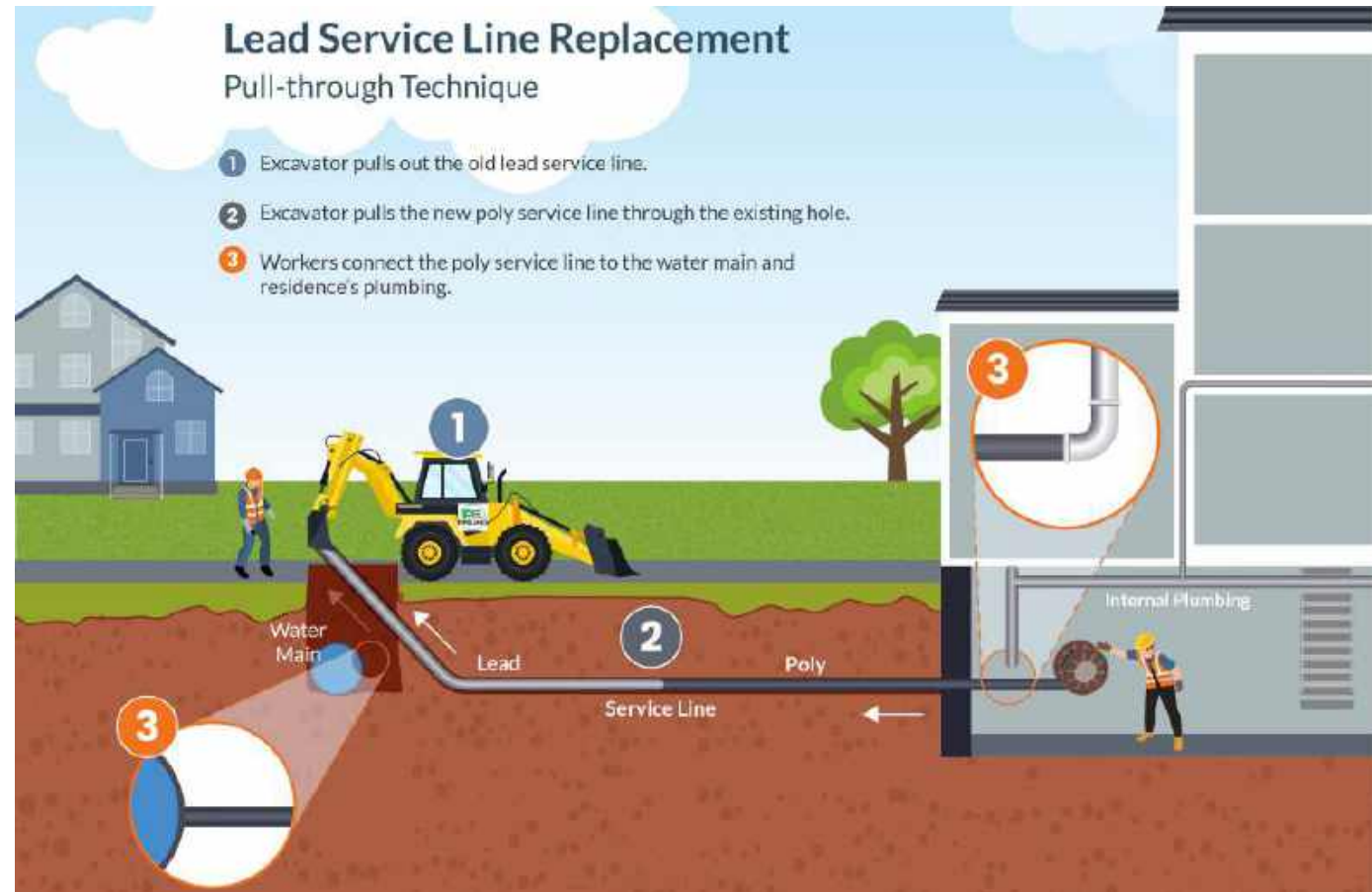
Our Services

Pull Through Method



Specializing in the replacement of lead service lines leveraging 4 techniques.

