

CRITICAL SEWER CHRONICLES

AN ELECTRO SCAN PUBLICATION. ALL RIGHTS RESERVED. ISSUE No. 6, OCTOBER 2015



TOO MUCH RAIN?

COMBATING INFILTRATION: Agencies Add Electro Scan To Certify Rehab Projects

As the drought continues to plague the western United States, the rest of the country has been pounded with historic storms and record rainfall. These wet-weather events have resulted in more sanitary sewer overflows (SSOs), combined sewer overflows (CSOs), and overwhelmed pumping stations and treatment plants, than ever before.

Agencies are turning to cured-in-place-pipe (CIPP) liners and point repairs to quickly fix sources of infiltration, but what happens when flows aren't reduced after a large rehabilitation project or leaks in liners are missed?

Electro Scan technology provides agencies with potential infiltration flows so they are able to prioritize and rehabilitate the leakiest pipes first. Once rehabilitation is complete, agencies are certifying contractor work to be sure agencies were delivered a "leak-free" project.




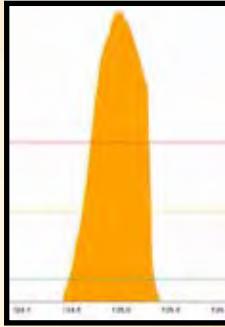
Taking the difference of the potential infiltration

rates from pre- and post-rehab, Electro Scans shows flows reductions -- resulting in more efficient CAPEX spending.



Added to your existing CCTV trucks, Electro Scan certifies CIPP and rehabilitation projects.



CCTV	ELECTRO SCAN
 NO DEFECT RECORDED	 ESTIMATED DEFECT FLOW 1.07 gpm or 0.07 lps
 NO DEFECT RECORDED	 ESTIMATED DEFECT FLOW 10.0 gpm or 0.63 lps

SFPUC Buys Electro Scan Sewer Leak Detection Van

With California in its fourth year of severe drought, public utilities are seeking new ways to reduce water usage and reuse water. SFPUC announced the first purchase of a standalone Electro Scan leak detection van to focus on areas where salt water has the potential to enter into sewer mains. SFPUC is able to reuse water, but does not have desalination capabilities.

Preventing ocean water from entering the pipes is at the forefront of their conservation efforts. Their Electro Scan Van will be delivered before year-end, but small projects and training have already commenced with SFPUC Staff and Electro Scan's West Coast Field Team.

Continued on Page 5



Electro Scan Partners With UK-Based WRc



Electro Scan Inc. and UK-based WRc Plc are teaming up to serve British Water and Sewer Companies (WASCs) in assessing gravity sewerage and stormwater mains.

WRc Plc has been appointed the exclusive service provider for Electro Scan's low voltage conductivity technology, including exclusive access to the Company's Critical Sewers® cloud-based data application.

"We are delighted with our appointment as Electro Scan's exclusive services provider in the UK," commented Dale Hartley, Commercial Manager, WRc Plc. "Electro Scan is a welcome addition to WRc's business unit."

Continued on Page 3



electro scan inc. Change Service Requested
1745 Markston Road
Sacramento, CA 95825-4026

PRSRT STD
U.S. POSTAGE
PAID
SACRAMENTO, CA
PERMIT NO. 1761

Hamilton Township Municipal Authority, PA Hosts BBQ for Staff, Friends, & Vendors



The Annual HTMA BBQ hosted in Chambersburg, Pennsylvania is something Electro Scan always looks forward to attending. Hosted by Sharon Purnell, HTMA Manager, the event was opened to neighboring authorities, friends, family, and vendors.

After purchasing their own ES-620 as an add-on to their CCTV van, HTMA and its crews have scanned a total of 40,773ft (12,400m). Since HTMA manages around 70 miles of sewer main that means they have successfully scanned over 11% of their system or 7.7 miles, finding 1,941 total defects representing 311 Large, 163 Medium, and 1,467 Small defects.

Congratulations to the HTMA Team!



