

CRITICAL SEWER & WATER CHRONICLES

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Still Using CCTV to Accept CIPP?

'Pulling Back The Curtain' on CIPP with New Testing & Acceptance Standards By Quantifying Leaks in GPM



Dye from Eye Dropper Passes Directly Through Cured-In-Place Liner

SEE BACK PAGE
Harmful Chemical Emissions Found in Major Study on Cured-In-Place Pipe Installations



"Cured-In-Place Liners Leak"

It's sad, but true. Cured-In-Place Pipe (CIPP) have hundreds of points of (possible) failure that cannot be detected with high resolution Closed-Circuit Television (CCTV) cameras because defects & weak spots in the liner wall *can't be seen*.

For years, agencies have relied on CCTV or visual inspection to judge the quality of CIPP liners, never really knowing whether newly relined pipes were water tight or not.

Contractors are often asked not only to reline a pipe but also to complete the CCTV inspection; essentially grading their own work. But, relined pipes that fill-up soon after rehabilitation, have unexplained pinholes in the liner wall, and show unexpected rapid deterioration after only a few years, have questioned the long-term durability and service life of CIPP liners.

Ensuring the water tightness of liners has not been possible with CCTV. Pinholes, accidental cuts, defective service reinstatements, accelerant burns, overcooked sections, ridges, and wrinkles are just some of the issues causing defect flows from the liner to host pipe, not found by CCTV inspection.

Backed by EPA- and WERF-sponsored benchmark studies, new inspection standards have replaced legacy CCTV and visual inspection to provide a reliable, unequivocal, and unbiased *machine-intelligent* solution that can automatically locate and measure defects in gallons per minute or liters per second. Enter Focused Electrode Leak Location (FELL).

Even better, equipment can be easily added to existing TV trucks to switch from CCTV to FELL, and back again in just minutes, on Electro Scan certified vans.

Learn More on Pages 4, 5, & 12

Japan Approves New Electro Scan Standard

JASCOMA Certificate No. 12 'Water Tightness' Represents New Quality Assurance for New & Relined Pipes



Electro Scan Inc. is pleased to announce that its Japanese and U.S. patented technology has been awarded JASCOMA Certificate No. 12, Water Tightness Investigation Technology 'Electroscan.'

The designation was granted by the Japan Sewer Collection System Maintenance Association (JASCOMA) for testing and certifying both existing and newly rehabilitated sewer pipes.

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Mark Grabowski, GM and VP, Electro Scan, Ken Kerri, Ph.D., P.E., Office of Water Programs, CSUS, Katsutoshi Shigemitsu, KANTOOL, and Mikio Goto, KANTOOL.

Kansas City to Assess Sewers in Environmentally Sensitive Areas Using Electro Scanning Technology

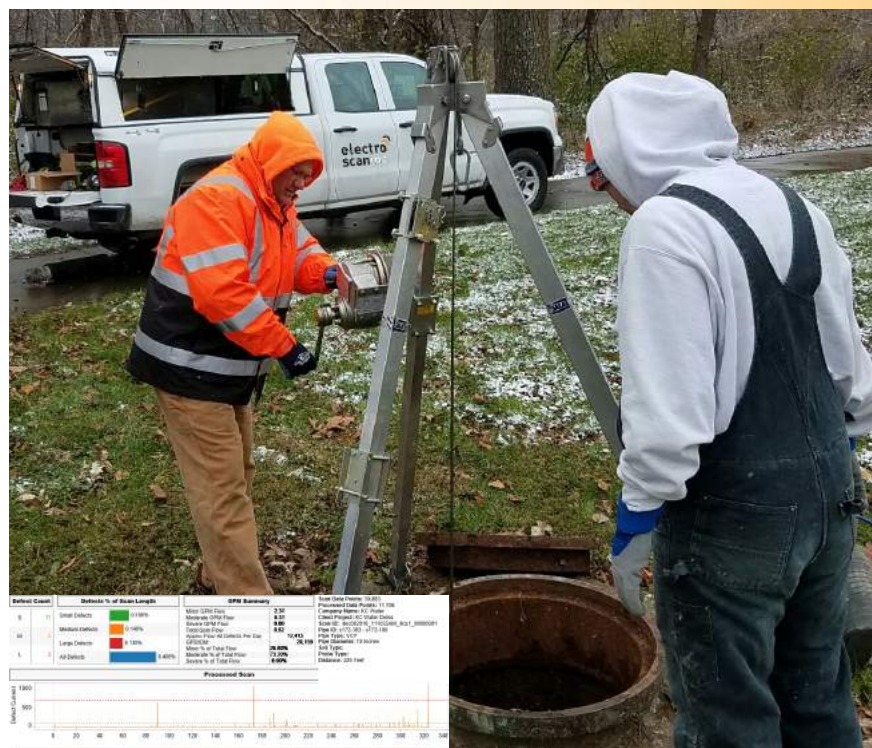
August 21, 2017 - Electro Scan Inc. is delighted to announce that the City of Kansas City, Missouri has selected Electro Scan's Next Generation leak detection technology for condition assessment of 15-inch and smaller diameter sewer mains.

The partnership with Electro Scan will include the assessment of 100 pipe segments with an approximate total length of 23,000 feet that cross under environmentally-sensitive areas such as creeks, rivers, and streams.

The project is part of Kansas City's largest infrastructure investment, the Smart Sewer Program. The \$4.5 billion Smart Sewer Program represents the first Consent Decree in the nation to include the use of green infrastructure solutions. Kansas City is also home to the nation's most connected Smart City.

"Kansas City's wastewater infrastructure system spans across 318 square miles," said Special Assistant City Manager, Andy Shively. "Some of this critical infrastructure lies beneath hard-to-reach locations."

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Electro Scan Selected for 16 Kilometer Sewer Assessment Project in U.A.E.

Despite being home to the world's tallest buildings, most modern hotels, and advanced transportation networks, sewer systems in the United Arab Emirates (U.A.E.) are routinely plagued by seawater infiltration that threaten treatment plant operations and contributes to sanitary sewer overflows.

Unfortunately, saltwater intrusion is a condition faced by many of the world's leading coastal cities, everywhere from Auckland to Singapore to Venice, just to name a few. The difficulty with finding these sources of infiltration using visual inspection is that when the tide is out, active infiltration cannot be seen,

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Electro Scan Services Inspect Force Main Siphon at Night

Problem

A large public agency in Southern California recently undertook a major project to CIPP line several thousand feet of 30" force main beneath a heavily traveled highway.

Adding to this already complex project, was a siphon with sharp bends. Due to the thickness of the liner, these bends in the siphon led to wrinkles and stretching in the CIPP.

Solution

With the liner still under warranty, the Agency decided to further investigate the liner in the siphon by utilizing Electro Scanning Inspection to locate (within 1 cm) & quantify (in GPM) any potential leaks in the CIPP.

Electro Scanning Inspection – also referred to as Focused Electrode Leak Location (FELL) – uses a narrow band of electricity to identify all openings in a non-conductive pipe

wall that go to ground. Anywhere electricity leaks, water will leak, too.

Result

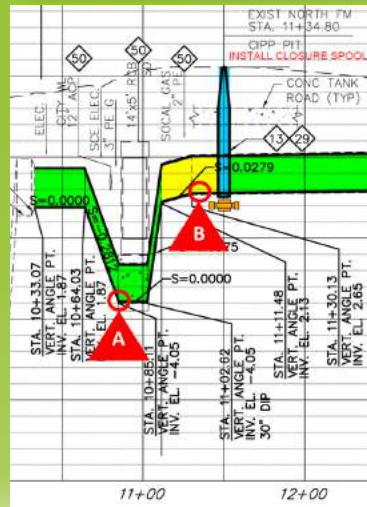
Electro Scan surveyed 159 feet of pipe at night when part of the Pacific Coast Highway could be shut down. Electro Scan found 6 individual defects contributing an estimated 8.17 GPM. The worst defect in the pipe represents 47.4% of the total estimated defect flow.

Defects are clustered within two primary locations and comparison to available CCTV from December 2015 show that defect areas corresponded with bends in the siphon, as suspected by the Agency.

Additionally, the siphon was inspected twice to confirm findings and demonstrate repeatability. Both scans found 6 defects and had a difference in length of just 0.2 feet.



Closing down the Pacific Coast Highway, June 30, 2017.



A
2.69 GPM



B
5.48 GPM



Northern, Calif. Agency Includes Electro Scan Inspection to Test & Certify CIPP



A Northern California City first started investigating Electro Scanning Inspection technology with a demonstration in January 2016. During the demonstration, two concrete pipes were scanned, totaling 624 linear feet, and Electro Scan located 71 defects with the potential to leak 49.9 gallons per minute (GPM).

The City recognized Electro Scan's ability to unambiguously locate and measure defects, which is extremely useful in pipes where defects can rarely be seen with high definition cameras, especially in cured-in-place pipe (CIPP) liners, or when a pipe is surcharged.

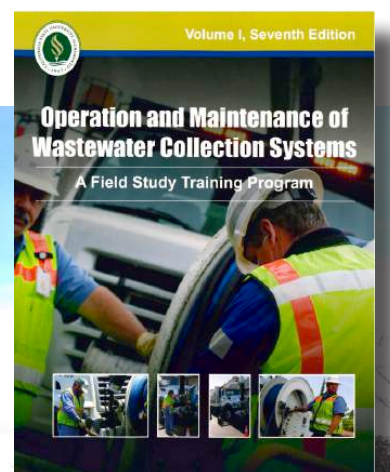
The City also follows "Best Practices" from the 7th Edition, Volume 1, **Operation and Maintenance of Wastewater Collection Systems** manual, wherein Electro Scanning Inspection is

recommended before and after any rehabilitation or renewal, and for new pipe installations.

In June 2017, the City began soliciting bids for a sewer rehabilitation project in which Electro Scanning Inspection was specified to scan the host pipe before and after the installation of a CIPP liner. The goals of taking pre- and post-CIPP scans are:

- Measure the Reduction in Leakage, as GPM, GPD/IDM, Percent of Flow Reduction, & Reduction in Defect Count
- Quality Assurance (QA) / Quality Control (QC)
- Testing & Certification before Project Acceptance

The project is set to start in late 2017.



California agencies are encouraged by the State Water Resource Control Board & CalEPA Office of Enforcement to use Best Available Technology (BAT) & Best Practices recommended in the 7th Edition O&M manual. See Page 5



FELL Inspection, Led By WRc, Takes Shape Across the Pond

With Electro Scan's recent partnership in the UK with WRc (creators of the NASSCO CCTV codes), combined with recent social and political pressure to reduce overflows and water pollution in the UK, Electro Scan and WRc have been quite busy across the pond.

Wessex Water

With many successful Electro Scan projects in the UK in 2012 and 2013 with Wessex Water and its Rehabilitation Manager, Julian Britton, Wessex was delighted to hear that Electro Scan Services now offered through WRc. The latest project for Wessex is slated to kick off in Stanton Saint Quintin with a few Electro Scan projects budgeted for 2018. The Stanton Saint Quintin project, scheduled after harvest, included several

manholes buried in a farmer's field! In the meantime, Chuck Hansen, CEO, Electro Scan and Julian Britton will be presenting a Masterclass on Condition Assessment at the UKSTT meeting in Birmingham on 21 September.

Anglian Water

Attending No-Dig Live in Peterborough gave the Electro Scan & WRc team the chance to meet with Directors and Innovation Managers from Anglian Water (the water company that services Peterborough). Almost immediately, Nick Sexton, Innovation Project Manager, put the wheels in motion to perform a 2100m project within their "Window Showcase" catchment - a known problematic area located in Exning where Anglian trials different techniques and evaluates data. The project is scheduled to start later this year.

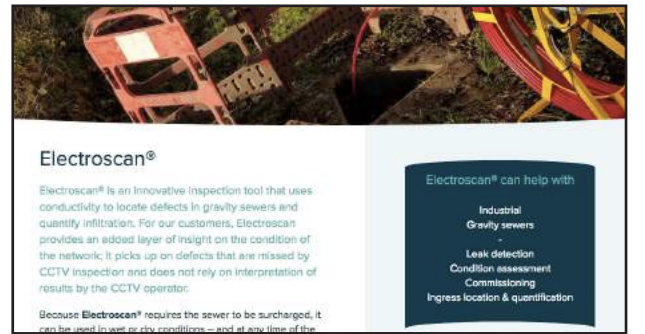
imity to water, and constantly full pipes, made it impossible to inspect with other methods.

After the success of the Ramsdell and Ampney St. Peter projects, Thames' Eight20 Alliance became interested. "Eight20" is an alliance of Thames and seven other industry consultants & contractor partners with the goal to carry out £1.75B of capital investment work during the AMP6 period (2015-2020). Eight20 has proposed 31 different catchments for Electro Scan projects over the next two years, with four catchments (20km) of inspection starting later this year.

Southern Water

Having heard of FELL back when the first prototypes were being tested in Germany 15-years ago, Keith Savage, Southern Water's Sewer Rehabilitation Manager, was keen to start up multiple projects. Now that the technology is being supported by WRc, 60 locations with infiltration, proven undetectable by conventional CCTV inspection methods, have been selected with the first two projects in Hambledon and Winchelsea, slated to begin in late 2017.

The data provided in initial benchmarks was described as "brilliant," and the Hambledon project was featured in both local press and Southern Water's newsletter.



WRc Deploys New Website Featuring Electroscan®



WRc's Peter Henley deploys Electro Scan's ES-225.



Industry Leaders Recognize Benefits of Innovative Technology as Part of KC's Smart City Initiative

Continued From Page 1

Electro Scan technology will be pilot-tested as a cost-effective and smart technology solution to help the City assess and maintain this infrastructure."

Typically, pipes running under waterways are frequently surcharged or full of effluent, often requiring dewatering with bypass pumping to use legacy closed-circuit television (CCTV) cameras to try and "see" defects in the pipes. Kansas City approached Electro Scan hoping to find a better solution to access and assess these critical pipes.

Electro Scan demonstrated the benefit of its technology during a demonstration which located and

measured defects in a pipe crossing a creek, that were missed by CCTV and then verified by dye flood testing.

Due to the majority of their pipes being located in remote-access areas, Kansas City selected Electro Scan's portable ES-620 for Sewer Mains system to automatically locate and measure defects - **in gallons per minute**. Electro Scan Inspection does not require a pipe to be dewatered, instead mimicking a wet-weather event from inside the pipe to internally assess 360-degrees of a pipe wall. Non-conductive materials prevent electricity from passing through, or along, the wall of a pipe. Electro Scan's patented

tri-electrode current should never be able to "leak" from inside of a pipe to earth, unless

there is an opening in the pipe wall. A defect in the pipe that leaks water will also leak electrical current. The larger the defect, the greater the electric current flow as described in ASTM F2550, *Standard Practice for Locating Leaks in Sewer Pipes By Measuring the Variation of Electric Current Flow Through the Pipe Wall*.

"I am delighted that Kansas City has chosen Electro Scan, but it comes as no surprise as the City has continued to have some of the most dedicated and innovative people in the industry. It's great to see industry thought leaders such as Kansas City, San Francisco Public Utilities Commission, & WRc adopting ground-breaking technologies to help solve problems," states Chuck Hansen, Founder and Chairman, Electro Scan Inc.

Kansas City's Smart Sewer Program is a 25-year plan to meet the requirements of the City's Federal Consent Decree. The program represents a \$4.5-\$5 billion dollar investment - the largest infrastructure investment in Kansas City's history and the first federally approved Consent Decree to incorporate green solutions.

www.kcmo.gov/smartsewer



Leaks Confirmed By Dye Flood Testing



Electro Scan's Return on Investment

Cost Justify Your Electro Scan Purchase By Certifying Your Next CIPP Project



$$\text{ROI} = \frac{(\$60,000 + \$60,000 + \$75,000) - \$160,000}{\$160,000} = 22\%*$$

*Assume 22% ROI when purchasing Electro Scan Equipment to self-perform 15,000 L.F. CIPP Certification

Pre-CIPP Assessment	
Average Project Size:	15,000 L.F.
Electro Scanning Service:	\$4/L.F.
Including Reporting & Mobilization	
Excluding Jet Truck & Operator Services	
TOTAL:	\$60,000 (A)

Post-CIPP Certification	
Average Project Size:	15,000 L.F.
Electro Scanning Service:	\$4/L.F.
Including Reporting & Mobilization	
Excluding Jet Truck & Operator Services	
TOTAL:	\$60,000 (B)

Pre-CIPP Assessment (Intangible)

Fixing the wrong pipe is a costly mistake when using visual inspection to prioritize rehabilitation when the goal is to eliminate infiltration.

Avoid Acceptance of Failing CIPP*

If 10% or 1,500 L.F. of CIPP Fails Electro Scan Certification

Average Cost of CIPP:	\$50/L.F.
10% CIPP Failure:	1,500 L.F.
TOTAL:	\$75,000 (C)

*Defect flow of 20 GPM or more

Electro Scan Equipment Cost	
Labor & Equip Overhead:	\$10,000
Electro Scan ES-620 Price	
<i>Before December 15, 2017:</i>	\$150,000
Includes ES-620 for Sewer Mains Equipment, Integration, Installation, Training, Data, Support, Desktop & Cloud Apps	
TOTAL:	\$160,000 (D)

CIPP 12-Month Warranty (Intangible)

Agencies can further avoid accepting failing CIPP within warranty periods.

Return on Investment (ROI): 22%

[(Pre-CIPP Assessment + Post-CIPP Assessment + Avoid Accepting Failing CIPP) - Electro Scan Purchase] / Electro Scan Purchase = ROI

[(\\$60,000 + \\$60,000 + \\$75,000) - \\$160,000] / \\$160,000 = 22%

Cost Benefit Analysis (CBA): \$35,000

(Pre-CIPP Assessment + Post-CIPP Assessment + Avoid Accepting Failing CIPP) - Electro Scan Purchase = CBA

(\\$60,000 + \\$60,000 + \\$75,000) - \\$160,000 = \$35,000

Calculate Your Own Return on Investment by Using the Electro Scanning ROI Calculator.

<http://www.electroscan.com/electro-scanning-roi-calculator/>

Retrofit Your CCTV Truck to Find Defects



Integrate Electro Scan with Leading American

CalEPA Office of Enforcement Adds O&M Manual to its "Best Practices"



Record sanitary sewer overflows (SSOs) from last winter's rainfall, following years of drought conditions, showed just how much work California's sewer agencies have to reduce SSOs or risk possible enforcement action.

Following a live field demonstration of Focused Electrode Leak Location (FELL) technology at the City of Roseville, Calif. on March 17, 2017, attended by multiple Northern California agencies and members of the CalEPA Office of Enforcement, Electro Scan was invited a week later to present a *technology workshop* at the State Water Board's CalEPA Office of Enforcement.



A month later, James Fischer, P.E. and Bryan Elder, P.E., of the CalEPA Office of Enforcement presented "Best Practices For Sanitary Sewer Overflow (SSO) Reductions" at the CWEA Annual Conference in Palm Springs, CA, naming the 7th Edition O&M manual as a resource for best practices, and including Electro Scan as an example "Best Practice."



Welcome Aboard, Homero!

It is a great pleasure to welcome Mr. Homero Belmonte as Electro Scan's newest Field Services Technician. Joining the company full time in April 2017, Homero has already visited dozens of cities & counties with Electro Scan.

Look for Homero to manage upcoming certification projects in San Francisco too.

Homero has helped bring Electro Scan to Akron, Beachwood, Cleveland Heights, Columbus, Hagerstown, Roseville, Sacramento, San Luis Obispo, Bucks County, New Castle County, Nevada County, Pierce County, Placer County, Orange County Sanitation District, Inland Empire Utilities Agency, and Tri-City Water & Sewer.

In July, Homero singlehandedly demonstrated Electro Scan to over 100 participants in Yellow Springs, OH, sponsored by the Rural Community Assistance Program. He has also communicated with numerous cities and partners located in Mexico, Spain, and South America, in addition to translating Electro Scan User Manuals into Spanish.