- Excavator pulls out the old lead service line
- Excavator pulls the new poly service line through the existing hole
- Connect the poly service line to the water main and residence's plumbing



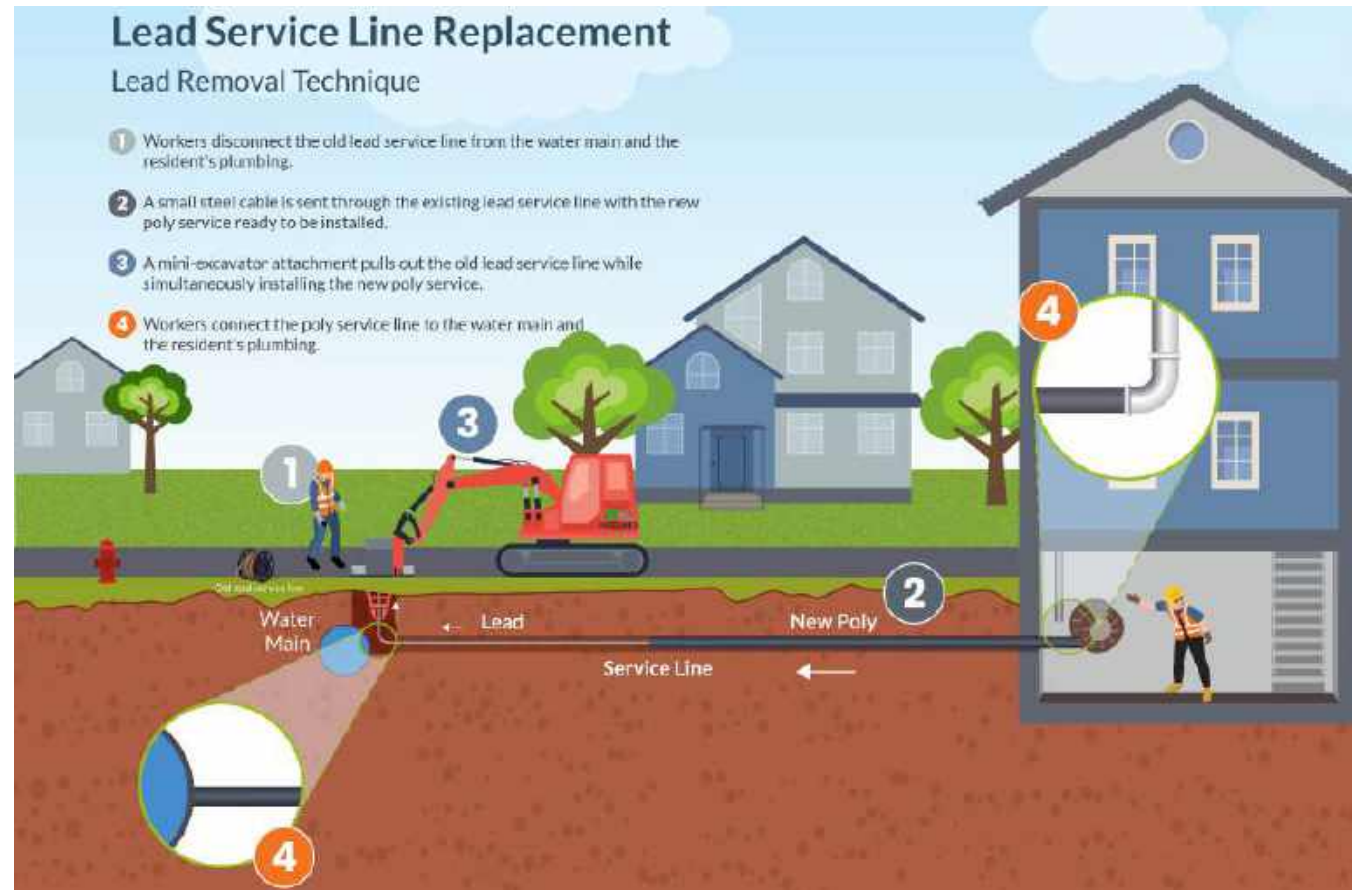
Our Services

Lead Removal



Specializing in the replacement of lead service lines leveraging 4 techniques.

- Disconnect the old lead service line from the water main and the residence's plumbing
- Send a small steel cable through the existing lead service line with the new poly service ready to be installed
- Mini-excavator attachment pulls out the old lead service line while simultaneously installing the new poly service line
- Connect the poly service line to the water main and residence's plumbing



Our Services

Mole Pipe Replacement Technique



Specializing in the replacement of lead service lines leveraging 4 techniques.

- The impact mole can be launched using a sighting level. It advances by a percussive action creating a bore hole.
- The new poly line is pulled through the bore hole and connected to the water main and residents plumbing.