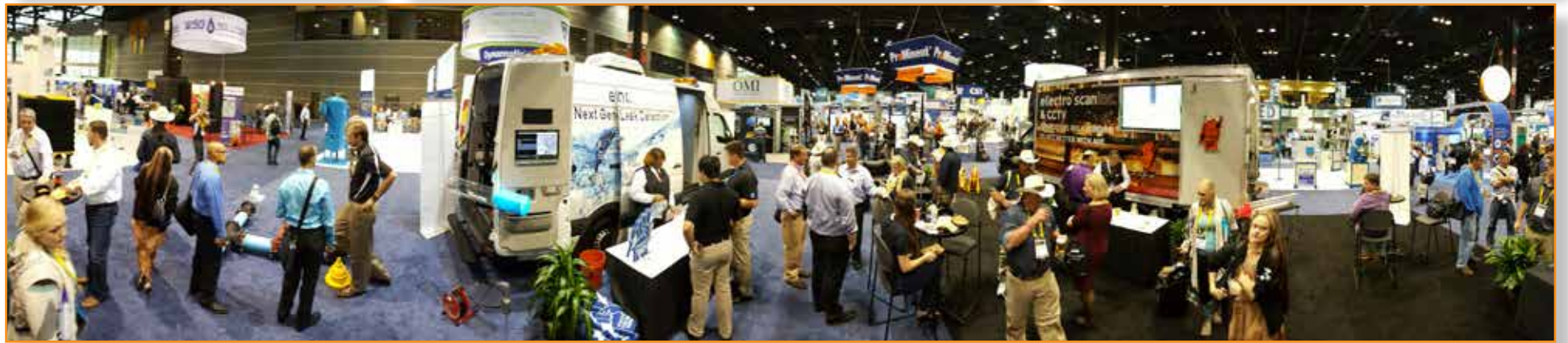
Electro Scan Draws Crowds at WEFTEC

McCormick Place, Chicago, IL -- Riding on the coattails of success from the ES-620 for Sewer Mains, Electro Scan unveiled its multi-sensor probe for pressurized water mains at WEFTEC in Chicago.

Drawing record crowds, Electro Scan staff Mark Grabowski, Macy Grubbs, Matt Campos, Pete Dannenberg, Carissa Boudwin and Jamie Johnson were on hand to answer questions and kept busy explaining how low voltage conductivity testing finds and measures leaks.

Thank you for stopping by Electro Scan's booth. Whether it was to hear the latest innovation in leak detection, or grab a locally brewed Chicago American Pale Ale, we enjoyed having you!

See you next year in New Orleans. Cheers!



Another Small City Gets Aggressive with RDI- The City of Coos Bay, OR, to Add Electro Scan

Oregon receives 2.8 inches more rainfall than the national average. As a result, rain dependent infiltration (RDI) is an issue for cities such as Coos Bay, who receives between 60-80 inches of rain per year. RDI can be difficult to locate using visual methods, such as CCTV, since in dry weather a defect may not be actively leaking so it may not be seen. Meanwhile, in wet weather there may be too much water in the pipe to locate the defects visually.

Coos Bay has turned to Electro Scan for a way to locate and quantify their RDI. The average rainfall in Coos Bay is 55% higher than the average in Oregon and 66% higher than the average nationwide, which makes RDI a significant problem. With 93 miles of sewer main, an aging sewer system, high groundwater, and poor soils the City is looking for a way to better prioritize repairs and capital improvement projects.

Coos Bay has an area zoned for industrial, commercial, single family, and multifamily development, which will subsequently add a large amount of sewage to the system. The City has analyzed the existing sanitary sewer system that serves this area and has determined that this area is over capacity.