Homero Belmonte

Age 30

Education California State University, Sacramento

Degree Civil Engineering

Previous Work Experience
 City of Atwater, Public Works Department, CA
 Pacific Underground Constuction, San Jose, CA
 Ghilotti Brothers, Inc., San Rafael, CA
 Teichert Construction, Sacramento, CA

Hobbies
 Dirt Bike Riding, Hunting, Traveling

Languages
 English and Spanish



Matt Campos and Homero Belmonte.

Missed By Visual Inspection



Don't let your wastewater collection agency get left behind in adopting new guidelines for Pre- and Post-Rehabilitation Condition Assessment. The new 7th Edition, Volume 1, O&M Manual with its standalone chapter on Electro Scanning Inspection, dramatically changes how to assess, prioritize, and certify repairs.



Make sure you can tell a citizen, municipal bond holders, and city insurance carriers that your sewer utility has adopted the latest recommended guidelines to inspect, rate, fix, and certify your pipeline rehabilitation program.

BUDGET

Electro Scan Inspection CCTV Retrofit Cost

\$130,000 - \$250,000

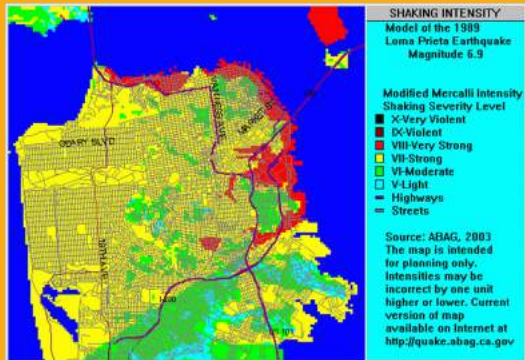
Range depends on...

1. CCTV Manufacturer
2. # Field & Office Users
3. Annual Support Plan

CONTACT ELECTRO SCAN FOR A BUDGET QUOTE FOR YOUR TV TRUCK - OR -

A SERVICES QUOTE TO CERTIFY YOUR NEXT LINING PROJECT AS LEAK-FREE

& European TV Vans!



SFPUC Adopts FELL Standard

SFPUC and the City & County of San Francisco continue to “tighten up” acceptance standards as over \$43 million in wastewater projects, including new pipe installation and pipe rehabilitation, are requiring Focused Electrode Leak Location (FELL) to test for leaks.

San Francisco is reinforcing its reputation as a leading West Coast agency by adopting innovations to better the overall health and quality of the City’s buried assets.

Instead of waiting for a Federal Government mandate on infrastructure renewal and spending, San Francisco is already several years into its \$6.9 billion Sewer System Improvement Program.

The City has made it clear that leaks allowing infiltration or exfiltration cannot be tolerated. As a result, FELL testing has taken on two major rolls for all new projects:

1. **Find & Fix.** FELL is used to test for leaks throughout the City, especially in critical areas, to prioritize pipes for rehabilitation.
2. **Testing Before Acceptance.** FELL testing is used to make sure the City is accepting only “leak-free” pipes from Contractors.

In sewer pipe specifications, FELL results are required to be uploaded directly to the City’s Critical Sewers® cloud application in real-time. This allows the City engineers to quickly make decisions. If a pipe is leak-free, it will be accepted. If a pipe is found to have a leak(s), the defect can be investigated further or repaired by the Contractor while still on-site.

Hello, SFPUC Sewers... Goodbye, Leaky Pipes!

SF Public Utilities Commission Utilizes Electro Scan Leak Detection For Joint Pressure Testing

A key goal for SFPUC and its partners is to identify key sources of groundwater and tidal infiltration, effect cost-effective repairs, and reduce saltwater intrusion to eliminate transport to the treatment plant.

But, recently, several joint pressure test results appeared to differ from Electro Scan results; finding joints that passed their pressure tests, using a packer, where low voltage current from Electro Scan testing found leak locations and an estimated GPM.

But, further analysis, showed results were quite understandable. Since groundwater levels influence air pressure test results, particularly for joints that may have encrustation or calcification, pressure testing of joints should undergo additional scrutiny especially during high tide conditions and where high groundwater conditions exist.

Supported by past studies by Vanderbilt University and GRW Engineers that compared FELL and Low-Pressure Air Tests for multiple pipe materials in Louisville, KY, agencies can utilize data from Electro Scan’s GPD / IDM reporting to provide an unbiased assessment of pipe

defects, without influence of groundwater levels that may produce false-positive readings when pressure testing sewer mains in high groundwater areas.

In a comparison of six (6) pipes in SFPUC (see below) using Pressure Testing with Electro Scan’s Critical Sewers® cloud platform showed that pipes that had the most failed air pressure joints, and that took the most grout, were also the worst pipes, according to the Electro Scan results.

While the number of “Small,” “Medium,” and “Large” defects are important considerations, the Total Quantified “Gallons per Minute” measurement is more important as it show agencies the magnitude & severity of the problem.

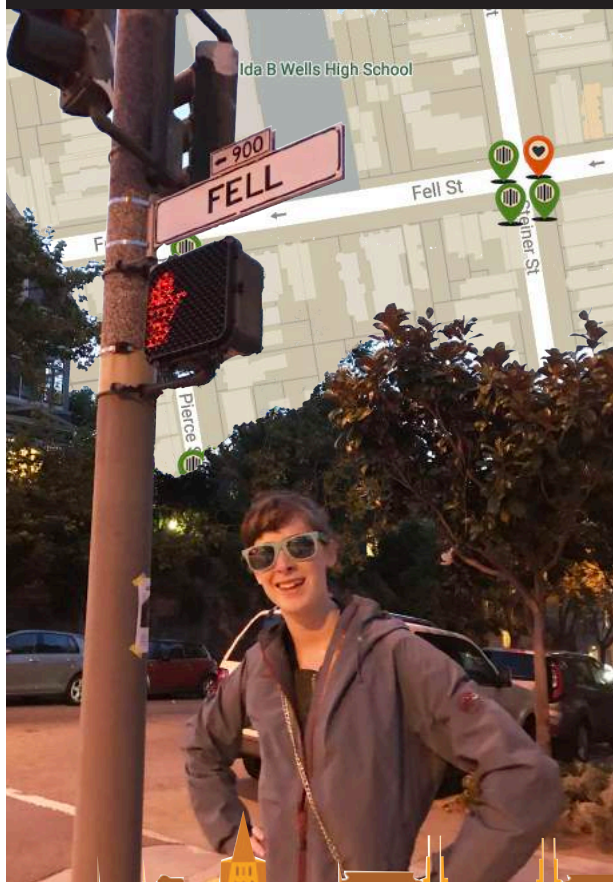
For the most effective rehabilitation program, Electro Scan recommends that Agency’s focus on prioritizing its worst pipes as rated by **defect flows** using **Gallons Per Day per Inch Diameter Mile**, as provided in Electro Scan’s Critical Sewers® cloud and EPA guidelines. This allows each pipe to be evaluated based on its own leakage rate, relative to pipe diameter and pipe length.

	Scans	Distance	S	M	L	GPM	GPD	GPD/IDM
Total:	6	1,305	176	25	23	223.54	321,898	1,340,124

Date	Mainline ID	Pipe ID	Pipe Type	Diameter	Distance (ft)	Small	Medium	Large	GPM	GPD	GPD/IDM
7/18/2016	MH35845 - MH10111	P-84453	VCP	15	259.0	35	2	0	22.36	32,198	43,760
	MH10240 - MH35845	P-83281	VCP	15	263.6	37	1	0	18.16	26,150	34,915
6/27/2016	MH36097 - MH10272	P-84539	VCP	12	181.5	23	10	5	35.34	50,890	123,394
	MH10261 - MH36097	P-76912	VCP	12	216.0	26	3	2	22.79	32,818	66,849
	MH10268 - MH10267	P-76917	VCP	12	291.6	47	1	0	25.33	36,475	55,042
3/3/2016	MH10113 - MH10119	P-77794	HDPE	8	93.1	8	8	16	99.56	43,666	1,161,163



FUN FACT: Dozens of vessels that brought gold-seeking miners to San Francisco in the 1800’s are still buried underneath the city’s streets. The ships were abandoned and later covered by landfill as the population skyrocketed.



Storm Drain Adopted By Electro Scan To Celebrate 10th Project in San Fran

A block away from San Francisco’s famous Painted Ladies, lies a lucky storm drain. This drain, stationed on the intersection of Fell Street and Steiner, is fortunate because it recently became the newest addition to the Electro Scan family.

On June 20 the drain was adopted and christened “FELL Inspection Rocks.” Electro Scan has pledged to clean out any leaves or debris whenever team members are in the area.

More than 1,600 of the San Francisco Public Utilities Commission’s storm drains have been adopted at <https://adoptadrain.sfwater.org/>

SFPUC, which manages over 25,000 catch basins and storm drains, and San Francisco Public Works uploads and manages the storm drain locations on the Adopt A Drain website.

San Francisco Bids To Date

Various Locations Sewer Replacement No. 1	\$8,000,000
Various Locations Sewer Replacement No. 2	\$7,300,000
Various Locations Sewer Replacement No. 3	\$6,900,000
Various Locations Sewer Replacement No. 4	\$5,500,000
University Street and Sunnydale Avenue Pavement Renovation and Sewer Replacement	\$2,456,344
Octavia Blvd and Oak Street Enhancement	\$1,008,481
Paul Avenue Sewer Replacement	\$770,000
Proposition K Curb Ramps FY 15-16	\$540,000
Filbert Street and Leavenworth Street Pavement Renovation and Sewer Replacement	\$7,300,000
California Laurel Village Improvement Project	\$3,500,000

More than \$ 43 Million

...more coming!

Risk Assessment Using Electro Scan Replaces CCTV for Better Decision Making

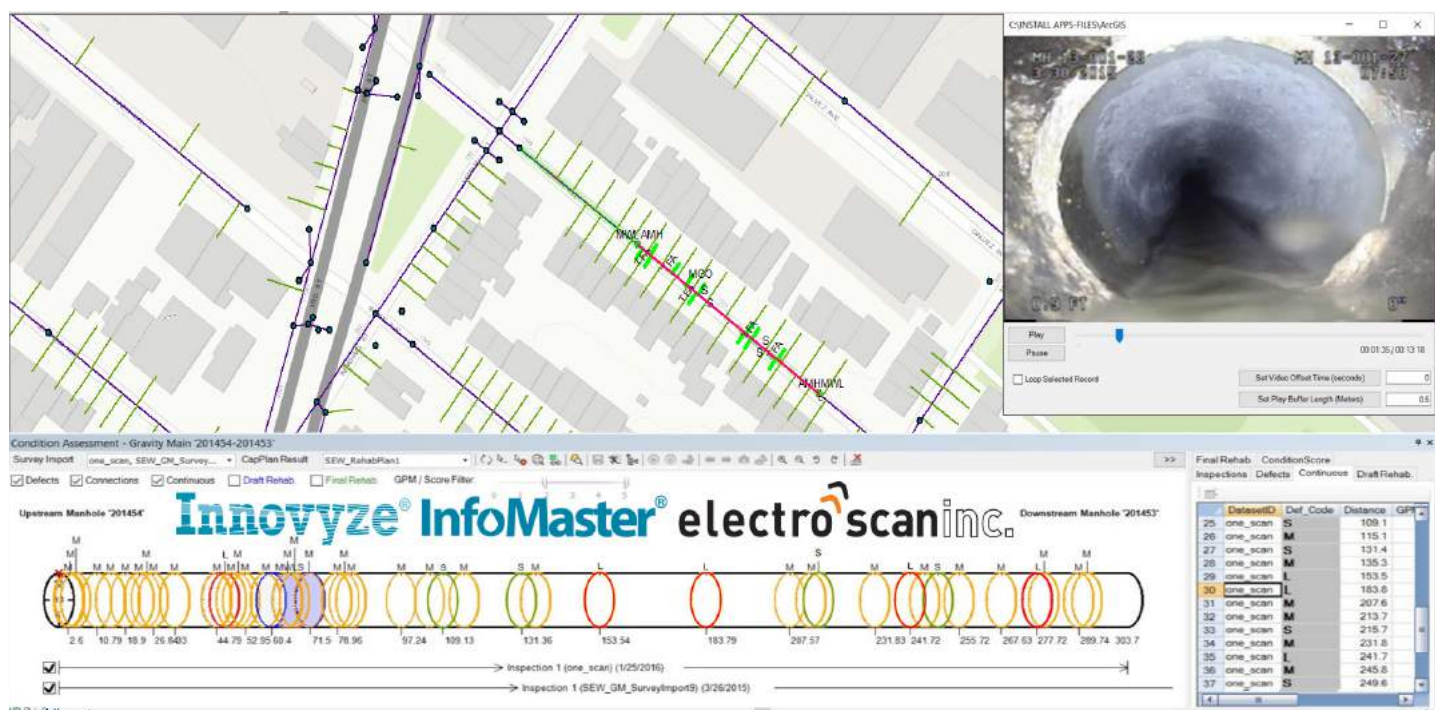
Recent Engineering Reports Worth a Second Look By Certified Electro Scan Data Providers As Visual Inspection Found to Recognize Only 1 in 10 Defects

Innovyze Asset Mgmt Prioritization User Group Meeting Unveils Electro Scan Technology

If you or your consulting engineer relies on visual Closed-Circuit Television (CCTV) inspection, your agency may be fixing the wrong pipes. Even worse, you may be accepting new or rehabilitated pipes as leak-free that could be leaking the same or more than before repair.

Those are the undisputed findings of several leading water and sewer utilities, consulting engineers, and educators that are upgrading their rehabilitation selection recommendations and certifications to include Electro Scanning Inspection.

A key decision support tool has been Electro Scan's integration with the Innovyze® InfoMaster for Sewer product.



“We are delighted to integrate our game-changing pipe condition assessment solution with the leading business analytics solution for the wastewater industry,” states Chuck Hansen, CEO, Electro Scan Inc.

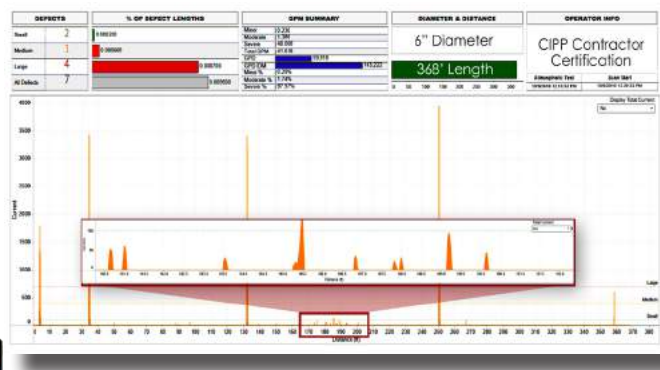
“CCTV compromises ‘risk of failure’ calculations by missing the majority of defects and can often be the leading cause of misapplication of scarce CAPEX.”

Chuck Hansen, Chairman & Founder, Electro Scan Inc.
Former Chairman & Founder, Hansen Information Technologies Inc.

Attention Sewer & Water Pipe Manufacturers

Are Your Pipes Water Tight After Installation? Arrange to Pre-Qualify Your Pipe Materials & Installers Today!

Does your pipe material pass your R&D testing at HQ, but still receiving calls from municipal & industrial clients that your pipes are leaking? Get your pipe material and installers PRE-QUALIFIED and put an early warning system in place using Electro Scan to know how your installation was performed, minutes after completion.



Electro Scan Begins Pre-Qualification of Spray-In-Place Pipe (SIPP) Vendors to Repair Defective CIPP and Renew Pipes



Courtesy Pipe TECH USA



Tom Edwards, Pipe TECH

Congratulations to Tom Edwards, and his production team at Pipe TECH USA, LLC for seeking out Electro Scan to pre-qualify the company's leading Spray-In-Place Pipe (SIPP) solution. While still not yet pre-qualified, they are diligently working through the process.

After initial rounds of laboratory testing, Electro Scan conducted field tests at selected customer locations to see how the most

promising technologies can solve everyday problems or be utilized as important parts of ongoing projects.

SIPP is becoming one of the fastest growing segments of the pipe rehabilitation market, especially as new compounds are combined with innovative pipe preparation & application delivery systems to create a long-term solution for customers.

“As one of the first lateral liners in the country, I’ve enjoyed seeing how SIPP solutions have gone from doing limited *hard-to-handle* specialty ‘niche’ applications to becoming the *go-to-solution* that does projects once attempted by lining contractors,” states Tom Edwards, Owner, Pipe TECH.

“We welcome industry leaders like Pipe TECH USA, relying on Electro Scan to certify its spray liners,” states Chuck Hansen.

PIPE TECH USA

Pipe TECH USA, LLC
10183 Croydon Way
Suite G
Sacramento, CA 95827
Tel: 877-507-0861
Web: <http://pipetechusa.com>
Email: info@pipetechusa.com
License #633553

FORMING A NEW PIPE USING SPRAY-IN-PLACE PIPE (SIPP)



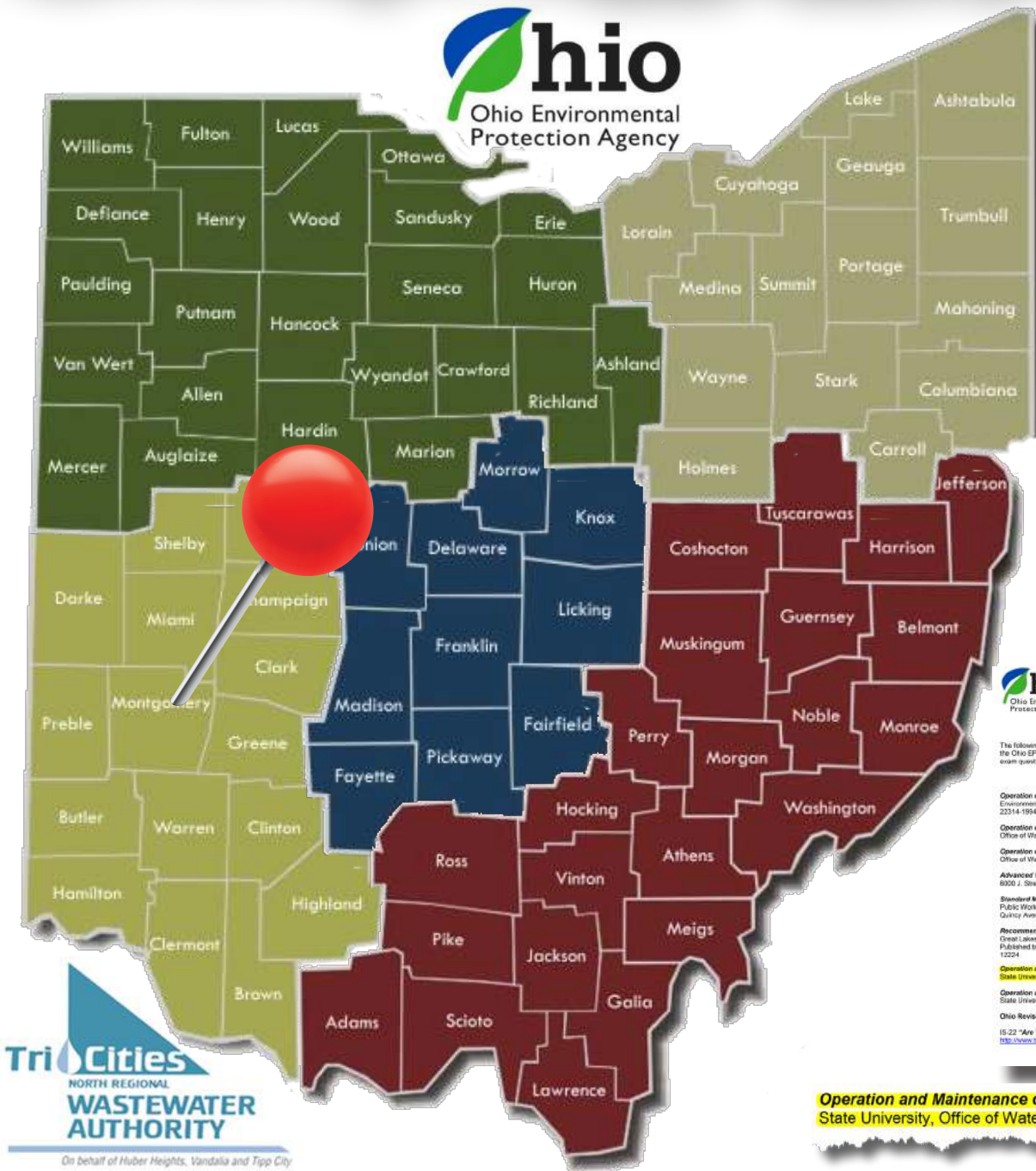
Ohio Sewer Agencies Find Out

Tri-Cities North Regional Wastewater Authority, Dayton, OH

	TOTAL SURVEYS	FOOTAGE	# OF DEFECTS	DEFECT FLOW GPM
TOTAL	785	163,815	12,986	13,987.09

Date	Mainline ID	Pipe Type	Diameter	Distance (ft)	Small	Medium	Large	GPM	GPD
6/27/2016	B149 - B147	CT	8	200.5	15	11	59	315.86	454,800
12/4/2015	v690 - v689	XXX	8	284.0	7	9	59	230.69	332,194
1/15/2016	v678 - v679	XXX	8	277.0	3	5	43	195.10	280,944
6/4/2013	V1189 - V1193	XXX	8	277.0	31	23	44	170.25	245,160
12/7/2015	v665 - v688	XXX	8	251.3	3	15	44	164.07	236,261
6/27/2016	HH1451 - HH1448	VCP	8	265.6	30	27	25	161.14	232,042
12/3/2015	v693 - v692	XXX	8	291.6	16	10	48	156.38	225,187
4/7/2017	HH1448 - HH1448	VCP	8	302.2	34	17	20	146.86	211,478
7/13/2017	T380	VCP	8	276.5	29	19	28	144.48	208,051
6/4/2013	V1195 - v1194	XXX	6	212.6	88	70	14	140.38	202,147
7/13/2017	T380 - T381	VCP	8	295.4	75	13	12	136.73	196,891
6/28/2016	HH1448 - HH1452	VCP	8	206.5	16	38	16	127.87	184,133
4/5/2017	HH0650 - HH0664	VCP	8	315.6	136	7	5	110.99	159,826
4/6/2017	HH1892 - HH1886	VCP	8	410.3	40	11	17	99.91	143,870
4/6/2017	HH1895 - HH1894	VCP	8	303.4	25	8	12	96.61	139,118
12/4/2015	v680 - v679	XXX	8	156.8	6	1	18	96.10	138,384
7/10/2017	T418 - T420	PP	8	446.4	50	7	2	92.50	133,200

**Critical Sewers®
Best Practice**



Reference Lists and Charts

The following information is provided as guidance to helpful references that may be used when studying for the Ohio EPA certification exams. Ohio EPA has used these references to assist in the development of exam questions. It is not essential to purchase each of these references in order to pass the examination.