ELEMENT:82

Nasdaq: CRKN

PEPIPELINES



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<https://element82.co/>



INVENTORY



GIS



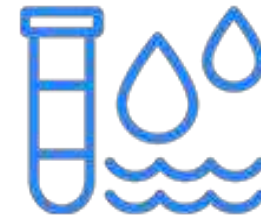
CONTACT



SCHEDULING



INSPECTION



TESTING



REPLACEMENT

CROWN

Question #6

The following is **TRUE** about Galvanized Pipes Requiring (GRR) Replacement:

- A. Cannot be partially replaced.
- B. Requires lead pipe to be anywhere upstream.
- C. Attracts lead particulates on its surface.
- D. Is a major reason why Electro Scan performs a lead swab test to confirm a GRR, and lead residue.
- E. All of the Above.



Part 6



Mike App

Executive Vice President
Electro Scan

Case Studies

1. **City of Baltimore, Maryland**
2. **City of Rock Hill, South Carolina**
3. **Town of Medley, Florida**
4. **Elementary School, California**
5. **Bard College, New York**



Case Study #1

Baltimore, Maryland Population 565,239



2 Service Line Inspection



1 Door Hanger Notices
30-Day | 2-Day



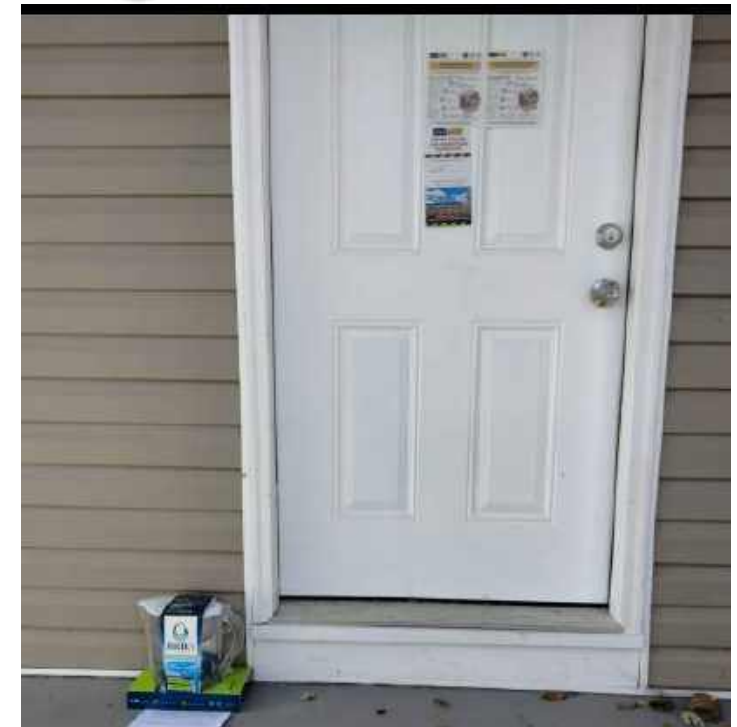
3 Reporting



4 Flush the Line



5 Customer Notification



Case Study #1

30-DAY

2-DAY



BALTIMORE SERVICE LINE PARTNERSHIP

IMPORTANT NOTICE


Dear Customer:

The 2021 revisions to the Lead and Copper Rule require the Baltimore Service Line Partnership to identify the material of all water service lines.

The Partnership engaged Electro Scan, Inc. to inspect water service lines in this area. A small probe will be inserted directly into the service line to verify its material.

Water service will be shut off during the inspection. The inspection will take less than an hour to complete.

Questions? Call 311 or visit <https://bit.ly/SAMple1> for more information.



BALTIMORE SERVICE LINE PARTNERSHIP

WATER SERVICE LINE INSPECTION NOTICE

Dear Customer:

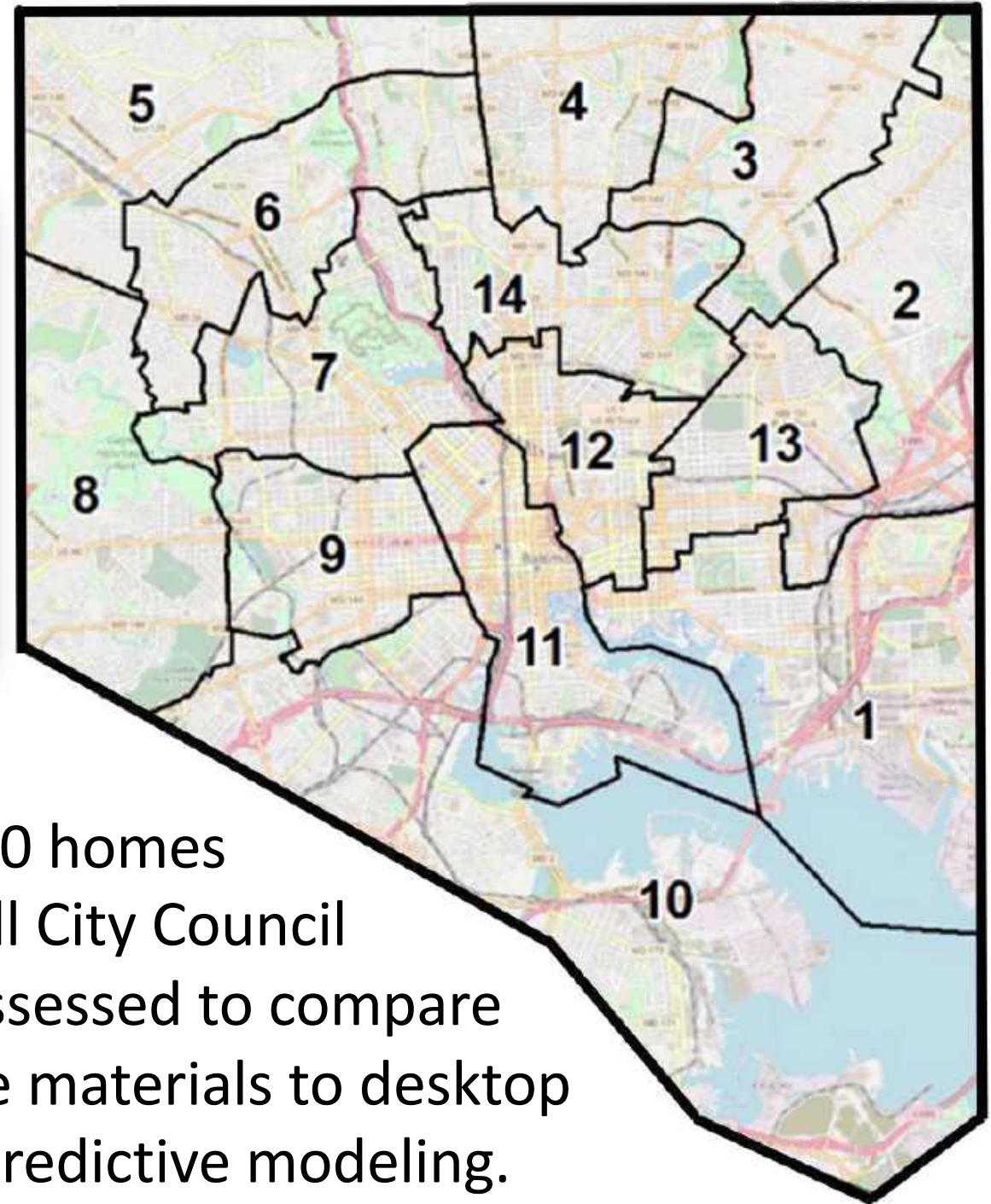
An Electro Scan representative may conduct a water service line material inspection at this address on

Date: _____

Morning _____ Afternoon _____

If you want to be present during the inspection, call the Electro Scan scheduling line at (667) 843-9500.

Questions? Call 311 or visit <https://bit.ly/SAMple1> for more information.



Initial 4,000 homes covering all City Council Districts assessed to compare actual pipe materials to desktop data and predictive modeling.

Case Study #3

Town of Medley, Florida Population 1,036



Case Study #4

California Elementary School Total Enrollment 384



Case Study #4

HANSEN
Hansen Analytics, LLC

criticalh2o

All Scans Standard

Swordfish

Scans

Project and Jobs Reports

Support

Log Out

Worksites

Inspections

33

Lead Detected

15

No Lead



Case Study #5

Bard College, New York

Total Enrollment 2,469



Question #7

TRUE OR FALSE

Predictive Models can easily tell if multiple pipe materials are present.

Predictive models are Best to provide neighborhood-level assessments, but have a poor track record predicting Utility-side & Private-side pipe materials.



Part 7

Wrap Up / Q&A



Richard Brown
Dir. of Marketing
Electro Scan





Lead Pipe Removal



Copper Pipe Removal



GOAL 100% Removal



GOAL 0% Removal



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ELEMENT:82

PE PIPELINES

SWORD  **FISH**

Lead and Copper Rule Improvements Webinar



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CEO
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INVENTORY



GIS



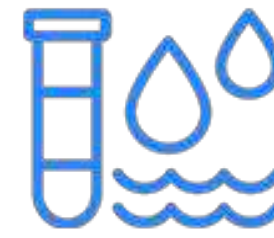
CONTACT



SCHEDULING



INSPECTION



TESTING



REPLACEMENT



That's all Folks!