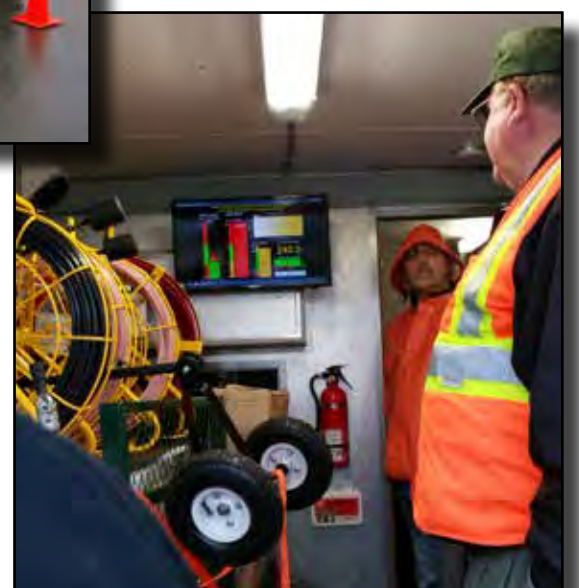
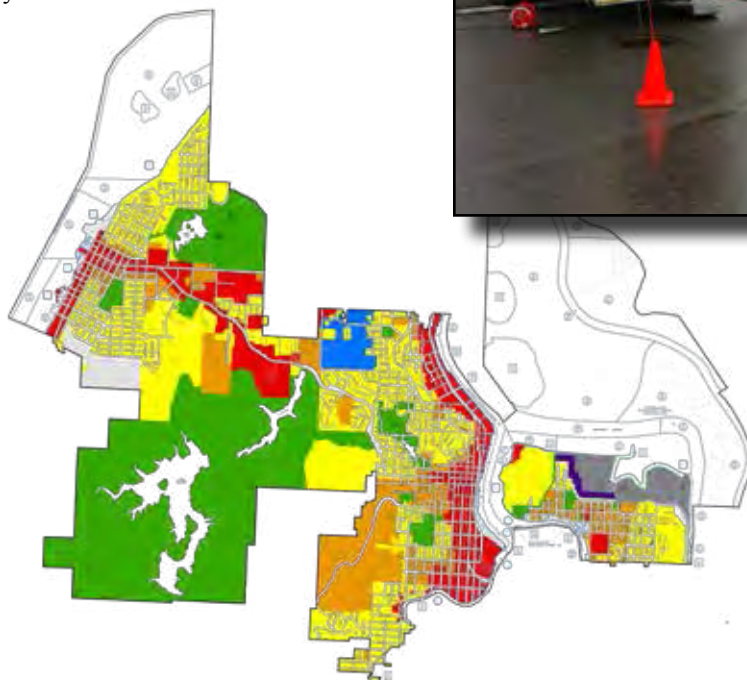
Coos Bay plans to use Electro Scan to locate where all their RDI is coming from. The idea being that by eliminating their RDI, they will be able to make room in the pipe for the additional sewage from the new development.

Electro Scan ventured to Coos Bay in December 2014 to demonstrate its low voltage conductivity testing technology for the City and SHN Engineers. Electro Scan's results showed that the PVC pipe was in great shape and no defects were detected in its 445 ft length. However, the three concrete

pipes were in varying conditions of needing repair. Over these three pipes, a total of 112 defects were located, representing an overall leakage rate of approximately 44 gpm, or 63,461 gallons per day (gpd).

In September 2015, Coos Bay's Staff presented Electro Scan's findings and project proposals to City Council members. The compelling data resulted in the decision being made for the City to consider the purchase an ES-620 for Sewer Mains system of their own.

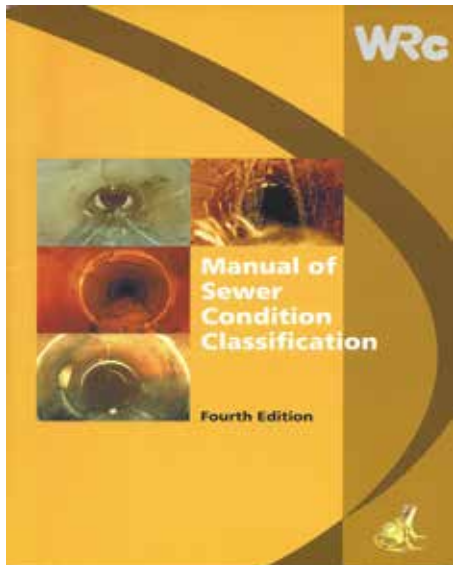
Coos Bay will be the first adopter of Electro Scan in the state of Oregon. Electro Scan is delighted to be working with the City of Coos Bay and their innovative team.