Wastewater/Wastewater Collection

- Operation of Wastewater Treatment Plants, Manual of Practice - MOP #1, 6th Edition, 2002, California State University, Office of Water Programs, 6000 J. Street, Sacramento, California 95819-6025.
- Operation of Wastewater Treatment Plants - Volume I, 5th Edition, 2002, California State University, Office of Water Programs, 6000 J. Street, Sacramento, California 95819-6025.
- Operation of Wastewater Treatment Plants - Volume II, 6th Edition, 2003, California State University, Office of Water Programs, 6000 J. Street, Sacramento, California 95819-6025.
- Advanced Waste Treatment - Fourth Edition, 2002, California State University, Office of Water Programs, 6000 J. Street, Sacramento, California 95819-6025.
- Standard Methods for the Examination of Water and Wastewater - 20th Edition, 1998, American Public Works Association, American Water Works Association, Water Environment Federation, 6959 West Quincy Avenue, Denver, Colorado 80235.
- Recommended Standards for Wastewater Facilities - 1997 Edition, A Report of the Committee of the Great Lakes - Upper Mississippi River Board of State Public Health and Environmental Managers, Published by Health Research Inc., Health Education Service Division, P.O. Box 7128, Albany, NY, 12224.
- Operation and Maintenance of Wastewater Collection Systems - Vol. I, Fifth Edition, 2003, California State University, Office of Water Programs, 6000 J. Street, Sacramento, California 95819-6025.
- Operation and Maintenance of Wastewater Collection Systems - Vol. II, Fifth Edition, 2003, California State University, Office of Water Programs, 6000 J. Street, Sacramento, California 95819-6025.
- Ohio Revised Code and Ohio Administrative Code
- IS-22 "Are You Ready? An In-Depth Guide to Citizen Preparedness", FEMA, <http://www.training.fema.gov/Emit/050522.asp>



Operation and Maintenance of Wastewater Collection Systems – Vol. I, Fifth Edition, 2003, California State University, Office of Water Programs, 6000 J. Street, Sacramento, California 95819-6025.

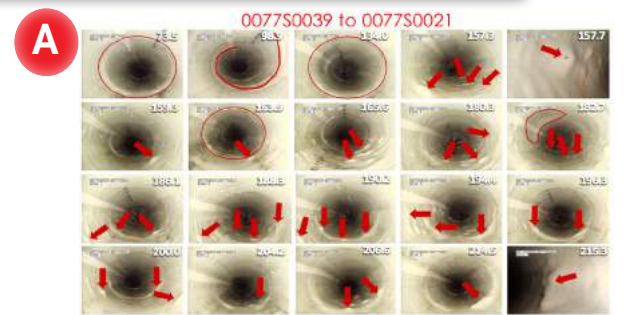
What They Have Been Missing

Ohio Pre- & Post-CIPP Assessments

A. Large Ohio City, Over 750,000 Population, Avg. 50,000LF Annually of CIPP

Mainline ID	Pipe Type	Diameter	Distance (ft)	Small	Medium	Large	GPM	GPD
0076S0357 - 0076S0013	CIPP ✓	8	227.80	7	1	8	85.22	122,717
0077S0039 - 0077S0021	CIPP ✓	8	222.50	5	1	3	29.09	41,890
0076S0404 - 0076S0405	CIPP ✗	10	302.04	9	0	1	12.20	17,568
0077S0002 - 0076S0403	CIPP ✗	10	212.97	13	0	0	3.78	5,443
0076S0403 - 0076S0404	CIPP ✗	10	246.58	3	0	0	1.17	1,685
0076S0405 - 0076S0406	CIPP ☆	10	212.17	1	0	0	0.17	245

PRE-ELECTRO SCAN CATEGORY
 ✓ Post-CIPP Internal Debate Over Issues
 ✗ Post-CIPP Liner Deficiencies
 ☆ Post-CIPP Approved by CCTV



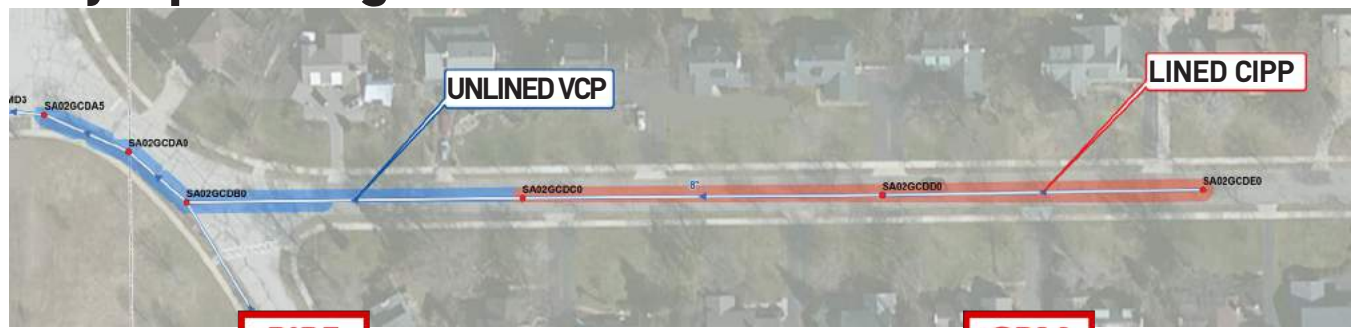
COMMENTS OVERHEAD FROM CIPP CONTRACTORS WATCHING FELL INSPECTION

“Everyone knows that pinholes are self-healing.”
 “We’ll have to double our prices if they don’t want liners that leak.”

B. Ohio Sewer Authority Operating Under EPA Consent Decree



Consulting engineers and local sewer agencies find new CIPP lines leaked more than unlined VCP sewer mains.



Date	Mainline ID	Pipe Type	Diameter	Distance (ft)	Small	Medium	Large	GPM	GPD
5/16/2017	SA16ADZC0 - SA16ADZB0	VCP *	8	152.4	20	23	31	112.76	162,374
	SA16ADZB0 - SA16ADZA0	VCP *	8	110.4	6	13	32	96.63	139,147
	SA02GCDE0 - SA02GCDD0	CIPP	8	262.6	1	1	7	70.88	102,067
	SA02GCDD0 - SA02GCDC0	CIPP	8	298.7	5	0	7	70.47	101,477
	SA02GCDC0 - SA02GCDB0	VCP	8	269.9	46	22	11	68.95	99,288
	SA02GCDB0 - SA02GCDA0	VCP	8	62.8	15	6	2	14.57	20,981

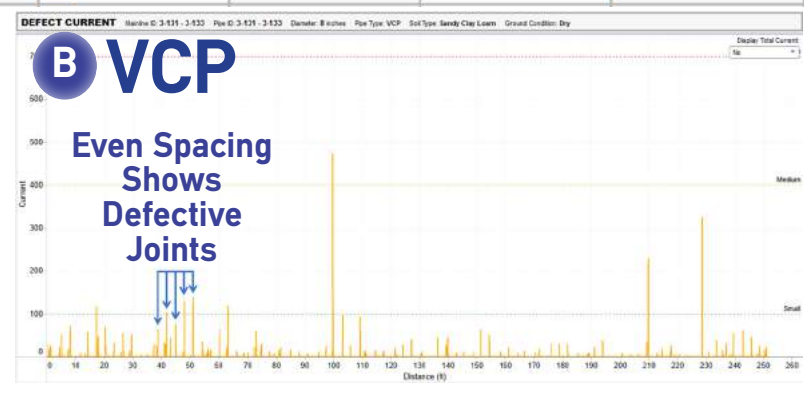
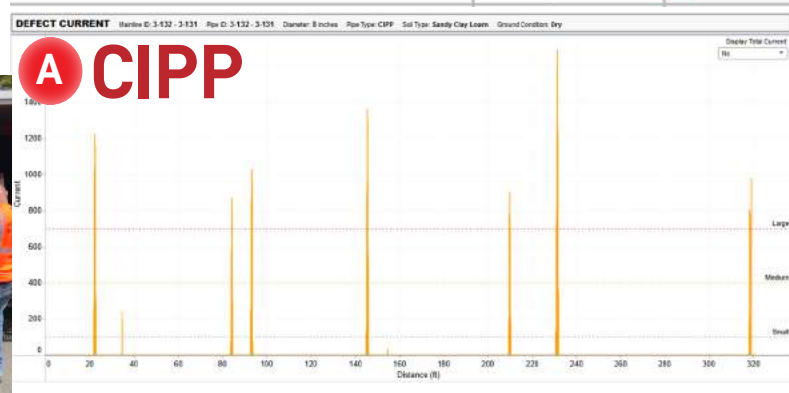
“Amazing that both the Pre- and Post-CIPP inspections using NASSCO CCTV Coding showed ZERO DEFECTS.”
 Chuck Hansen

C. Small Ohio City, Population Less Than 40,000

Scans	Footage	Total Defects	GPM	GPD
3	693	62	103.68	149,299

City finds CIPP from two different vendors were worse than the older VCP.

Pipe Type	Diameter	Distance (ft)	Small	Medium	Large	GPM	GPD
CIPP A	8	321.2	1	0	8	61.01	87,854
CIPP	8	120.7	38	4	2	40.15	57,816
VCP B	8	251.3	8	1	0	2.52	3,629



Repeatability Adds to Electro Scan's Unbiased & Unambiguous Method of Sewer Inspection

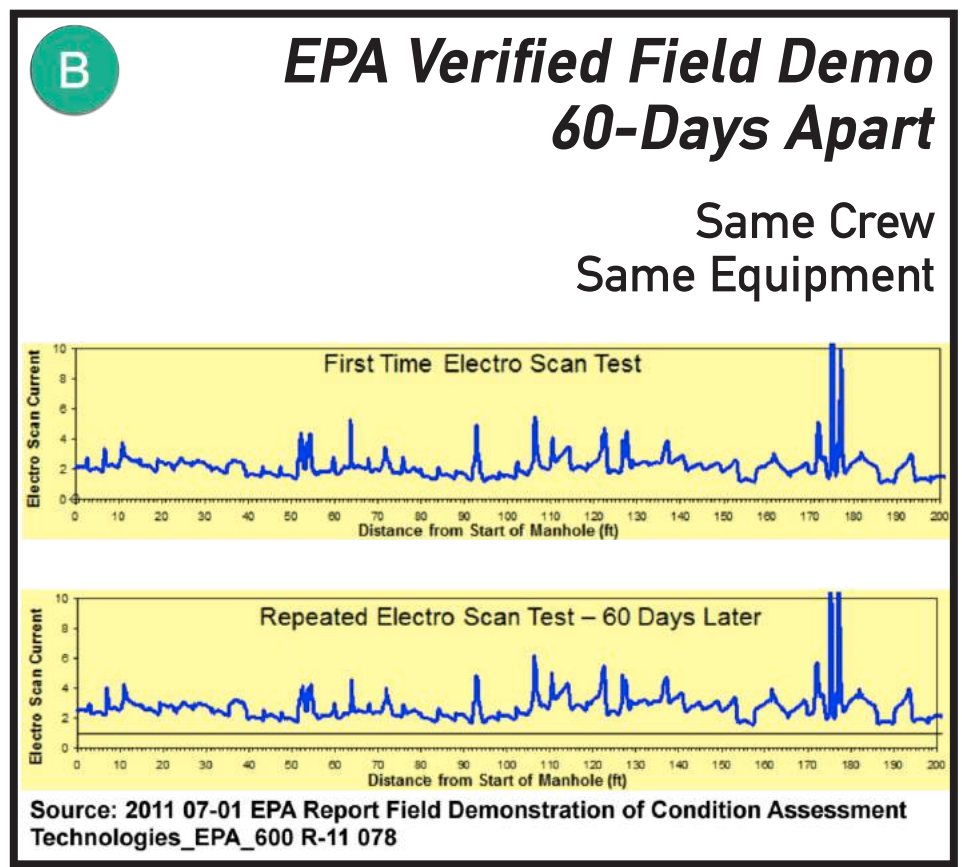
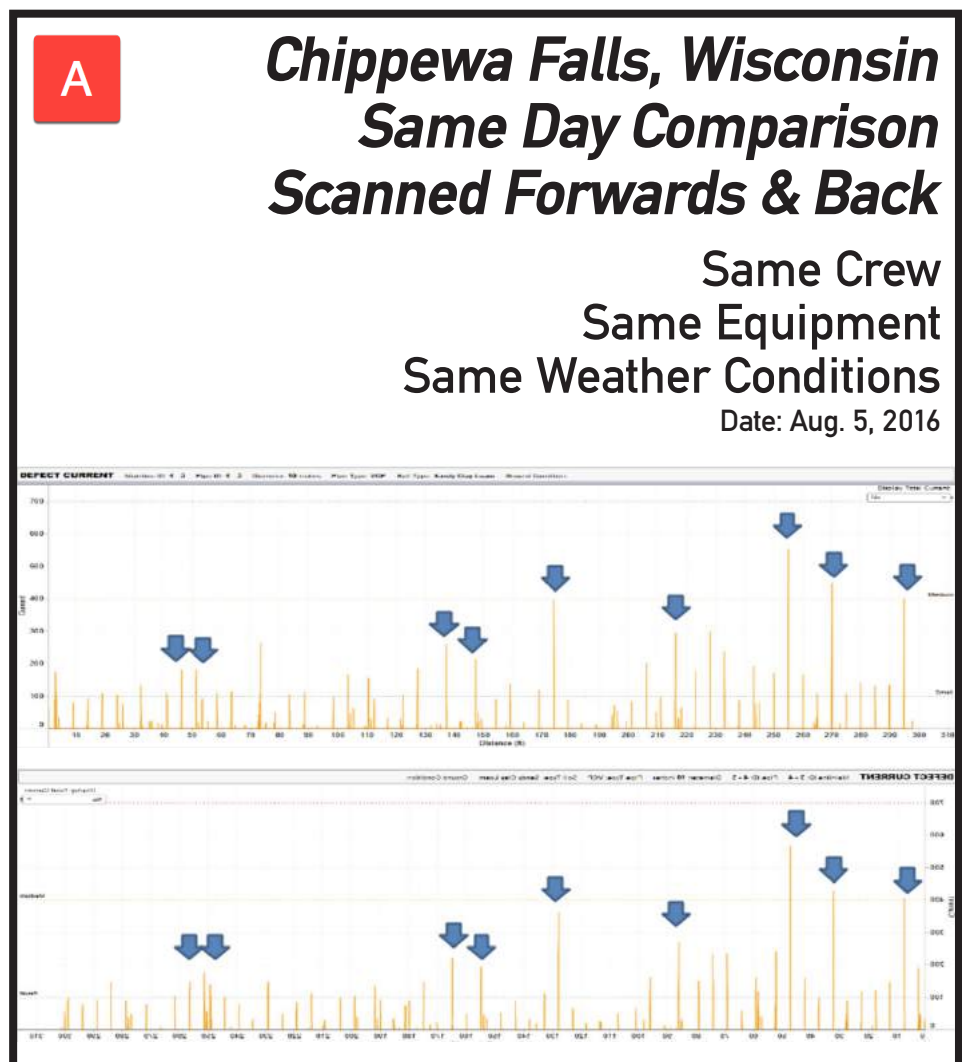
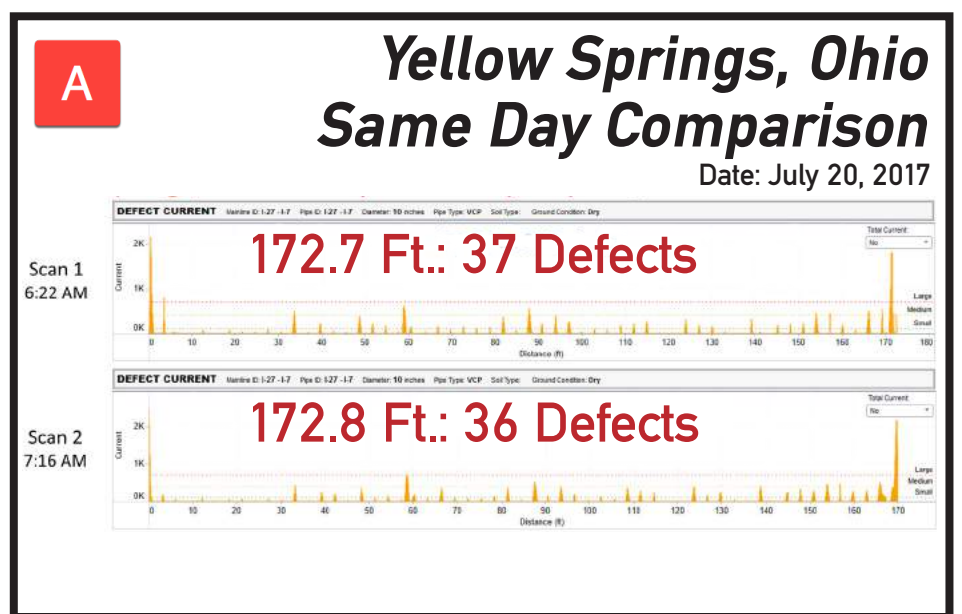
A major advantage of using Electro Scan is its repeatability, i.e. ability to repeatedly and consistently assess the same defect locations and defect flow rates, when scanning either forwards or backwards in a pipe.

reel manufacturers, different season, with readings taken 142-days apart).