WRc Partners with Electro Scan to Offer Exclusive Services to the UK and the Republic of Ireland

Continued from Page 1

"We are excited to have one of the most trusted names in the British water industry represent us in the UK," states Mark Grabowski, General Manager, Electro Scan Inc. (USA).



WRc's famous Manual of Sewer Condition Classification, 4th Edition.

About WRc Plc

WRc is an Independent Centre of Excellence for Innovation and Growth operating across different sectors including Water, Environment, Gas and Resource Management. Their clients include regulators, water and gas utility companies, government organisations, NGO's, trade organisations, industrial manufacturers and waste management companies.

Building on a legacy in the international water and environment sector stretching back over 90 years, combined with the knowledge of approximately 120 staff based in Swindon, WRc brings a shared purpose of discovering and delivering new and exciting solutions that enable their clients to meet the challenges of the future.

WRc recognises the benefits of collaboration as a driver of innovation. By exploiting their knowledge and legacy, combined with the appropriate technology and continuously develop-

ing their professional networks, they work with their clients to implement valued solutions.

WRc's strategic priorities are achieving revenue growth, improving profitability and delivering exceptional service. Achievement of these allows WRc to continue to supply their clients with the innovative solutions they require. WRc are established innovation leaders and every innovation is underpinned by their technical expertise.

#innovatorsofgrowth.

Through the innovative approach to all underground assets -- irrespective of size, material, or depth; on trunk mains and sewers, water and gas distribution lines, rising sewer mains, and industrial, fire, cooling & process water supplies -- WRc is driving down the cost of pipeline operation and maintenance, whilst improving overall asset longevity.



UK Business Contacts

Dale Hartley, Commercial Manager
WRc Plc, Frankland Road, Blagrove
Swindon, Wiltshire SN5 8YF, ENGLAND
Tel: +44 (0) 1793 865000, dale.hartley@wrcplc.co.uk
www.wrcplc.co.uk

Mark Grabowski, General Manager
Electro Scan Inc., 1745 Markston Road
Sacramento, California 95825-4026 USA
Tel: +1 916 779 0660, mark@electroscan.com
www.electroscan.com



City of Monterey Hosts WRc & Cal Am Water Co. For Electro Scan Survey of Recent CIPP Lining

MONTEREY, CA -- Electro Scan was pleased to have officials at the City of Monterey, California host a one-day demonstration project allowing Electro Scan Inc. to evaluate over 1,000 ft of its sanitary sewer mains for special guests from WRc (Swindon, England) and California American Water Company. The City of Carmel-by-the-Sea was also in attendance.

The key objective of the project was to demonstrate Electro Scan's ability to find and measure defect flows in recently installed cured-in-place-pipes, which had been completed less than 60-days earlier.

Electro Scan's first pipe scanned was a 300 ft Vitrified Clay Pipe (VCP) installed over 40 years ago. While the VCP pipe had a large amount of defect flow, 11.8 gallons per minute, the surprise was the excessive number of defects and amount of estimated infiltration in the recently lined CIPP pipes, finding defect flow ratings of 17.93 and 11.11 gpm, respectively.

While visual inspection of CIPP has been predominately used for project acceptance, Electro Scan is able to locate and measure defects, like cuts, wrinkles, over-heating, and defective service reconnections where water (i.e. and future roots) can pass through the liner, yet they go undetected with high resolution CCTV cameras.

Thanks to the City of Monterey for a memorable day of scanning on the peninsula.



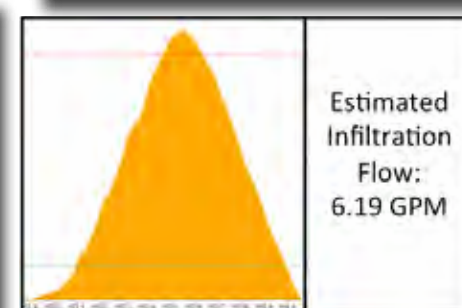
Kevin Anderson, City of Monterey (Left) and Dale Hartley, Commercial Manager, WRc (Right).