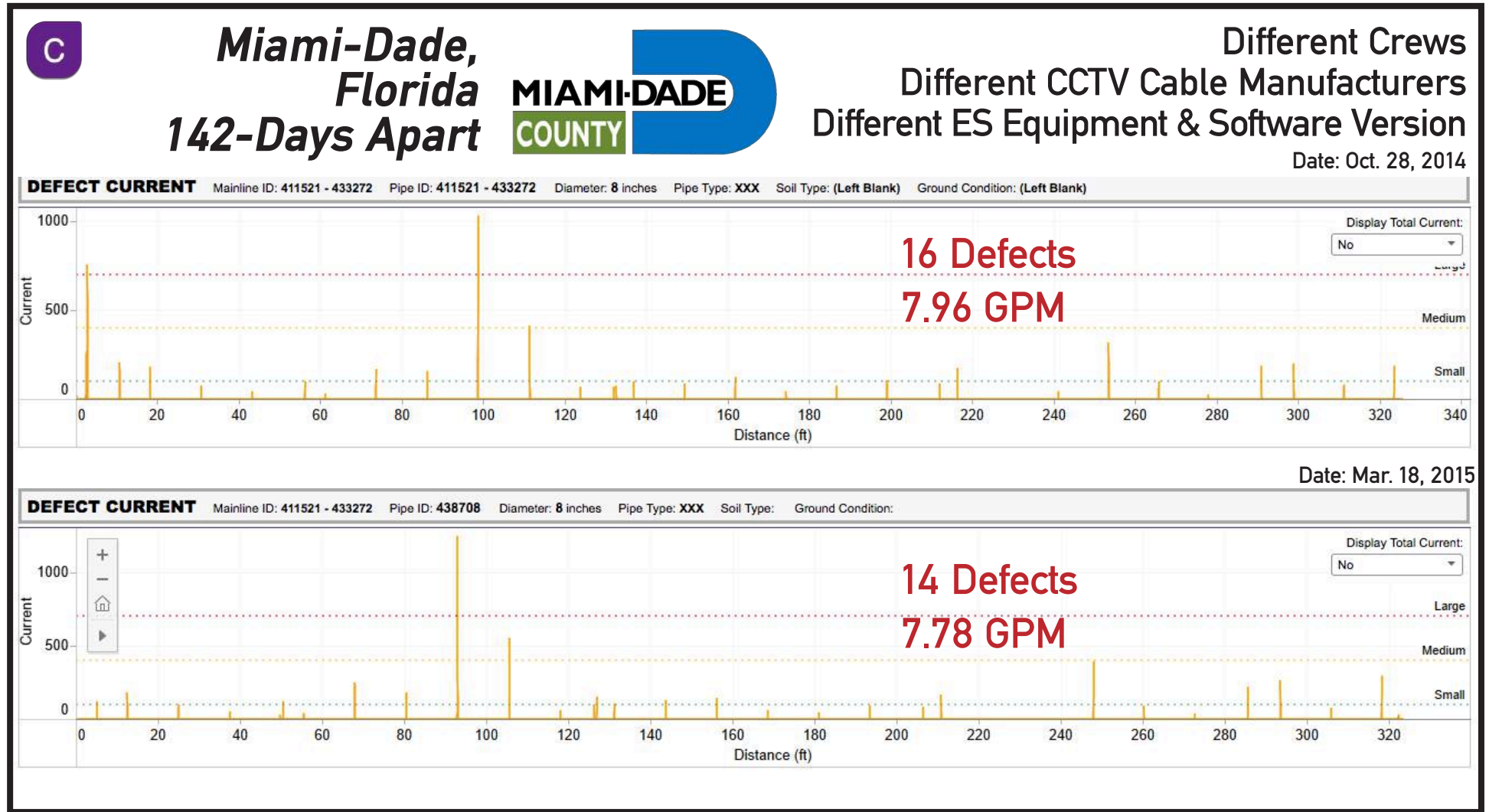
Rarely possible with visual inspection or other testing methods, achieving repeatability of test results is an important factor in utilizing multiple Electro Scan-equipped vans as part of larger assessment projects.

While repeatability testing has been independently tested by outside laboratories, field investigations confirm the same findings. Whether re-testing the same pipe on the Same Day **A** (i.e. same day, same crew, same equipment like), Sixty-Days Apart **B** (i.e. same crew, same equipment, with readings 60-days apart), or One Hundred Forty-Two Days Apart **C** (i.e. different crews, different equipment, different software versions, different cable &

Repeatability is also important when comparing Pre- & Post-CIPP liners where contractors may unintentionally over- or under-cut service reinstatements with high performance robotic cutters, only to create larger holes or pathways for water to enter or exit a pipe after CIPP, than were present before CIPP.



You Can Find Even More Individual Scans and Electro Scan Reports at <http://www.electroscan.com>



First Project in UAE Identifies Sources of Infiltration in Pre-Commissioned Pipes

Electro Scan Team Braves 100 Degree Heat & High Humidity to Train Aramoon Staff

Continued From Page 1

but when the tide is in, the pipes are full of water and the camera still cannot see anything.

This is why cities such as San Francisco and Ras Al Khaimah are turning to Electro Scanning Inspection, which uses water to surround its probe in order to locate and quantify all the leaks in the pipe using electrical current. Anywhere that electricity can escape, water can enter or exit the pipe as well.

Electro Scan Inc. was recently selected to complete a 16-Km (52,500-Ft) Focused Electrode Leak Location (FELL) Project in partnership with Riyadh, Saudi Arabia-based International Aramoon Co. Ltd (IAC).

Chuck Hansen (CEO), Mark Grabowski (VP), and Matt Campos (West Coast Field Operations) of Electro Scan spent a week in the U.A.E. training Aramoon operators on the use of Electro Scanning Inspection.

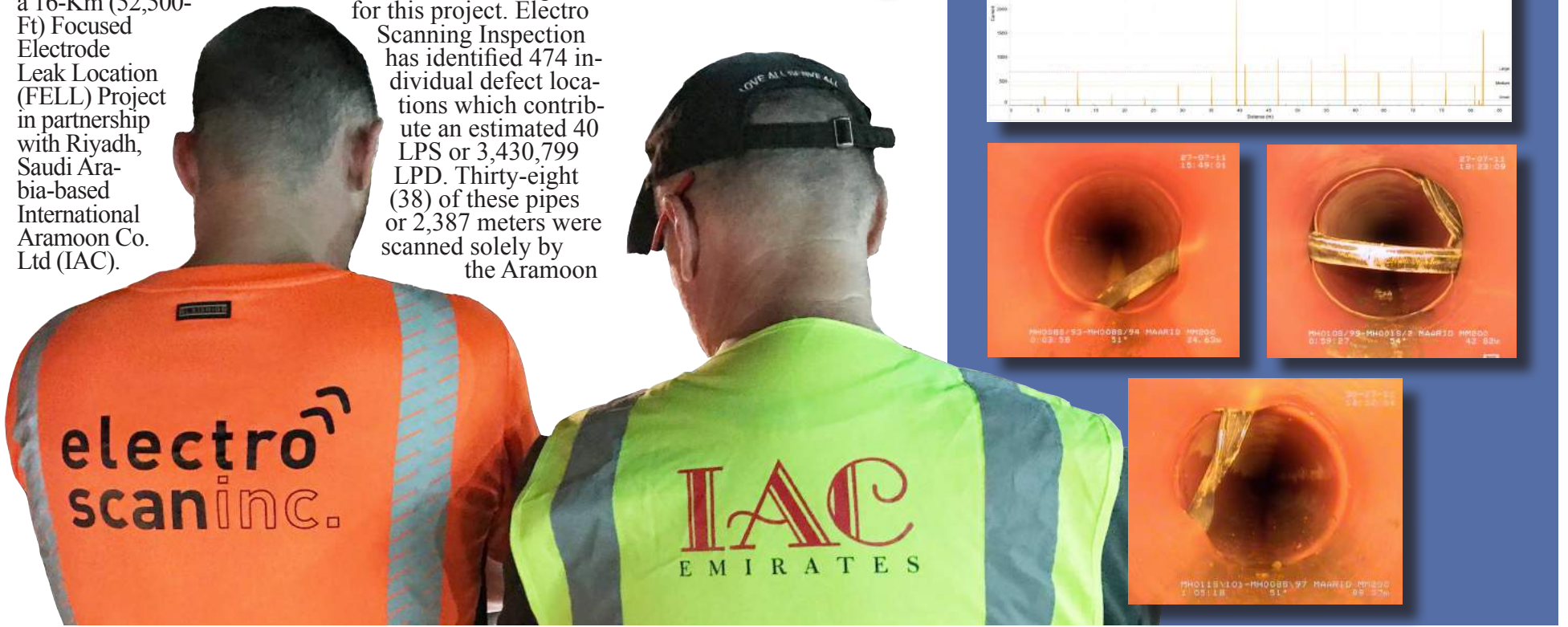
With daytime temperatures reaching 110 to 120 degrees Fahrenheit, all inspections had to take place in the night when temperatures cooled off enough to work outside.

To date, a total of 68 polyvinyl chloride (PVC) pipe segments or 4,446 meters have been inspected for this project. Electro Scanning Inspection has identified 474 individual defect locations which contribute an estimated 40 LPS or 3,430,799 LPD. Thirty-eight (38) of these pipes or 2,387 meters were scanned solely by the Aramoon

operators, who are now certified in Electro Scanning Inspection.

Thus far, the ten (10) worst pipes, despite making up only 17% of the linear footage, contain 31% of the defects and contribute 51% of the estimated infiltration.

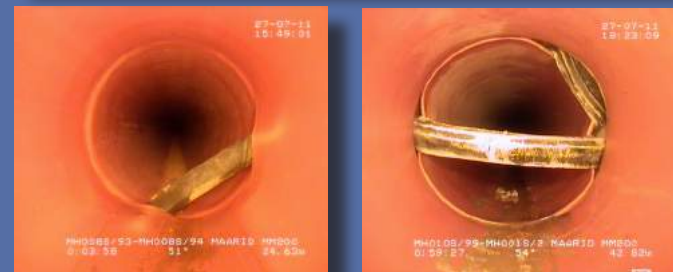
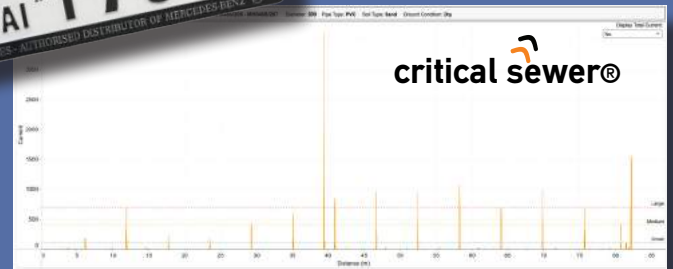
Thank you to Aramoon's Management, Operators, and the people of Ras Al Khaimah for their hospitality. We look forward to many more successful projects!



SAMPLE FOCUSED ELECTRODE LEAK LOCATION

DIAMETER & DISTANCE		OPERATOR INFO	
200		Aramoon Pipe Inspection	
82		Project	
0 20 40 60 80		West Trunk Main Mairid Network	
		Job	
		area 3 inactive wast water network	
		Atmospheric Test	Scan Start
		8/14/2017 12:14:31 AM	8/14/2017 1:23:39 AM

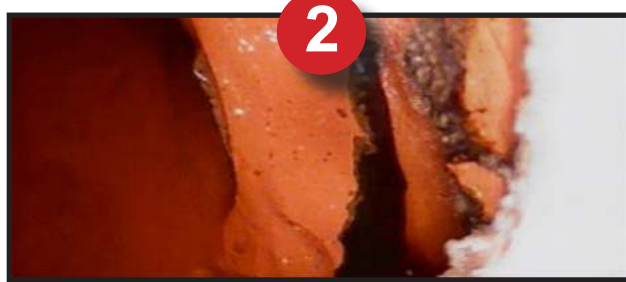
% OF DEFECT LENGTHS		LPS SUMMARY	
0.00210	Minor	0.15	
0.00580	Moderate	1.22	
	Severe	1.16	
	Total LPS	2.52	
	LPD	218,040	
	LPD IDM	213,964	
	Minor %	5.79%	
	Moderate %	47.53%	
	Severe %	46.67%	



Common CIPP Defects Not Quantified or Recorded By CCTV



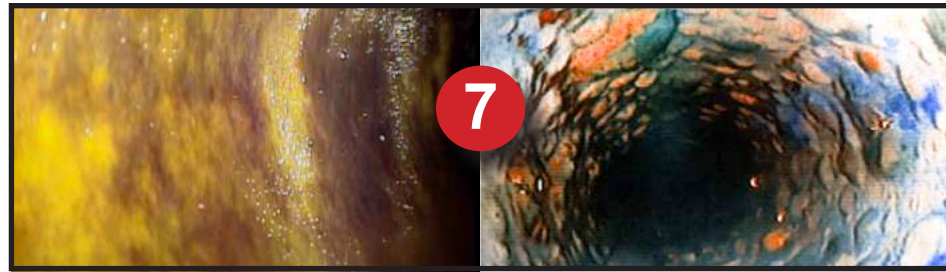
1. Post-CIPP, Bad Service Reconnection.



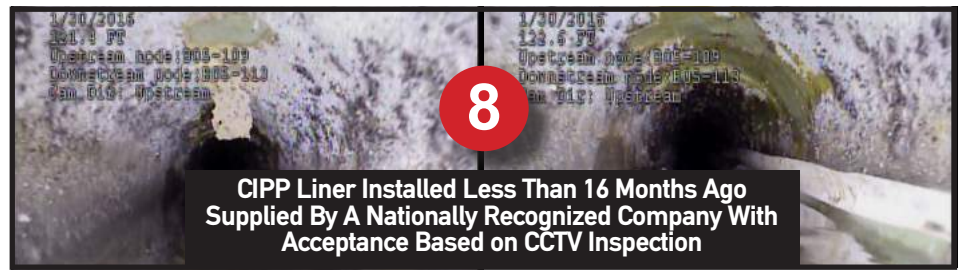
2. Post-CIPP, Bad Service Reconnection. Infiltration.



3. Wrinkles. They May Leak!



7. Accelerant Burns, Called Out As 'Discolored' But Actually Leak Water



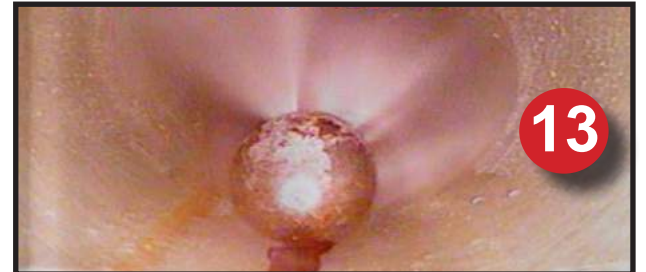
8. Bad Resin



11. Defective/ Porous/ Weak Liner



12. Overcooked Liner



13. Unreported Contractor Equipment Damage



17. Defective Epoxy



18. Mis-Reported Bad Reconnection. Same Leak, 4 years running.



19. Annular Space

TOP 12 REASONS To Update Your CIPP Specifications

1 Defects in CIPP Are Prevalent Nationwide, and Found to be Missed by Visual Inspection.

Widespread defects are being found nationwide in Cured-In-Place Pipe (CIPP) lining projects that are not being identified by visual inspection. If cities or counties publish CIPP specifications utilizing F1216-16, which uses older inspection standards for visual inspection or closed-circuit television (CCTV) inspection to certify their projects, they eliminate the ability to reject lining work as part of their negotiated warranty period where unseen leaks occur. As a result, FOCUSED ELECTRODE LEAK LOCATION (FELL), also known as LOW VOLTAGE CONDUCTIVITY or ELECTRO SCANNING INSPECTION, is now the recommended published standard by federal, state, and international environmental agencies to certify and accept CIPP.

2 Lower Resin-to-Felt Mixtures Sometime Used When Only Visual Inspection Is Required.

CIPP vendors have reportedly supplied lining projects using lower resin-to-felt and catalyst ratios when a city or county limits their CIPP acceptance standard to visual inspection or CCTV inspection. In contrast, a higher resin-to-felt and catalyst ratios are used when FELL, Low Voltage Conductivity, or Electro Scanning Inspection is required as part of CIPP or rehabilitation bid specifications.

3 ASTM F2550 Standard Developed Specifically to Address CIPP Quality Issues.

In 2013, ASTM published ASTM F2550-13, *Standard Practice for Locating Leaks in Sewer Pipes by Measuring the Variation of Electric Current Flow Through the Pipe Wall*, where Section 8.5.1 states that "It is recommended that separate scanning tests be taken before and after any pipe repair, relining, or renewal activity to compare electrode current values, and for closed-circuit television (CCTV) video to re-examine pipes to determine if any visual defects were missed or not recorded during initial examination."

4 Contrary to What CIPP Contractors Might Say Pinholes Are Not 'Self-Healing' Anomalies.

"I've heard that one before," a consulting engineer, who deals with high flows in a Post-CIPP sewer, recently said. Not easily identified by visual inspection, pinholes occur when curing has been uneven or incomplete, and in some cases result from accidental cuts or from bad lateral reinstatements.

5 U.S. EPA's CMOM Program's Adoption of the Wastewater O&M Manual Volume 1&2.

Electro Scanning Inspection was added to the *Seventh Edition, Volume 1, Operation and Maintenance of Wastewater Collection Systems Manual*, ISBN 978-1-59371-066-8, and referenced by the U.S. EPA's Collection Systems *Capacity, Management, Operation, and Maintenance* (CMOM) Program, superseding the use of CCTV inspection, for pre- and post-rehabilitation assessment.

6 NASSCO CCTV Codes Superseded by Electro Scan Standard for Pre- & Post-Rehabilitation.

Many cities and counties have traditionally utilized NASSCO CCTV codes to visually inspect the inside surfaces of pipes. Developed by British-based WRc plc (Swindon, England), the use of visual inspection for repairs, relining, and renewal projects has been replaced in the UK by low voltage conductivity technologies offered by California-based Electro Scan Inc. for all pre- and post-rehabilitation assessment.

7 Sewer Main Leakage Can Be Worse AFTER CIPP, Than BEFORE CIPP.

Just as CCTV is unable to identify defects after lining, new standards help identify Post-CIPP sewer mains that have greater leakage rates AFTER CIPP, than BEFORE CIPP. The biggest source of larger leaks is due to Contractors over-cutting pipes when reinstating laterals. Smoothly connected taps before lining, can be broken as part of remote tap cutting to open lateral connections, and not even discovered by CCTV.

8 State EPAs Are Adopting New Standards to Test and Inspect CIPP.

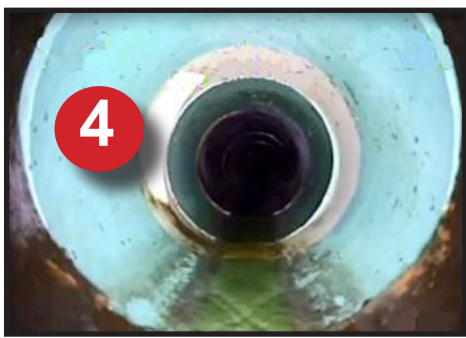
State environmental protection agencies are adopting the *Seventh Edition, Volume 1, O&M Manual* as "Best Practice" guidelines. Over 30 states are adopting *Volume 1 & 2 of the O&M of Wastewater Collection Systems* as their primary training resources for wastewater operators; Electro Scanning Inspection is a primary resource for Sanitary Sewer Overflow (SSO) Reduction.

9 AWWA M77 Condition Assessment of Water Mains References 'Low Voltage Conductivity' to Assess CIPP.

In 2016, the American Water Works Association (AWWA) M77 Committee on Condition Assessment of Water Mains circulated a first edition draft standard of practice. Scheduled for publication in 2017 or early 2018, Chapter 7 Leak Detection, identifies a single technology able to accurately assess leak locations and estimate defect flow rates in gallons per minute (GPM) in cured-in-place pipe: **Low Voltage Conductivity!**

10 FELL or Low Voltage Conductivity Is Recommended Prior to Any Warranty Expirations

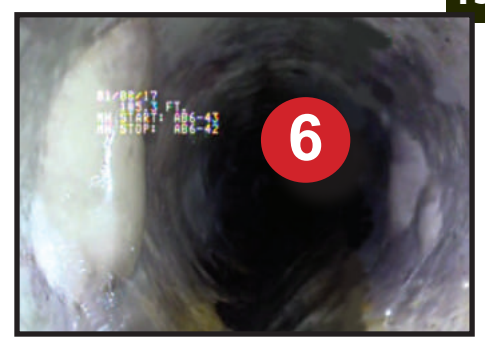
In addition to evaluating CIPP immediately after curing so that contractors may fix, repair, or replace their liner, it is important to survey all CIPP liners before warranty expirations, recommended to be a minimum of five years. Poor CIPP installations may show greater signs of deterioration after two or more wet weather events, and particularly at pinhole leaks and bad service reconnections.



4. Bad Sectional Spot Repair



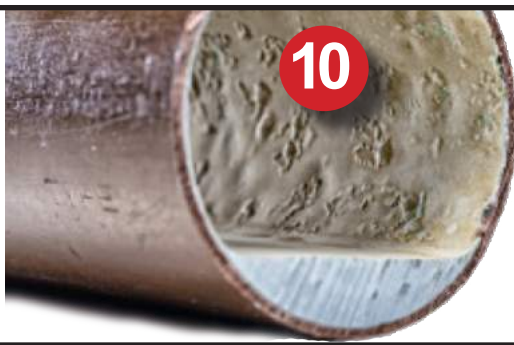
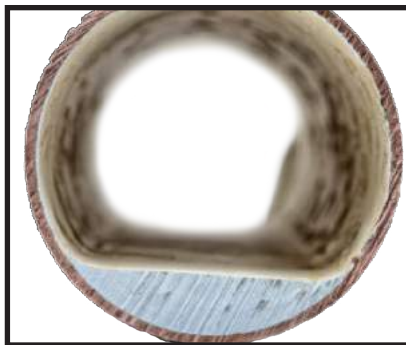
5. Infiltration Spotting and Staining



6. Bulges



9. Missed Lateral Reinstatement



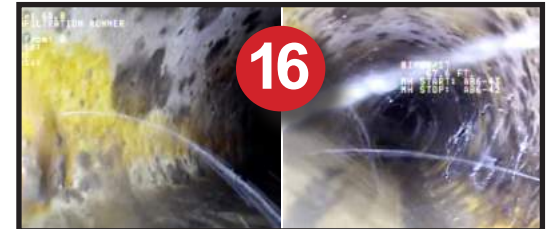
10. Bad Epoxy Lining



14. Sag In Liner



15. Defective Top-Hats



16. Pinhole Leaks



20. Infestation



21. Post-CIPP Misaligned / Open Joint



22. Blistering



11 Marginal CIPP Suppliers & Contractors That Contact Other Vendors to 'Boycott' New Guidelines Show The Effectiveness of New Inspection Standards. They Work!

Can you believe it? Some of the nations largest CIPP suppliers have contacted regional competitors to "boycott" new inspection standards! Better standards must be a good thing, especially if CIPP companies, unable to pass new testing standards for pipeline water tightness, don't bid on your project. Municipal sewer departments and utilities have long suspected poor liner quality, but only had visual inspection to base their claims, easily rebuked by the CIPP contractor.

12 Chemical Emissions Found in CIPP Lining Installations Have Accelerated the Need to Update Existing Specifications.

The failure of national associations and consulting engineers to warn members about available studies that exhibited how CIPP installation emissions could be a safety hazard has caused a shift in industry trust. Municipal agencies looking for guidance are encouraged to reach out to unbiased, independent educational and international thought leaders, such as Purdue University, Louisiana Technological University, WRc (England), IKT (Germany), etc. to adopt new standards to protect workers and the general public from harmful chemical emissions from the installation of CIPP.

Do You Have Your Own Reasons for Upgrading Your CIPP Specification?



Share Your Stories With Us So We Can Help Other Cities.



We'll keep your identity secret, but make sure others hear your story!


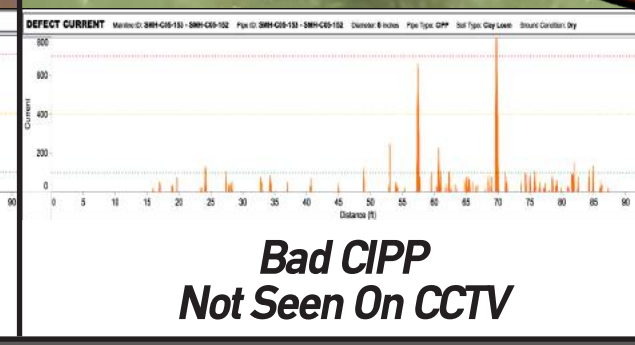
Don't Keep Using CCTV to Accept CIPP Projects

BEFORE



Pre-Rehabilitation Assessment

NEXT DAY

Bad CIPP Not Seen On CCTV

16 MONTHS

Find Defects Before Your Warranty Expires!

NOT SEEN ON CCTV

Electro Scan Pulls Up In Style At AWWA's Weeklong Annual Conference & Exposition

In The City of Brotherly Love, Convention Attendees Flock To Visit "Philadelphia's Most Popular Hydrant" While Learning The Latest on Electro Scan Leak Detection



The American Water Works Association's 2017 Annual Conference & Exposition (ACE 17) made a splash in Philadelphia, June 11-14, by showcasing more than 450 exhibitors from around the world.

As one of the supporting sponsors of the event, Electro Scan Inc. set up shop in the Pennsylvania Convention Center and then invited attendees to try out "the most popular fire hydrant in Philadelphia," as Director of Marketing Carissa Boudwin called the new hydrant-shaped beer tap.

On June 12, Chuck Hansen, Chairman of Electro Scan Inc., broke off from the action to host a session entitled *Assessing Water Loss in Plastic Pipe in Water Distribution and Transmission Systems*.



Chuck Hansen, Chairman of Electro Scan, Inc., Presents at ACE 17.



FELL Inspection Can Certify CIPP Lined Water Mains Defects typically missed by visual inspection picked up through electric leaks

Defects in water mains using Cured-In-Place Pipe lining typically go unnoticed by visual inspection and pressure testing.

While both ASTM F1216 (2016) and F1743 (2017) recommend visual inspection of CIPP, newer methods have been welcomed into the industry as standards of practice.

As seen in ASTM F2550 (2013), Electro Scanning Inspection or Low Voltage Conductivity, has been more

frequently cited to find defects previously missed by CCTV inspection.

The AWWA Manual M77 Water Main Condition Assessment, Standards of Practice also indicates that only Low Voltage Conductivity is able to assess CIPP lining for water tightness.

As a result, Electro Scan Inspection should be an integral part of any water main lining project specification.

Condition Assessment of Water Mains

Chapter 7 **Leak Detection** AWWA Manual M77 First Edition

Low-voltage conductivity testing. Low-voltage conductivity testing (also referred to in other manuals and standards as "focused electrode leak locating") is the process by which leaks are identified and quantified within non-conductive pipes, using a focused electrical current. It is an in-pipe, tethered inspection method, and uses the fluid within the pipe to analyze the pipe walls for leaks. At the locations where the fluid leaks out, the current will leak out, and using the earth as an electrical return path, the technology will record the leak and estimate its leakage potential.

Patent-Pending 4-in-1 Solution

- Conductivity Sensor
- HD CCTV Camera
- Pressure Sensor
- Acoustic Hydrophone

Unmatched Data For Decision Support

Budget for Services Call for Sample Specifications

Machine-Intelligent Leak Detection Automatically Measures Results In Gallons Per Minute.

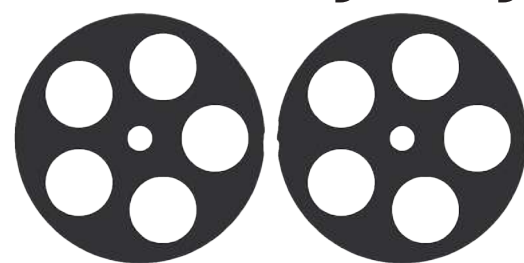
Come Check Us Out at WEFTEC in The Windy City



From September 30 to October 4, WEFTEC will take over Chicago, IL!

Electro Scan is delighted to present or be represented in the following technical sessions:

- *SFPUC's Use of Innovative Technology to Reduce Salt Water Intrusion* by Chuck Hansen & Jamie Johnson, Oct. 3rd during Session 317 - Room S403b.
- *The City of Racine Utilizes New Inspection Technology to Measure Flow Reductions Before and After Rehabilitation* by John C. Rooney, P.E., City of Racine, & Paul Pasko, P.E., SEH Inc., Oct. 4th during Session 610 - Room N426a.



Don't forget to visit Session 329 IKE on Oct. 3 in Room S402a to watch Electro Scan's video entry!



**Booth #7734,
Where the Beer
Flows Daily!**



Carissa Boudwin & Jamie Johnson at WEFTEC 2015



Setting up the Booth at WEFTEC 2016



Crowds rush in for WEFTEC 2015

Chicago: Get Ready to 'Bring The Funk' to Jammin' 4 Water!

Jammin' 4 Water 2017
all night PARTY
Sept. 30, 2017 | 6PM-1AM
Park West, Chicago, IL
322 W Armitage Ave
www.Jammin4Water.org

Looking to dance the night away before WEFTEC? We have the place for you.

This year's Jammin' 4 Water is expected to host more than 1,000 WEFTEC attendees and showcase performers on two stages.

In addition to witnessing highly entertaining performances given by water-quality professionals, spectators have the chance to donate to and support a variety of Water-Focused charities.

Electro Scan, Inc. will also participate yet again in the now five-year-old tradition as a Diamond Level Sponsor.

For tickets, visit at www.Jammin4Water.org.



Electro Scan Sets Up Shop At The American Gas Association's Exhibition

On May 2 & 3, Electro Scan was stationed, along with NED (Never-Ending Demo featured below) at the 2017 American Gas Association Operations Conference & Biennial Exhibition.

from across North America and the world.

Over 900 operations managers regularly attend as well as 150 speakers.

This conference, located in Kissimmee, FL, is considered the natural gas industry's premier gathering of natural gas utility management

Electro Scan had the great fortune of being one of the 260 vendors in the Biennial Exhibition and looks forward to venturing further into the natural gas industry.



Where to See Us

September 25-27, 2017 in Richmond, BC
Trenchless Technology Road Show



Presentation: "The Advantages and Disadvantages of CCTV Inspection of Water Distribution Mains"
By Chuck Hansen on Sept. 26 at 2pm, Session 5

Booth #107



October 23-26 in Reno, NV
AWWA CA-NV Fall Conference

Partner Sponsor
Electro Scan Leak Detection Reception
Drinks & Appetizers on Monday, October 23rd at 5:30pm

Booth #402

October 30- November 2, 2017 in Houston, TX
AWWA Water Infrastructure Conference



Presentation: "Comparing Acoustic Sensor and Low Voltage Technology in Plastic Pipes"
By Chuck Hansen on Nov. 26 at 11am, Session WED5

Booth #102



December 3-5, 2017 in San Diego, CA
NAWL Conference (Platinum Sponsor)

Presentation: "Assessing Water Loss in Plastic Pipes in Water Distribution & Transmission Systems"
By Chuck Hansen on Dec. 5 at 7:35am, Session 17

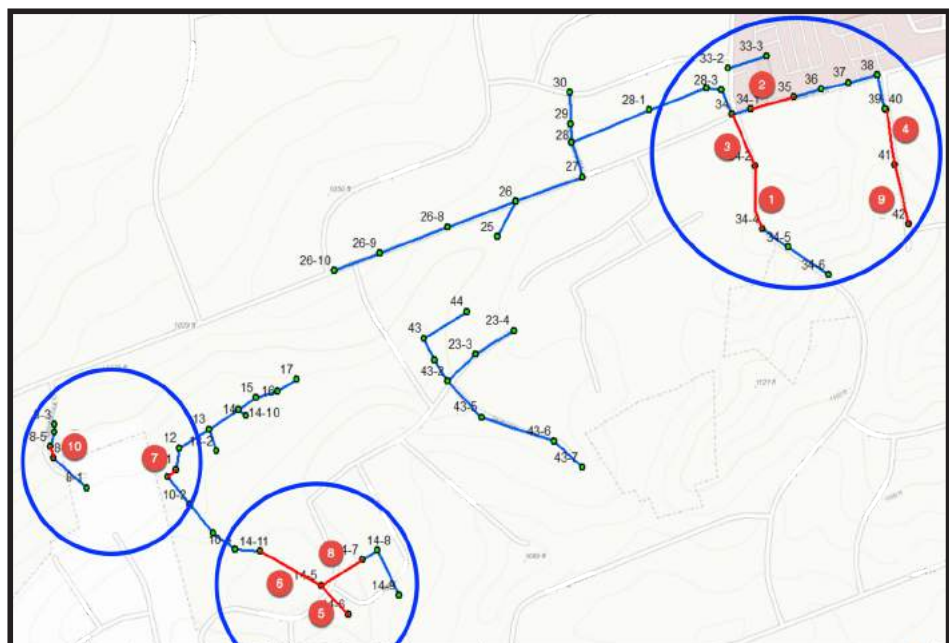
Booth #502 & 503

10 of 53 Sewer Mains Contribute 94% of Defect Flow in Eastern Tennessee Utilities Project



	# of Pipes	% of Total Footage	Pipe Length	Defect Flow			
				Total Defect Locations	GPM	GPD	% of Total
Top Ten Worst Sewers	10	22.5%	2,167	55	105.11	151,358	94%
Other Sewer Mains	11	23.5%	2,264	18	7.10	10,224	6%
Sewer Mains with 'ZERO DEFECT FLOW'	32	54%	5,188	0	0	0	0%
TOTAL	53	100%	9,619	73	112.21	161,582	100%

TOP TEN WORST SEWER MAINS RANKED BY GALLON PER MINUTE OF DEFECT FLOW



In 2012, a Utility Board in Eastern Tennessee performed a rehabilitation and replacement project, which did not result in the reduction in Infiltration and Inflow (I/I) that the Utility Board had hoped to see – a problem facing many utilities.

The Utility Board was familiar with Electro Scan, a leak detection technology for water and sewer pipes, after having seen a demonstration in the spring of 2016 and wanted to determine if this innovative technology could identify areas that the previous rehabilitation project had missed.

This led to the Sewer Electro Scanning Inspection Pilot 660. This project was performed by Compliance EnviroSystems, LLC in conjunction with Electro Scan Inc. over the course of four days – January 24-27. A total of 55 sewer mains were inspected for a total of 9,828 linear feet. However, it was discovered that two pipe materials were mislabeled and were, in fact, Ductile Iron. Since Electro Scan is not recommended for metal pipes, these two pipes were removed from the total. After the adjust-

ment, a new total of 53 sewer mains were inspected for a total of 9,619 linear feet. Electro Scan identified 73 defects which contribute an estimated 112.21 Gallons Per Minute, or 161,582 Gallons Per Day of potential defect flow.

In addition to a previous rehabilitation and replacement project taking place near by, it was discovered that the sewers in this area ultimately flow to a neighboring utility where the flow is metered. This means that there is a permanent meter in a location with few mains upstream, which is rare in the Utility Board's system. The hope is to complete an additional rehabilitation project based on Electro Scan's findings and see a reduction in the flow measurements.

The worst ten (10) sewers or 2,167 linear feet make up 94% of the estimated defect flow while eleven (11) sewers or 2,597 linear feet provide 6% of the estimated defect flow.

However, thirty-two (32) Sewers or 5,188 LF had ZERO DEFECT FLOW.



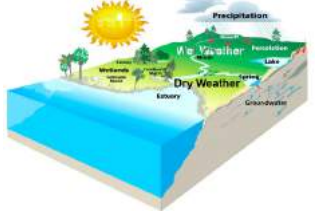
	IPID	UPS	DWN	Install/Date	Diameter	Material	Liner Type	Liner Install Date	Pipe Length
1	1041578	34-4	34-2	10/29/1990	8	PVC	CIPP	3/27/2012	300.0
2	40920054	35	34-1	1/1/1900	8	CIPP	CIPP	3/27/2012	216.3
3	40920062	34-2	34	10/29/1990	8	CIPP	CIPP		265.6
4	1041600	41	40	12/8/1978	8	PVC	None		261.4
5	40942135	14-6	14-5	7/1/1981	8	CIPP	CIPP	7/1/1991	189.9
6	1042160	14-5	14-11	7/1/1981	8	PVC	None		336.2
7	40162192	12-1	10-1	10/2/2009	12	PVC	None		50.8
8	40942136	14-7	14-5	7/1/1991	8	CIPP	CIPP	7/6/2010	231.1
9	1041601	42	41	12/8/1978	8	PVC	None		281.9
10	20461201	8-5	8-2	10/29/2008	8	PVC	None		54.9

ELECTRO SCANNING INSPECTION													
Electro Scan Survey Date	Electro Scan Length	Defect Locations				Defect Flow							
		Small	Medium	Large	Total	GPM	GPD	Cumulative Amount	Cumulative %				
1/25/2017	295.8	11	1	3	15	37.40	53,856	53,856	33.3%				
1/26/2017	210.4	11	1	1	13	14.09	20,290	74,146	45.9%				
1/26/2017	261.4	1	0	1	2	10.30	14,832	88,978	55.1%				
1/25/2017	260.8	1	0	1	2	10.18	14,659	103,637	64.1%				
1/24/2017	195.0	2	0	0	2	10.12	14,573	118,210	73.2%				
1/24/2017	333.1	13	0	0	13	7.50	10,800	129,010	79.8%				
1/25/2017	45.6	1	0	1	2	4.66	6,710	135,720	84.0%				
1/24/2017	233.0	1	0	1	2	3.87	5,573	141,293	87.4%				
1/25/2017	276.5	2	0	0	2	3.56	5,126	146,419	90.6%				
1/25/2017	55.8	1	1	0	2	3.43	4,939	151,358	93.7%				

Smart Cities Limit Use of CCTV Due to Major Drawbacks

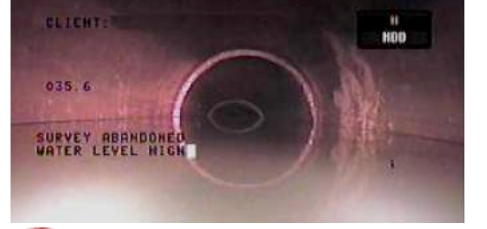
1 Reliance on Dry Weather Pipes

A key reason for curtailing CCTV inspection is that it is primarily used during dry weather conditions – when pipes are less likely to leak.



2 Pipe Half Full or Half Empty?

TV cameras are not effective in full or half-full pipes, missing any defects below the waterline.



3 Fats, Oil, and Grease (FOG)

While grease is a frequent call out for certified TV operators, it often disguises structural problems that may only be assessed if the pipe is thoroughly cleaned.



4 Roots

Representing a clear pathway between the inside of a pipe and surrounding ground, roots are an obvious potential source of infiltration, yet national coding standards recommend that operators rate the level of roots, and not identify or measure the potential defect flow resulting from roots.



5 Encrustations

Often referred to as self-healing defects – at last check, encrustations are still not an approved rehab method – encrustations can harden and cover-up cracks and fissures to the point of passing some pressure tests; but its non-conductive feature can still be positively passed through to determine the location and size of a potential defect flow.

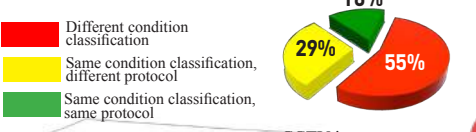


6 Same Code, Different Defects

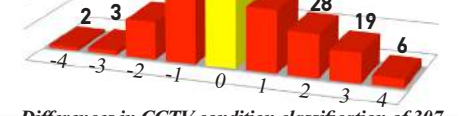
A corollary for using different codes indicating the same defect, is finding that TV operators frequently use the same codes to describe different defects. As confirmed in the EPA/WERF sponsored study in Milwaukee, Wisconsin, it was found that certified TV operators frequently used the same code for widely different defects, creating highly questionable Overall Pipe Rating Index (OPRI) metrics frequently used to determine rehabilitation priorities.

7 Different Codes, Same Defect

It is unfortunate, but true: train and certify two TV operators on the same day, using the same course instructor, utilizing the same materials (i.e. videos, photographs, etc.), test both using the same video, and you may get completely different interpretations of defects, not to mention a different number of defects. It's human nature and has been studied extensively, as shown below.



Studies confirm that CCTV is not reliable. In a 2006 study of parallel TV inspections of 307 sewer mains, only 49 or 16% of participants had the same condition assessment classification.