	Scan	Distance	S	M	L	GPM	GPD	GPD/IDM		
Total:	3	1,832	40	5	5	40.84	58,810	123,261		
Date	Mainline # com...	Pipe Type	Diameter							
7/8/2015	G12-015 to G12-007	VCP	1	200.1	10	2	11.80	16,182	14,732	
	D08-049 to D08-020	CIPP	2	311.4	41	2	17.65	23,894	27,426	
	D08-019 to D08-020	CIPP	3	100.6	18	1	11.11	15,898	11,120	
				Distance (ft)	Small	Medium	Large	GPM F	GPD	GPD/IDM

(Above) As expected, VCP registered the largest defect flow as measured by gallons per day per inch diameter miles (GPD/IDM) with a maximum amount of infiltration of 74,732 GPD/IDM. (Below) An 8" CIPP is found to have multiple defects missed by visual CCTV inspection, with the largest defect flow occurring at the service connection at 117.4 ft representing a single defect flow rating of 6.19 GPM.

DEFECTS	% OF DEFECT LENGTHS	GPM SUMMARY	DIAMETER & DISTANCE	OPERATOR INFO
S: 15	Small Defects: 4.8333%	Minor GPM: 13,150	8	Dale Hartley
M: 1	Medium Defects: 0.0000%	Moderate GPM: 1,140		
L: 1	Large Defects: 0.0000%	Major GPM: 1,118		
	All Defects: 0.0000%	Total GPM: 15,398	300.00 ft	



(Above) Electro Scan's low voltage conductivity technology only assesses openings in a pipe from the water level and below, relying on water to be the conductor for Electro Scan to assess the wall of the pipe and water tight service connections.



IKT-Praxistage 2015 Conference „Neubau Sanierung und Reparatur“

Elektro Scan GmbH was delighted to be cordially invited by IKT, Institute for Underground Infrastructure, to attend their 'Practice Days' featuring the world's leading technologies and best practices for new construction, renovation, and repair.

Held annually at IKT's headquarters in Gelsenkirchen, Germany, Elektro Scan GmbH demonstrated its low voltage conductivity testing for gravity (sewer) and pressurized (water) mains.



Elektro Scan GmbH demonstrated how it can repeatedly and consistently locate hidden defects in a plastic pipe, undetected by acoustic sensors and CCTV cameras.

"IKT's leadership in testing CIPP lining samples from some of Europe's largest rehabilitation companies was a key factor in Elektro Scan GmbH's decision to attend the festivities September 8 & 9, 2015," stated Chuck Hansen, Managing Director, Elektro Scan GmbH. "Given our growing backlog in sewer & water inspection services, we may not be able to make it to the 2016 IFAT, so this gave us the opportunity to meet with a number of Germany's leading water utilities."

Macy Grubbs and Matt Campos attended IKT-Praxistage 2015 and appreciated the help and support shown by their IKT hosts.



Matt Campos, Elektro Scan GmbH, Roland Waniek, Managing Director, IKT, and Macy Grubbs, Elektro Scan GmbH.

Limitations of CCTV Brings Changes To SSES & CIPP Acceptance

Electro Scan Brings More Accurate Assessment of Sewer Mains & Laterals - Overcoming Drawbacks of Closed-Circuit Television (CCTV) Cameras

Sewer utilities, sewer contractors, and consulting engineers have traditionally inspected wastewater pipes using closed-circuit television (CCTV) cameras. However, limitations to accurately locate & measure defects and its inability to find sources of infiltration is expected to reduce or significantly curtail its use as a pipe condition assessment tool.

"CCTV will not go away," states Chuck Hansen, a pioneer in CCTV assessment, "but TV cameras are clearly past their maturity stage and entering a decline stage as newer technologies do a better job and provide better metrics."

Sewer utilities, contractors, and engineers have long acknowledged problems with TV camera inspection and utilities need to only go as far as their own data to see *why*. Utilities should ask how many times conditions like Fats, Oil and Grease, Roots, Silt, and Encrustation have been recorded as a % of total observations. Or look at the frequency of pipes that were ¼, ⅓, or ½ full of water -- all covering up defects not typically seen.