Differences in CCTV condition classification of 307 sewer reaches after parallel inspections (Müller, 2006).

The introduction of Electro Scan has not only shed light on defects not found by television inspection, but also highlights why CCTV inspection is not recommended to certify post-CIPP rehabilitation.

8 Can't Record What You Don't See

CCTV is not good at assessing the condition of pipe joints, primarily due to the basic design of joints. No matter how close an operator zooms into the surface of a joint, there is no possible way to assess the integrity or remaining useful life of the mortar. That is, unless pressure testing the joint or using Electro Scan.



9 Silt

Silt is a dangerous thing to find in a sewer as it oftentimes represents the liquefaction of bedding surrounding a pipe that may indicate the early start of a void – a warning to all sewer utilities that have an over-reliance on vac trucks to routinely remove silt. But while TV cameras cannot see through silt on the bottom of a pipe, Electro Scan can. When wet, silt is a conductive material, allowing Electro Scan's low voltage current to go right through silt to find defects where leaks can occur.



10 Clean v. Dirty Pipe Assessments

In 2010, the EPA arranged a benchmark in Kansas City, MO to compare Electro Scan and CCTV. While Electro Scan found 40% more defects and selected critical pipes that were rated in good condition by a nationally certified CCTV operator, comparisons were also evaluated on whether the pipe had been cleaned or not, prior to evaluation. While cleaning may eliminate fats, oils, and grease, roots, debris, and silt, it also eliminates key evidence of water leaks. As a result, TV inspections in the study did find fewer defects after cleaning, as clues to locating leaks were removed, and therefore more difficult to see with a camera.



11 Cracks

Unfortunately, CCTV cameras are not able to tell the difference between a superficial surface crack and a crack that goes completely through the pipe wall. Too often, cracks are blamed for the infiltration, when in reality, the unsealed joint, a few inches away has a larger leak potential.



12 'Favorite' Code, Different Defects

Some operators often use 'favorite' codes that may or may not relate to the same or different defects.

Code	Defect Description	Frequency
1	Crack	15
2	Blockage	10
3	Roots	8
4	Grease	12
5	Structural	5
6	Other	3

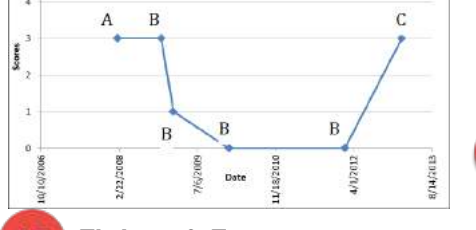
13 Different Codes, Same Operator

Not including data entry, CCTV operators may enter different observations on the same sewer main.



14 Repeatability

Recent studies suggest that certified TV operators are often unable to repeat the same CCTV observations, when evaluating the same pipe at different times – undermining development of an accurate visual assessment of sewer mains.



15 Fittings & Ferncos

CCTV cameras do not have the ability to test or validate the water tightness of fittings or Ferncos often used in VCP pipes, and located outside the pipe. The subject of an open trench smoke testing benchmark, Electro Scan accurately found defective ferncos (shown below), missed after repeated CCTV inspections.



16 Dark-Colored Pipe

Darkened pipe walls not only mask visual signs of defects, but dark colors typically absorb a camera's lighting, further reducing the chance of a proper inspection. Ductile iron pipe, polyethylene, and high density polyethylene pipes are just some of the materials that may have darkened surfaces that are difficult to observe and assess.



17 Point Repairs

CCTV is not a reliable tool to certify point or spot repairs. Whether completed with a trenchless or open-cut method, CCTV is not able to see if newly-created seams are watertight.



18 Pre-Rehabilitation Selection

Too often, a rehabilitation program is deemed "unsuccessful" when flows are not reduced. Unfortunately, since CCTV cameras cannot properly assess pipes for leakage potential, TV programs should not be used to rank or prioritize needed repairs, rehabilitation, or renewals.

CIPRI Grading	Structural Performance Grade (SPG)	Pipe Failure
3	Immediate Attention	Collapses or collapses imminent. Pipe may fail or will likely fail within the next 5 years.
4	Poor	Collapses likely in foreseeable future. Pipe will probably fail in 5 to 10 years.
5	Fair	Collapses unlikely in near future. Pipe may fail in 10 to 20 years.
2	Good	Minimal collapse risk. Pipe unlikely to fail for at least 20 years.
1	Excellent	Acceptable structural condition. Failure unlikely in the foreseeable future.

CCTV 1-5 RATING SYSTEM NOT RECOMMENDED FOR REHABILITATION SELECTION

NOW LATER

19 Missed Defects

Relying on a visual technology results in missed defects more often than not. Smudges on the lens, build up of debris and effluent on pipe walls, high flows, and operator inattentiveness, all contribute to missed defects. Not to mention the most common missed source for leaks – unsealed joints – which cameras cannot assess.



20 Infiltration

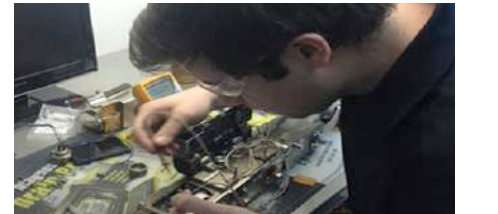
The requirement to have an empty pipe during CCTV inspection and inability to readily quantify openings in a pipe make identification of "infiltration" difficult, if not impossible. Further complicating the accurate identification of infiltration, is the lack of any correlation between 'Root' intrusions to possible defect flows – solved by Electro Scan.

Code	Defect Description	Frequency
1	Crack	15
2	Blockage	10
3	Roots	8
4	Grease	12
5	Structural	5
6	Other	3

I INFILTRATION
 IW Weeper 6-13
 ID Dripper 6-13
 IR Runner 6-13
 IG Gusher 6-13

21 Camera Breakdown

A multitude of moving parts coupled with considerable heat build up while inside a pipe, results in a treacherous environment for cameras and their crawlers. As a result, breakdowns may occur for a variety of reasons including entanglements from roots & debris, getting stuck in thick silt, or caught in a broken joint, all contributing to compromised video quality or an abandoned survey.



If Your Agency or Consulting Engineer Relies on CCTV for Rehabilitation Selection, You Are Likely Fixing the Wrong Pipe & Accepting Moderate-to-Severe Liner Defects



Electro Scan Certified to Test Existing & Trenchless Pipe Repairs in Japan

エレクトロスキャンが日本での非開削管路修復・更新における水密性調査の技術で認定を受ける

Continued From Page 1

Prefectures, local governments, consulting engineers, and trenchless manufacturers are now able to conduct independent certification of water tightness of sewer repairs, rehabilitation, and renewals, to enhance environmental sustainability, maintain asset stewardship, and promote quality assurance of public works.

To celebrate the distinction, Electro Scan's Founder and Chief Executive, Chuck Hansen, attended the 30th Anniversary Sewerage Works Exposition, Tokyo International Exhibition Center (Tokyo Big Sight), 1-4 August 2017.

"We are honored to have our proprietary technology recognized by such a prestigious organization as JASCOMA and to help guide the selection and acceptance of future trenchless renewal programs in Japan," stated Hansen.

"Some things *do not* get better with age," stated Hansen. "And underground sewer pipes are one of them."

Japan's aging sewer pipes have been in the spotlight as Prime Minister Shinzo Abe has pushed to revitalize the world's third-largest economy by

overhauling the country's infrastructure.

Last year, pipe rehabilitation in Japan exceeded 500 km, with cumulative sewer pipe renewal projects reaching 8,000 km.

Yet, prior to JASCOMA Certificate No. 12, no generally accepted standard was in place to ensure pipe quality assurance once a sewer was installed or relined and after service laterals were reconnected.

JASCOMA Certificate No. 12 represents a new support technology that automatically locates and measures leaks, allowing machine-intelligent hardware and software to determine an estimated leakage rate — in either liters per second or gallons per minute — for each defect and for the entire pipe.

Defect flow ratings, provided by Certificate No. 12, allow sewer repairs to be easily ranked and prioritized by severity, without requiring third-party data interpretation.

By 2035, about 28 percent of all sewer pipes in Japan — about 130,000 km — will reach the end of their 50-year life span.

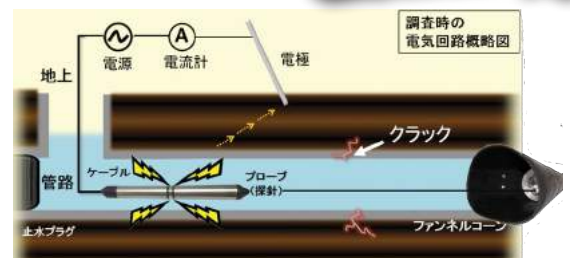
Replacement costs for pipes, pumps and other equipment are seen ballooning 66 percent to ¥1 trillion (\$9.1 billion) over the next 20 years.

Since 2014, US-based Electro Scan Inc. conducted knowledge & technology transfer with Japan-based trading company KANTOOL CO., LTD. to bring its new pipe testing and condition assessment solutions to Japan.

Ken Kerri, Ph.D., P.E., Chief Project Consultant, Office of Water Programs, California State University, Sacramento, California, USA, was instrumental in communicating the advantages of the new technology in meetings between Electro Scan and KANTOOL.

After equipment installation and training, Electro Scan Inc. also deployed a Japanese version of its award-winning Critical Sewers® Software as a Service (SaaS) cloud application.

Government tenders for trenchless rehabilitation are recommended to reference JASCOMA's Certificate No. 12 for all future projects so contractors and engineers can independently determine the water tightness of sewer pipe renewals, repairs, and rehabilitation.



Aging U.S. Water Infrastructure Made Apparent, Necessary Rehabilitation & Replacements Imminent

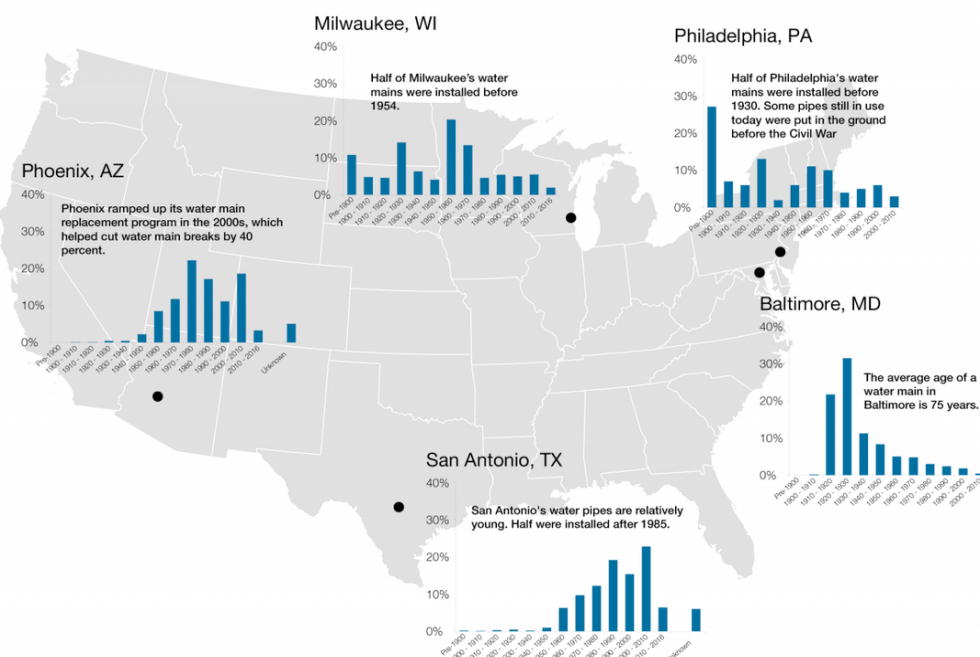
Numerous recent reports by media outlets, such as The New York Times, CNBC and The Washington Post, warn of an impending crisis. This crisis is solely the result of America's decrepit and aging infrastructure, including the nation's vast network of corroded water pipes that have exceeded or are fast-approaching the end of their expected useful life.

The devastating effects of such poor infrastructure can be seen everywhere. Americans have faced catastrophes such as the Flint Water Crisis (when budget cuts led to tainted drinking water), widespread sinkhole formations often resulting from leaks in pipe joints causing erosion in surrounding soil, and massive sewage spills that contaminate public waterways.

Due to these issues, a \$1.8 trillion infrastructure bill is in the works with much to be set aside for the water industry. Furthermore, the EPA awarded over \$4 billion for grants to both small non-profits and large state governments.

The Age of U.S. Water Pipes

From pre-Civil War to Civil Rights era, U.S. water systems reflect a range of ages.



Each year about 240,000 water main breaks result in lost water and disruptions to daily life. (U.S. Environmental Protection Agency)

America's municipal water systems are responsible for more than 1.2 million miles of water mains. (Utah State University)

Repairing and replacing old water pipes could cost more than \$US 1 trillion over the next two decades. (American Water Works Association)



Pipe age data requested by Circle of Blue from Baltimore Department of Public Works, Milwaukee Water Works, Philadelphia Water, Phoenix Water Services Department, and San Antonio Water System.



Electro Scan Leads New Field of Environmental Accounting for Utility Pipeline Performance



While most cities have a combined value for their utility assets in their balance sheets (e.g. water, sewer, stormwater), often representing almost 70% or more of the value of their town, most have no idea as to where their value is located (i.e. to individual components), when it should be replaced, or when/who/how the asset was certified to serve the public.

Having a digital map is great to send a worker to investigate a problem, but without the proper asset stewardship, or valuation, environmental sustainability can not be easily achieved.

What is missing? Some say that a new Environmental Accounting capability is needed.

So how does this apply to Electro Scan? By providing an easily

deployed cloud-based software as a service (SaaS) application, cities can now track an asset's current condition (based in terms of its water tightness), connection to customer service laterals, certification of renewal or repair, and warranty assurances.

Using Critical Sewers®, Storm and Water application, Electro Scan equips cities with a user-friendly system for compiling data on infrastructure environmental compliance.

By creating a generally accepted standard to ensure environmental quality assurance – i.e. documenting proper installation, warranty, and replacement – cities can offer residential and commercial constituents a quantifiable and audit-proof assurance that public works infrastructures are safe and sustainable.



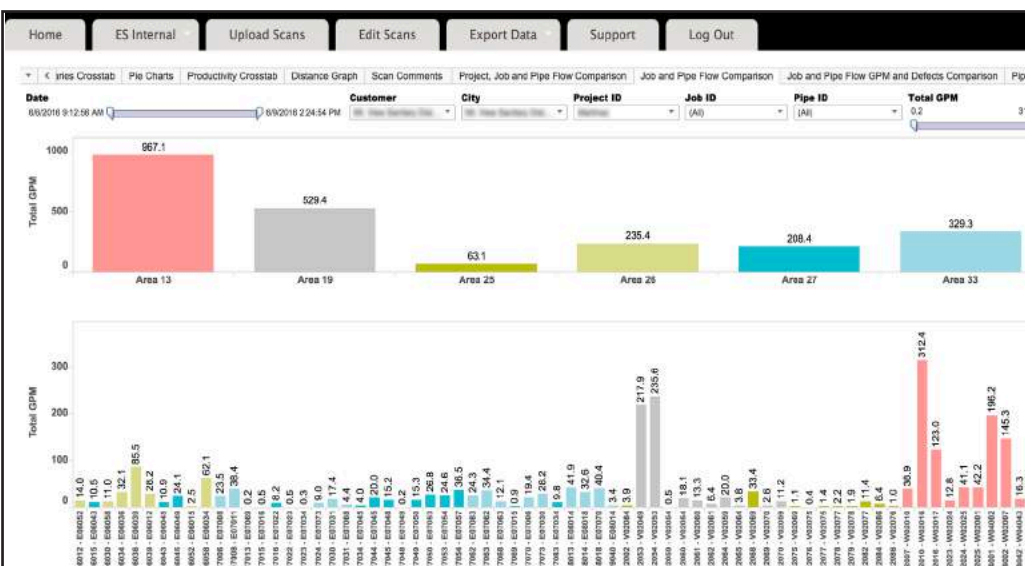
critical sewers®

A tool that delivers installation-to-replacement environmental performance accounting on a pipe-by-pipe basis.



“Air and water-related environmental data must be managed with the same intensity as financial accounting information.”

Chuck Hansen



Japan Sewer Collection System Maintenance Association Certificate No. 12 Issued July, 2017



2016 Sacramento Region Innovation Award CleanTech



UK Society of Trenchless Technology 2015 Best Project Award



Water Environment Federation 2013 Best Innovative Technology Award



2013 Best Clean Tech Company Award Water & Sewer Industry



North American Trenchless Technology 2013 Innovative Product Award



Electro Scan Intern Palooza

College Bound Summer Interns Beat The Heat At Electro Scan



Emil Erickson

Education

Entering as a freshman at Cal Poly, San Luis Obispo. Recent graduate of Sacramento Country Day School.

Work Experience

Worked for a remodeling company as a laborer last summer and had previously worked as a golf caddy.

Summer Projects

Worked with fellow intern Charlie Johnson to design and test Electro Scan probes in COMSOL Multiphysics. "It was incredibly interesting to try to figure out how the probes could be modeled in such a powerful program. COMSOL is really hard to use but really cool."

Fun Fact

Middle name is Blue.

Favorite Moment

When he, Marigot and Sonja made pancakes for the office!



Marigot Fackenthal

Education

Entering as a freshman at Cornell University. Recent graduate of Sacramento Country Day School.

Work Experience

"This was my first job!"

Summer Projects

Used InDesign to format and correct Arabic and Spanish versions of Electro Scan handouts. Also used FileMaker Pro to create a new database for Electro Scan's thousands of contacts and projects. Helped fellow intern Sonja Hansen with the newsletter by giving InDesign tips and writing stories.

Fun Fact

Afraid of fruit! Not only will she not eat it, but she also doesn't want it near her.

Favorite Moment

When she and Sonja flew out to join the Electro Scan team in Philadelphia for the AWWA Annual Conference!



Sonja Hansen

Education

Current senior at Sacramento Country Day School.

Work Experience

Volunteered for Breakthrough Sacramento last summer.

Summer Projects

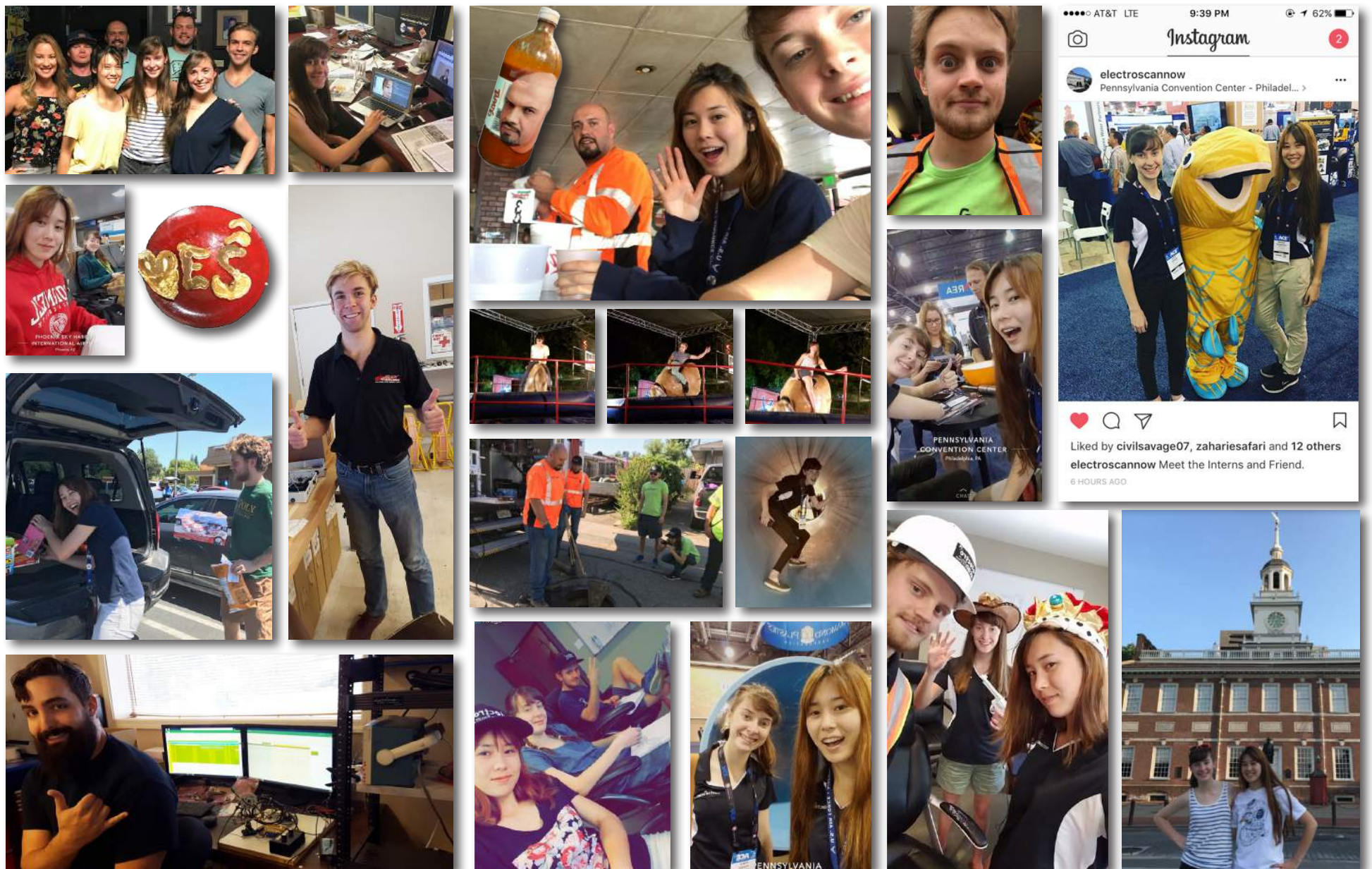
Designed, wrote, and served as guest Editor-in-Chief of the Critical Sewer & Water Chronicles, Issue 9.

Fun Fact

Can turn her foot backwards.

Favorite Moment

When the Electro Scan team took a trip to the California State Fair, she bought an amazing pulled pork sandwich, and everyone got a chance to ride a mechanical bull! Sonja spent a total of 57 seconds on the bull. Her other favorite moment occurred when Marigot scratched Chuck Hansen's car on the office gate. No injuries or fatalities were reported.



And College Engineering Students Help Out With Software, Tech

Sean Blottie

Education

Entering his senior year at Sacramento State University for his BS in Electrical Engineering with a focus on robotics and automation.

Work Experience

As his college career has progressed, he has moved from the retail environment to an engineering position with the State of California and now to an internship with Electro Scan to develop his professional engineering experience.

Summer Projects

"I've mostly been swapping between programming software for testing and prototyping new probes and equipment that Electro Scan is developing, and working on propulsion systems and general fabrication for Electro Scan's upcoming water probe. On top of everything else, I'm also helping to expand the number of ready-to-ship probes in our existing ES-620 lineup."

Fun Fact

"After our wedding next year, my wife and I will be traveling to Europe to complete the Tour du Mont Blanc – a roughly 1,000 mile hike through three countries in a week and a half!"

Favorite Moment

"Getting welcomed into the Electro Scan family was a great experience. I've only been around for a few months, but I've felt like my opinions have been taken seriously, and I've been able to test myself and develop new skills that will lead directly into my future career!"



Charlie Johnson

Education

Entering his senior year of Mechanical Engineering at California State University, Chico and is set to graduate in the Spring of 2018.

Work Experience

Has worked as an engineering intern for Electro Scan during the last two summers, doing everything from COMSOL & Solidworks to writing patents and working in the field. Has also previously worked as a valet, lifeguard, and summer camp counselor.

Summer Projects

Primarily worked with fellow intern Emil Erickson on modeling the Electro Scan probe and different field variables in COMSOL. Also assisted with product assembly.

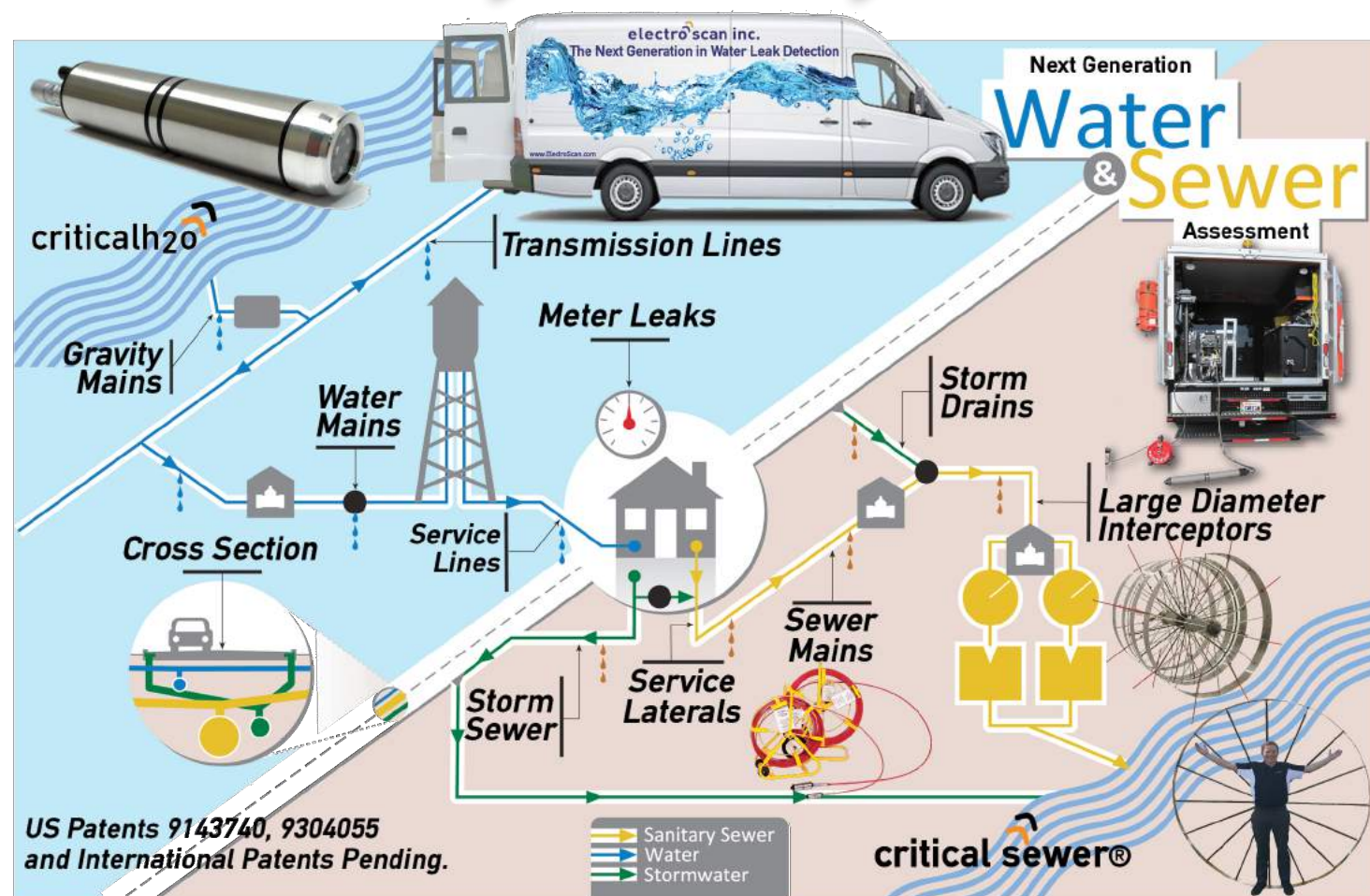
Fun Fact

"I play five instruments: saxophone, clarinet, piano, guitar, and drums! During the school year, I play alto saxophone in the jazz band at CSU Chico."

Favorite Moment

"One of my favorite parts about working at Electro Scan is the camaraderie, so going to the CA State Fair with everybody was so much fun. Com dogs, a hypnotist, & mechanical bull riding - great times with great coworkers!"

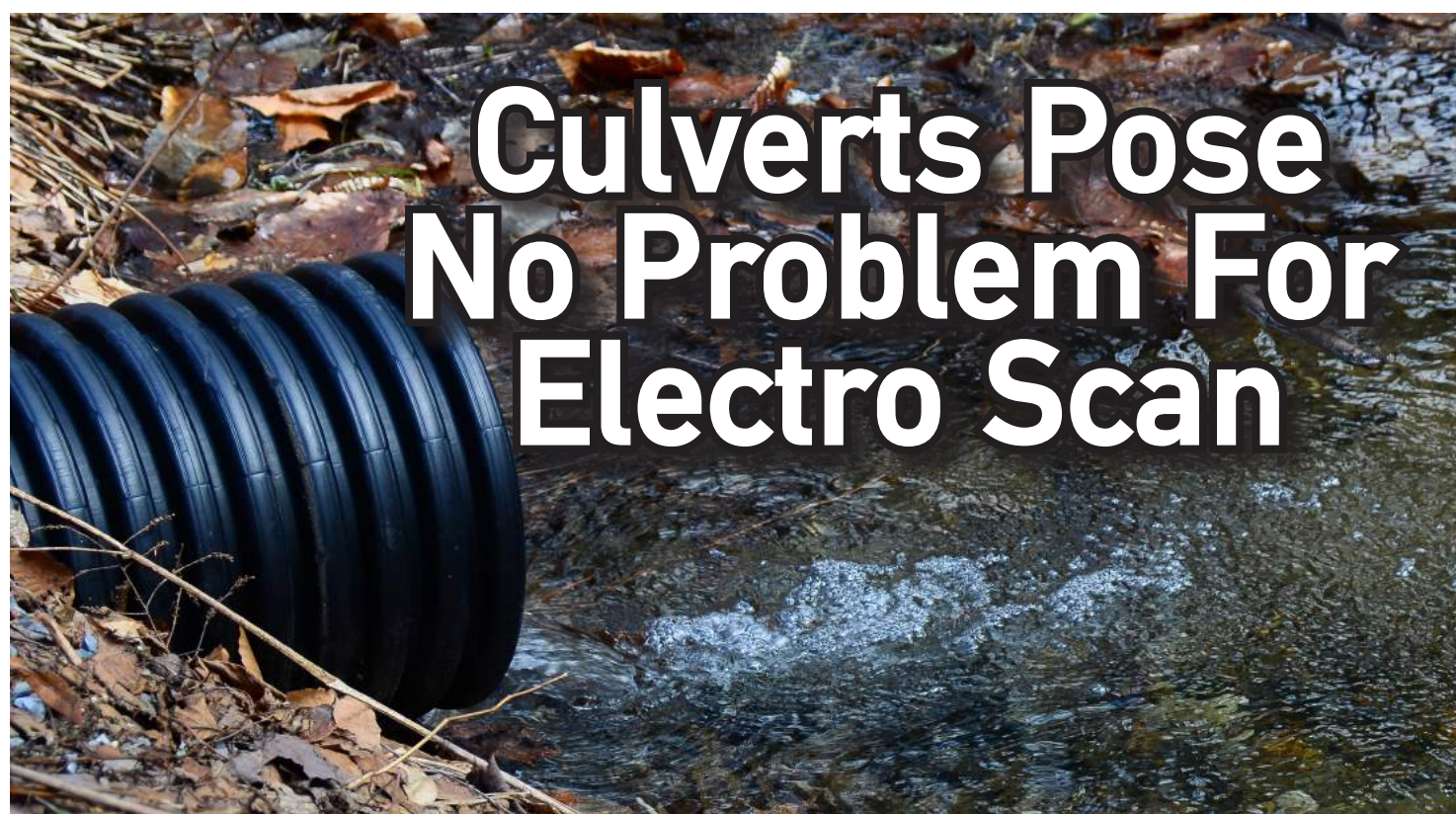
Electro Scanning Inspection Available For Water, Sewer, and Gas Pipelines



SEWER (Gravity Pipes)
 Assessment Technology: **Focused Electro Leak Location**
 Diameters: 3 to 66 inches.
 Non-Conductive Materials: PVC, HDPE, CIPP, RCP, ACP, VCP, Cement Mortar-Lined Steel, etc.
 Specialty Inspection: Siphons and Force Mains

WATER (Pressure Pipes)
 Assessment Technology: **Low Voltage Conductivity**, High Definition Closed Circuit Television, Acoustic Hydrophone & Pressure Sensor
 Diameters: 6 to 20 inches.
 Materials: PVC, MDPE, HDPE, CIPP, RCP, ACP, VCP, Cement Mortar-Lined Steel, DI, etc.

GAS (New Installations)
 Assessment Technology: **Focused Electro Leak Location**
 Diameters: 6 to 30 inches.
 Materials: PVC, MDPE, HDPE, etc.
 Specialty Inspection: Commissioning of New Pipelines



Culverts Pose No Problem For Electro Scan

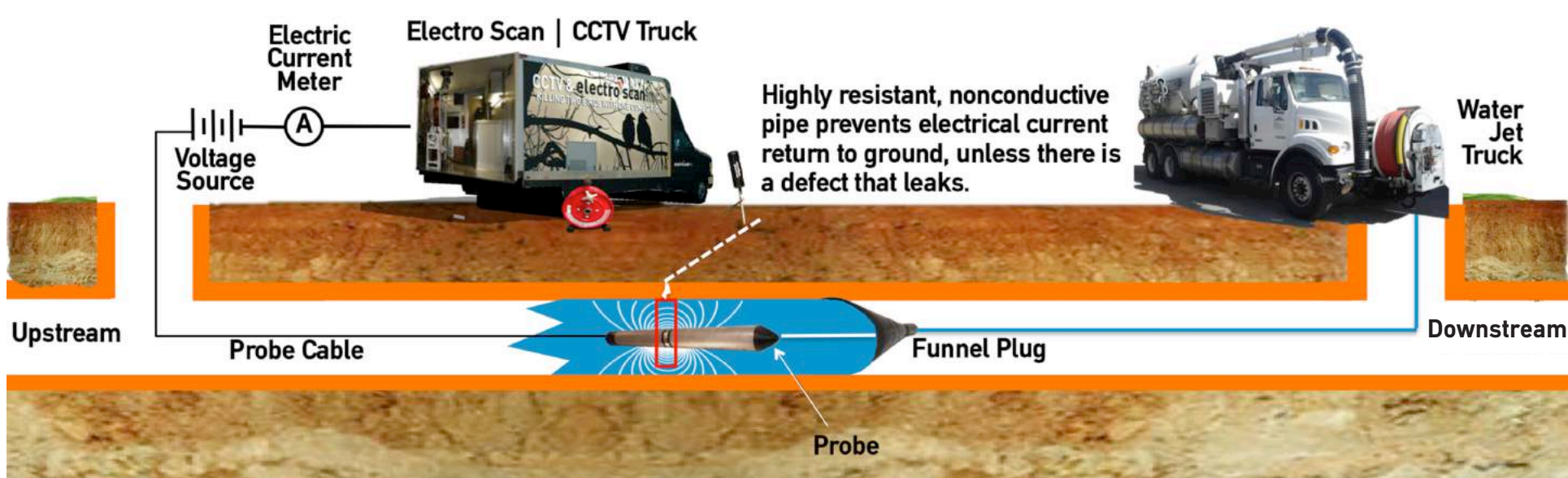
Culverts are structures that allow water to flow under obstructions, including roads, railroads, trails, sidewalks, etc., to allow proper drainage. When defects go undetected in culverts, the failure can be catastrophic. If a pipe collapses or voids form in the soil around the pipe, often a sinkhole is the devastating result.

Like sewer pipes, many culverts have constant water flowing through them, making it difficult and expensive to use visual inspection to try and "see" defects.

In contrast, Electro Scan needs water! Water is used as a medium to conduct its low voltage, high frequency electric current to the pipe wall. Electro Scan continues to assess non-metallic culverts across the US because of its ability to automatically locate and measure defects, in GPM.

Field Set-Up Measures Water Tightness of Sewers

How can you accurately and consistently locate and measure defects after service reinstatements? The answer is using Focused Electrode Leak Location (FELL). Recognized by WEF, WERF, and WRc as the recommended way to provide unambiguous and unbiased data when assessing pre- and post-rehabilitation pipes. Either purchase your own equipment for your municipal crew to assess your pipes or hire Electro Scan Services to provide same-day reporting of pipe condition and contractor acceptance.



 **12,737** Number of Scans
 **2,178,338** Total Feet
 **318,112** Defects Found
 **326,629** Gallons Per Minute

New White Paper By Industry Veteran, Chuck Hansen, Chronicles Growth of New Technology and Standards to Test & Certify CIPP

“After hundreds of projects investigating CIPP liners, I was asked to recount how the industry transitioned away from the use of visual inspection, primarily using CCTV cameras, to adopt a new machine-intelligent expert system to automatically locate and measure defects in Gallons per Minute or Liters Per Second,” says Chuck Hansen.

I started this journey to satisfy the curiosity of an old professor, Dr. Ken Kerri, which quickly spawned a whole new level of condition assessment. We now have answers to questions never answered by our long-time use of CCTV cameras.

Electro Scan has earned a number of awards, but more importantly, large and small adopters in the U.S., England, and Japan.

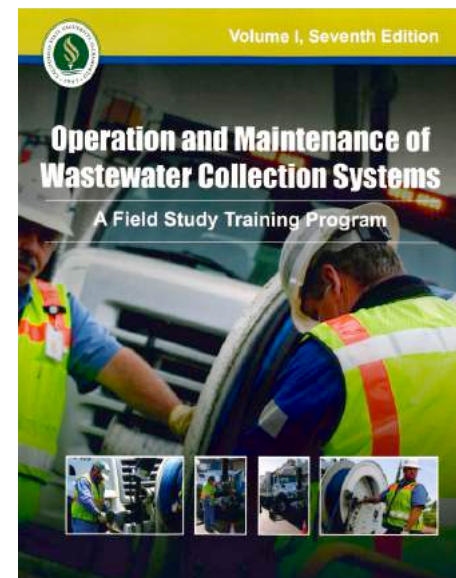
I hope to publish an update in 2018.

Chuck Hansen 

After our first one-hundred projects, including demonstrations and full scale SSES projects, Ken surprised me by asking if he could write a chapter in the next edition of his O&M manual, telling me it was time to overhaul the testing and collection chapter.

Ken was often heard saying “At first, people will be skeptical and probably won’t believe you, but they soon will.”

Fortunately, this industry has a lot more players that like racing to the top, instead of sinking to the bottom, and have an overriding interest to serve the public.



New Standards for Testing and Certifying Cured-In-Place Pipe

By Chuck Hansen, BSc, MBA, Founder Electro Scan Inc., Former Chair ASTM F36.20, Former Chairman & Founder Hansen Software Inc. (1983-2007).

Introduction

It is estimated that nearly 75,000 miles of wastewater and water pipelines have been lined with Cured-In-Place Pipe (CIPP), with nearly \$3 billion spent annually on the trenchless renovation method, worldwide.

Yet, little if any testing has been done once CIPP lining has been fully installed. Instead, agencies have relied on visual inspection or closed-circuit television (CCTV) cameras to approve large and small projects. In contrast, German sewer authorities, at a minimum, require CIPP lined pipes to undergo independent testing of samples taken from each liner at the manhole. In 2016, liners from 24 European contractors underwent rigorous testing by the Institute for Underground Infrastructure GmbH (IKT), publishing all results.

Recognizing the growing use of CIPP and inability of CCTV inspection to accurately or consistently certify trenchless rehabilitation as *defect-free*, this paper chronicles the emergence of new guidelines to test, certify, and accept CIPP lining projects, using *Focused Electrode Leak Location (FELL)* inspection.

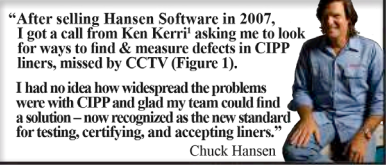
Trenchless Industry Development

It all started in 1971 in London, England when Eric Wood had a leaky pipe under his garage. To eliminate the need to dig up his entire garage floor to repair the pipe, Wood invented a new renovation method: cured-in-place pipe (CIPP) lining. He initially named the process *insitu form*, derived from the Latin meaning “form in place.”