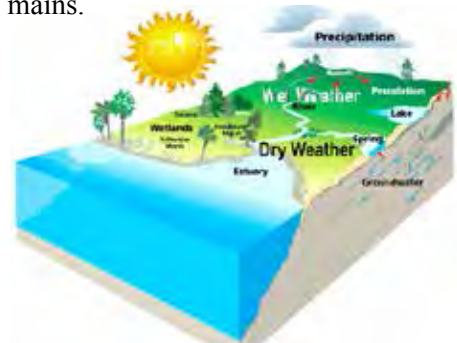
Still have doubts? Have your best two TV operators independently review and rate the same CCTV videotape.

Why The Industry Is Shifting To Better Solutions

The Top Ten Limitations of CCTV Inspections

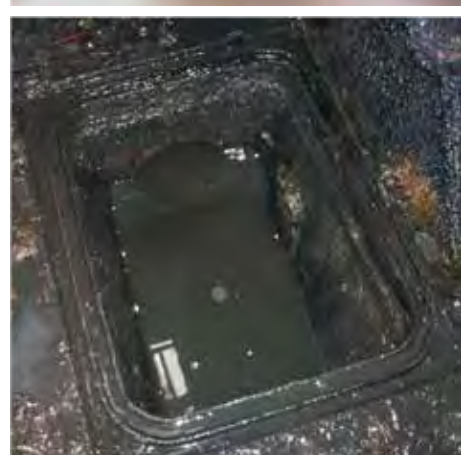
1. Reliance on Dry Weather Pipes

A key reason for curtailing TV inspection is its primarily used during dry weather conditions -- when pipes are less likely to leak. In fact, if rain is just starting, most crews will call it a day as cameras are not able to effectively televise surcharging sewer mains.



2. Pipe Half Full or Half Empty?

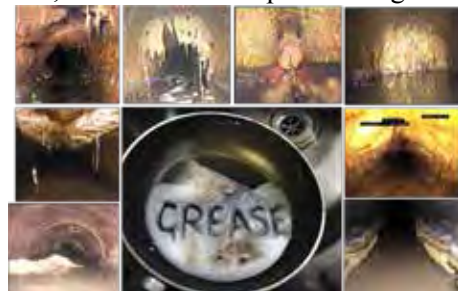
TV cameras are not effective in full or half full pipes, missing any defects located below the waterline. The result: 30 to 50% missed identification of defects. More dramatic in larger diameter pipes, major cracks and leaks tend to be where the water is located.



3. Grease

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.

In contrast, Electro Scan does not require a clean pipe to assess, even in cases of light to medium grease. Since grease represents a non-conductive material, Electro Scan's low voltage current is able to assess the pipe wall, with or without the presence of grease.



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.

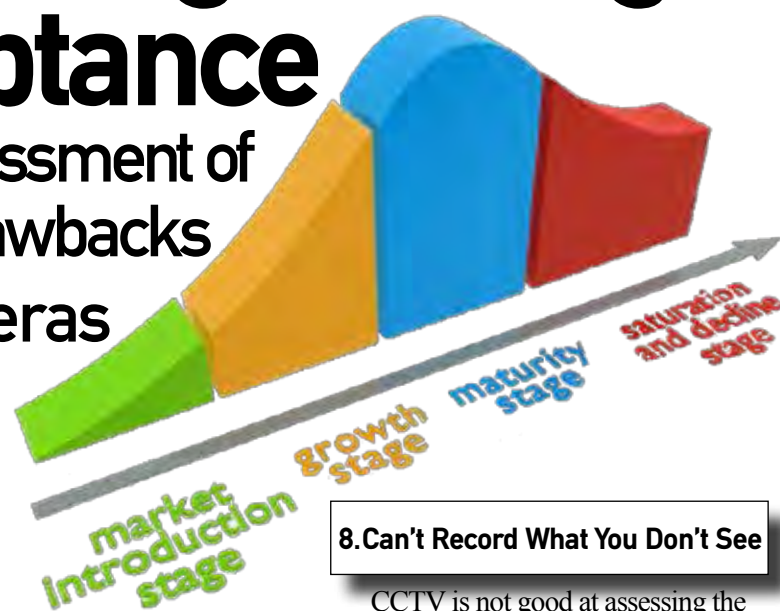
As a non-conductive material, Electro Scan measures the size of the opening allowing roots to flourish and is able to measure an estimated gallon per minute of defect flow, too.