In January 1975, Wood applied for a patent for cured-in-place pipe lining that was granted in February 1977. Insituform Technologies later commercialized the patent and brought the technology to the United States shortly thereafter. Since its inception, CIPP has enjoyed widespread adoption due to its ease of installation and low cost, compared to dig and replace.

CIPP can be used to rehabilitate sanitary sewers, storm drains, and pressurized water and gas pipelines. Circular pipe, from 4 inches to 60 inches and a variety of noncircular pipe such as egg shapes, ovoids, and box culverts, can be lined. Lining removes the pipe from service for the duration of the CIPP installation and reinstatement process, with bypass pumping sometimes necessary.

Prior to lining, the pipe must be cleaned by jetting to remove corrosion and debris. Protruding lateral connections must also be removed, with some repairs required where the existing pipe is substantially deformed, damaged, or collapsed. After lining, each service connection or lateral must be reinstated before the pipe can be returned to service, usually within the same day. Lined water mains must also be disinfected before returning to full service.



“After selling Hansen Software in 2007, I got a call from Ken Kerri asking me to look for ways to find & measure defects in CIPP liners, missed by CCTV (Figure 1). I had no idea how widespread the problems were with CIPP and glad my team could find a solution – now recognized as the new standard for testing, certifying, and accepting liners.”
Chuck Hansen

CIPP liners of non-woven polyester felt or fiber reinforced fabric are manufactured to fit each host pipe. Liners are typically impregnated with a polymer resin, which creates a lined pipe within the host pipe when cured or cooked. Liners are designed with sufficient thickness when cured to sustain the loads imposed by external groundwater and internal service pressure, soil, and overhead traffic.

Liners are typically saturated with polyester, vinyl ester epoxy, or silicate resin using vacuum, gravity, or other applied pressure. The resin includes a chemical catalyst or other hardener to facilitate curing. The outermost layer of the liner tube is typically coated with a polymer film to protect the liner during handling and installation, with impregnated liner typically chilled for transportation to the job site to maintain stability until installed.

In the mid-1990s, patents for cured-in-place pipe expired, opening up competition from foreign and domestic suppliers. As the number of lining companies grew, the overall cost for CIPP declined. As municipal contracts continued to be awarded to the lowest bidder requiring only *visual inspection* to accept a contractor’s work, post-CIPP inspection, prior to contractor acceptance, has never been more important.

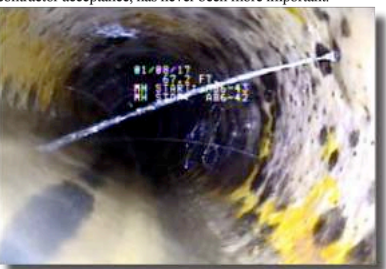
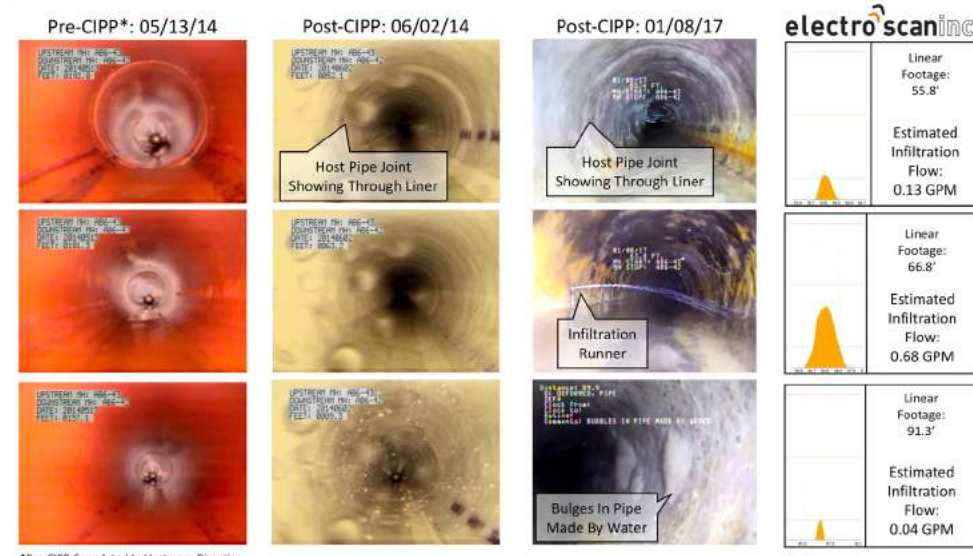


Figure 1. Cured-In-Place Pipe lining installed in 2014 by a national lining contractor, approved by CCTV inspection in 2014, in accordance with ASTM F1216 (See Table 1). FELL inspection in 2017 located nineteen (19) measured defects and over 100 pinhole leaks and is now recommended to certify all CIPP liners as leak free, prior to acceptance.

1. Ken Kerri, Ph.D., P.E., Chief Project Consultant, Office of Water Programs, California State University, Sacramento, Ph.D., Sanitary Engineering, Oregon State University, Corvallis, 1965, MS, Sanitary Engineering, University of California, Berkeley, 1959, BS, Civil Engineering, Oregon State College, Corvallis, 1956, WEF Fellow, 2014, Water Distribution and Water Treatment O&M Committee, American Water Works Association, 1998-2014.
2. Twenty-four (24) European lining companies submitted 1,841 CIPP samples in 2016 to IKT (Gelsenkirchen, Germany), performing laboratory only testing, on modulus of elasticity, flexural strength, wall thickness, and water tightness. While 61% of all samples passed all test criteria, 59% did not. Results are from the Institute for Underground Infrastructure (IKT) 13th Annual Liner Report, published February 2017.

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Supplemental analysis of Figure 1. White Paper, Page 1.

Melissa Meeker's Keynote in Japan Features Electro Scan



certifying the water tightness of existing and newly rehabilitated sewer pipes in Japan.

Keynote speech by WERF CEO Melissa Meeker on “SSO Management in the U.S.” at the 54th Annual Japanese Technical Conference on Sewerage in Tokyo, Japan, stated that “Electro Scan provides unambiguous evaluation of lateral condition and the location of potential defects, including an estimated defect flow in GPM.”

Attended by an overflow crowd, Melissa’s keynote and follow-up questions were simulcast in English and Japanese. Melissa took some great questions and answered them masterfully.

Thanks, Melissa Meeker (WERF), Barry Liner, Ph.D., P.E. (WERF), and Bri Nakamura, P.E., ENV SP (WERF), for making the trip to Japan to share U.S. best practices.

This was quite the exclamation point to the announcement by the Japan Sewer Collection System Maintenance Association (JAS-COMA) granting Certificate No. 12 to ‘Electroscan’ for testing and

Make sure your next Pre- and Post-CIPP Lateral or Sewer Main Assessment Project incorporates this groundbreaking, unbiased, and timely solution.



Tokyo, Japan, August 2, 2017, Japan Technical Conference on Sewerage, Keynote Address by Melissa Meeker, CEO, Water Environment & Research Federation (WERF), simulcast in English & Japanese.

Electro Scan Testing - Scanning



電気探査 - 探査中



NYC Prohibits CIPP and Epoxy Lining For Not Meeting Standards of Strength, Effectiveness

IT'S THE LAW.



USING EPOXY OR CIPP TO LINE PIPES IS ILLEGAL IN NEW YORK CITY

MAKE SURE THE COMPANY YOU USE IS A LICENSED PLUMBER.

For more information visit www.plumbingfoundation.org



While most of the US and much of the world encourages the practical use of Cured-In-Place Pipe (CIPP), New York City's Office of Technical Certification and Research (OTCR) has made it clear that CIPP is not to be used within the City's water, sewer, or storm pipes, for any reason.

In 2011, the OTCR - a government department that oversees safety, sustainability, and efficiency specifications of materials and technologies in NYC - released *Buildings Bulletin 2011-022*, which formally outlawed the use of CIPP. The bulletin cited Title 28, Article 113, Section 2.2 of New York's Administrative Code (AC 28-113.2.2), which states:

"[Alternative] material, method or work offered is, for the purpose intended, at least the *equivalent of that prescribed in this code in quality, strength, effectiveness, fire resistance, durability and safety.*"

According to the bulletin, CIPP is banned for use as it does not meet standards equivalent to those specified in the code.

Recently, Alan D. Price, P.E., Director of the OTCR, confirmed that the 2011 bulletin outlawing CIPP is still in effect. This means that every time a pipe in NYC has significant leakage or damage, CIPP cannot be considered as a repair method.

Interestingly, according to a 2011 article by David Balkan, Vice President of Balkan Sewer and Water Main Service (the largest water main and sewer contractor in New York City), CIPP has always been outlawed in NYC, even before the 2011 bulletin. However, because there had been no official government documentation (or, at least, none that was easily accessible), the use of CIPP within the City had been unclear.

As a result, many Property Owners had already purchased and installed CIPP without knowing it was against regulation. When the 2011 bulletin was issued, those Owners were forced to scramble to pursue lawsuits against CIPP contractors. Not only was the CIPP "faulty" in the eyes of the City, but it also needed to be removed—an expensive and highly invasive process.

"The frequent end result of the lining of house plumbing in NYC is the work having to be performed twice and at around double the initial cost," Balkan wrote. Balkan went on to point out that unfortunately for many Property Owners, it was too late to pursue monetary lawsuits.

With many cities finding that their CIPP will not last the estimated life claimed and the additional costs of fixing bad liners, CIPP contractors will have to step up their game or perhaps other cities will follow in NYC's footsteps.

§ 28-113.3.3 Alternative Materials.

Except as otherwise specifically limited by this code, the provisions of this code are not intended to prevent the installation of any material or to prohibit any alternative engineered design or method of construction not specifically prescribed by this code, provided that the use of such alternative material has been previously approved by the commissioner and may be used only to the extent set forth in such approval. The use of an alternative material, design, or method of construction or equipment shall be approved where the commissioner finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, at least the equivalent of that prescribed in this code in quality strength, effectiveness, fire resistance, durability and safety.

Thanks For Tuning In For Our Trenchless Tech Webinar!

92

Attendees Interested In Updating CIPP Specs to Include FELL.

71

Attendees Experienced a Recent CIPP Failure.

500+

Attendees Signed On and Watched!

Interested attendees were sent sample specifications, a certified copy of ASTM F2550, and a new 7th Edition, Volume 1, *Operation and Maintenance of Wastewater Collection Systems* manual.

And there are many failures that go undetected, until it's too late. Failure can be predicted and addressed before Contractor Acceptance and within the warranty period by using Electro Scanning Inspection as your new certification standard.

This has been our most successful webinar to-date! We are delighted that so many of you joined us. Thanks to everyone for answering our polls and asking follow-up questions. To request more information and downloads, email carissa@electroscan.com.



Re-Watch Our Free Webinar
<https://goto.webcasts.com/viewer/event.jsp?ei=1133317>

Harmful Emissions From CIPP Unsafe for Workers & General Public



Product specifications, operating procedures, and performance standards that discount or minimize the harmful effects of inhaling or direct contact with CIPP materials should be immediately replaced with new language to properly safeguard workers and protect the general public.

Download a full copy of the study:
<http://bit.ly/2vMxavk>

After years of claiming that exposure to 'steam' during the CIPP curing and cool down process was safe, a new study says the plume from CIPP installation is actually a complex mixture of organic vapor, particulates that include partially cured resin, and liquid droplets.

The purpose of the study was not to determine human health impacts caused by CIPP chemical exposure. Instead, its purpose was to determine what materials were released by CIPP installation that provided acute toxicity induced by emitted materials.

Given defects in CIPP from accidental cuts, bad service reinstatements, contractor damage, overcooked liners and inconsistent curing, chemical emissions may travel up laterals into homes & businesses and out through leaks.

What Should Cities Do?

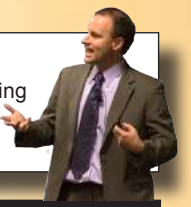
Be responsible!

New CIPP specifications should protect field workers and the general public safety by (1) minimizing direct exposure of CIPP plumes to the skin, (2) capturing & containing emissions to eliminate risk of spreading into nearby structures, (3) requiring workers to use personal protective equipment (PPE), and (4) having independent testing services monitor air emissions at all job sites.

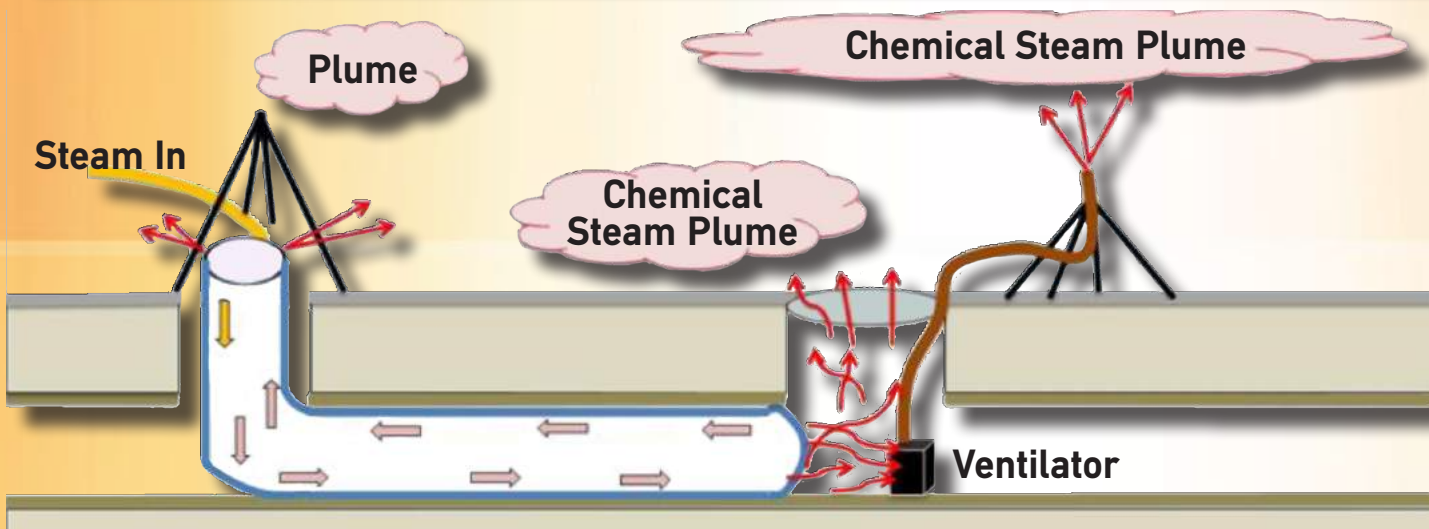
While air emission studies have been limited to municipal sewer, water, and storm drainage systems, findings are also applicable to local plumbers and contractors that market & sell trenchless repair methods that use CIPP to reline service laterals.

For More Information Contact

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Chemical Emissions During CIPP Installation



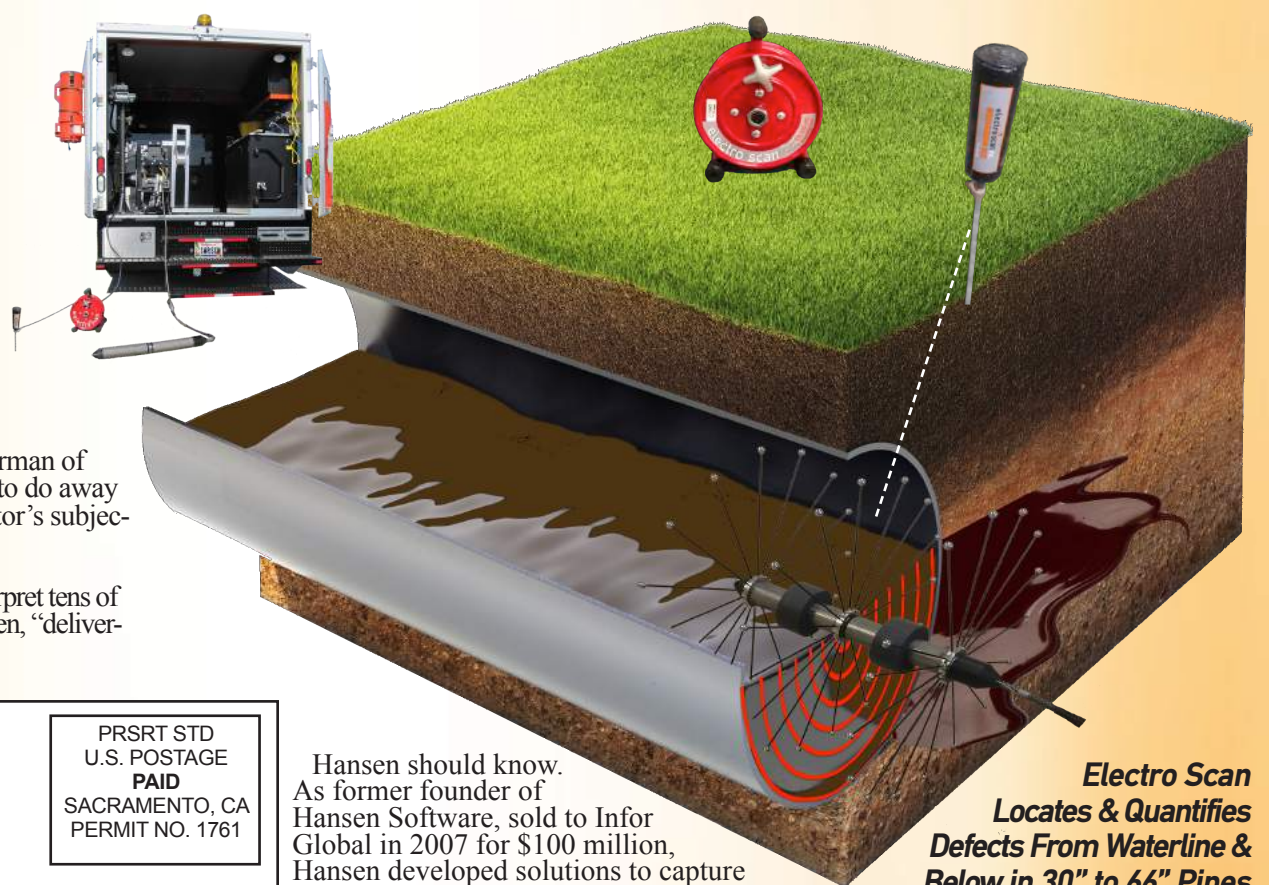
Large Diameter Pipes Ready for Inspection

Electro Scan Inc. is pleased to announce the availability of its patented technology to automatically assess large diameter pipes (i.e. up to 66 in or 1650 mm). The service is offered exclusively by the Company and represents a new addition to its expanding product line of proprietary machine-intelligent devices.

Once limited to using tethered sonar devices, *able to measure the outline of debris fields, but not locate or estimate the size of leaks*, sewer utilities can now accurately identify pipe specific locations and severity of each defect and total pipe, to accurately prioritize rehabilitation. Data is collected in accordance with the 7th Edition, Volume 1, **Operation and Maintenance of Wastewater Collection Systems manual**, written by the late Ken Kerri, Ph.D., P.E., with data integrated with Innovyze® InfoMaster® for Sewer.

"Some people call it *witchcraft*," says Chuck Hansen, Chairman of Electro Scan Inc. "I wish it was that simple. But, we wanted to do away with the need for third-party data interpretation and an operator's subjective visual observations."

"We needed to make our code extremely smart and able to interpret tens of thousands of data points in a matter of seconds," continued Hansen, "delivering a GPM estimate within minutes of completing any survey."



Electro Scan
Locates & Quantifies
Defects From Waterline &
Below in 30" to 66" Pipes

Hansen should know. As former founder of Hansen Software, sold to Infor Global in 2007 for \$100 million, Hansen developed solutions to capture every major pipeline condition assessment technique since 1983.

"This represents a new day for assessing large diameter pipes," continued Hansen. "Whether a high density plastic, cured-in-place liner, reinforced concrete, clay, or fiberglass pipe, our service is recommended for new pipe acceptance at installation, repair, and rehabilitation."

Budgets should plan a \$10-\$25 per foot professional service fee, with mobilization, difficult access, and reporting, priced separately. Call to learn how to appoint Electro Scan Inc. your *sole source provider* using this year's funding.

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