5. Encrustations

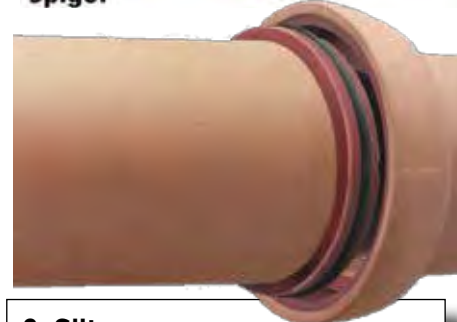
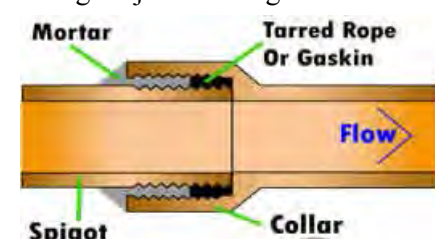
Another potential misdirection in terms of false-positive sewer condition assessment surveys can happen when TV operators catalogue *encrustations*.

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 still can be positively passed through to determine the location and size of a potential defect flow.



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 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.



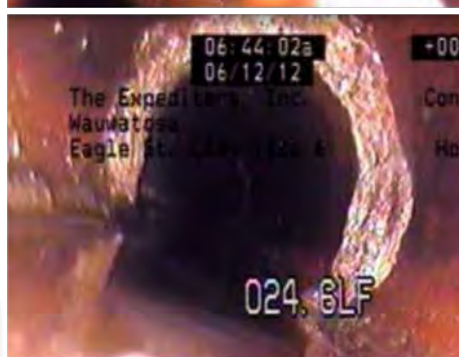
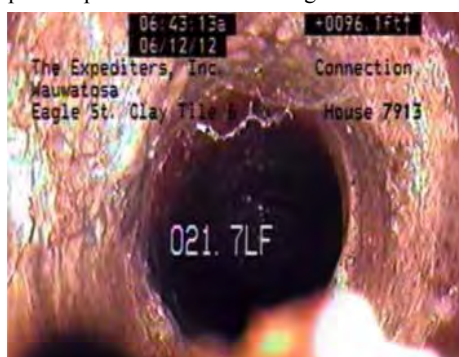
10. Clean v. Dirty Pipe Assessments

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.

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 actually did a worse job in locating defects as clues to locating leaks were removed, and therefore more difficult to see with a camera.



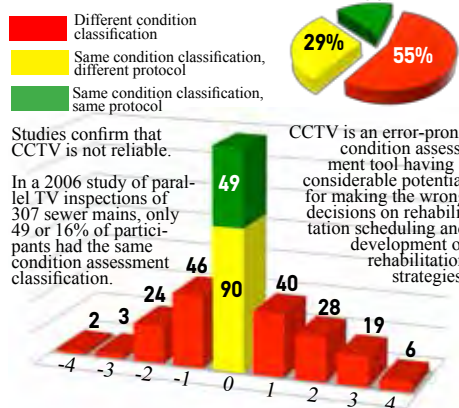
Below -- A sample series of encrustation call outs that passed a pressure test and found in good condition.



6. 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, too.

It's human nature and has been studied extensively, as shown below.



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 finding defects not found by television inspection, but also highlights why CCTV inspections should be limited, and not recommended to certify post-CIPP rehabilitation.

7. 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.

San Francisco Public Utilities Commission & Electro Scan Lead Water Reuse Efforts

Continued from Page 1

New Technology Helps Pinpoint Leaks & Increase Reuse of Reclaimed Wastewater

SAN FRANCISCO, CA -- June 30, 2015, Electro Scan Inc. announced that the San Francisco Public Utilities Commission has placed an order for a Sewer Leak Detection Van to help locate and measure defects that allow infiltration into its wastewater collection system.

The San Francisco Public Utilities Commission (SFPUC) is a leader in using green technologies to manage its water resources, waste recovery, and water reuse; however, it faces the same challenge as other global communities where coastal salt water seeps into sewers, reducing the ability to fully utilize reclaimed wastewater.

“Our industry’s long term goal is to achieve 100% reuse of our potable water,” states Lewis Harrison, Manager, Wastewater Enterprise, Collection System Division, SFPUC.

“But, with global warming, persistent drought, and an already high water table South of Market Street, it is important that we identify and patch unwanted openings into our combined sewer system to minimize salt water intrusion.”

“With Electro Scan, we will have a new technology to find leaks and help reduce salt water entering our system so we can increase the beneficial reuse of our reclaimed wastewater,” explained Harrison.

Using its patent pending technology, Electro Scan automatically measures the variation of electrical current that flows through cracks and defects in pipes without relying on closed-circuit television (CCTV) cameras, acoustic sensors, or third party data interpretation.

Results are immediately available in the Company’s award-winning Critical Sewers® cloud application.

“This specialized van identifies defects that are not typically seen by operators using camera based systems,” commented Douglas J. Lipps, P.E., Mechanical Engineer, Engineering Division, SFPUC.

“More importantly, it provides an estimated rate of infiltration in gallons per minute, for each defect and the entire pipe, to help prioritize our repairs,” states Lipps.

Electro Scan’s low voltage technology is also the leading method to certify and accept rehabilitation, relining, and repairs for water and sewer pipes which previously relied on acoustic or CCTV inspection techniques.

“I am delighted to support the resource recovery initiatives at SFPUC and help California achieve its goal for recycled water use,” states Chuck Hansen, Chairman and CEO, Electro Scan.

“New technologies, like Electro Scan, not only find problems that were previously undetected, but often change the way we prioritize rehabilitation and deliver needed benefits, sooner,” explains Hansen.

Each non-rainy day an average of 80 million gallons of wastewater is collected and transported to one of SFPUC’s two treatment plants.

When it rains, SFPUC’s wastewater system can collect and treat up to 575 million gallons a day (MGD) through a network of 1,000 miles of pipe.

High salinity or shock loads of sodium chloride adversely affect organic removal at the treatment plant, lowering the efficiency of the treatment process and lowering reusable water levels.

Additionally, high levels of unwanted water in a collection system means higher treatment and transportation costs due to greater pumping and electricity costs, contributing to higher CO₂ emissions.



A beautiful day on Embarcadero, South of Market, working with our newest customer, San Francisco Public Utilities Commission.

The Company’s selection is an integral part of SFPUC’s ongoing commitment to pursue cleaner, greener, and smarter strategies to help manage its business.

Earlier this year, Electro Scan was awarded Best Project by the United Kingdom Society for Trenchless Technology. Previous awards include Best CleanTech Company (The New Economy Magazine), Best Technology Innovation (Water Environment Federation), and Best New Product (North American Society of Trenchless Technology).

Available as either a standalone mobile van or added to an existing CCTV truck, Electro Scan is able to assess pipes at the rate of ~50 feet per minute and estimate defect flows in gallons per minute, operated in accordance with ASTM F2550-13.

Electro Scan Inc. expects to deliver its standalone Leak Detection Van by year end and has already begun working on several demonstration projects allowing SFPUC to hit the ground running upon delivery of their new system.



It’s not only important for SFPUC to reuse water during the severe California drought, but to also keep the San Francisco Bay healthy and clean.

United Septic-Grease Joins Growing List of Contractors

When shopping for a new CCTV truck, United Septic visited their long-time dealer, EJ Equipment in Manteno, IL. Electro Scan’s ES-620 for Sewer Mains system was integrated onto EJ’s Electro Scan-CUES CCTV combo truck.

Eric LeSage, Chicagoland Sales, EJ Equipment, explained Electro Scan’s accuracy in locating and measuring defect flows in sewer mains, along with production rates up to 3x that of CCTV. Eddie Auer, Owner United Septic, made the decision to add Electro Scan’s main-line system to their CCTV truck order, fulfilling their commitment to use the best technologies to get jobs done right - the first time!

EJ Equipment delivered United Septic’s Electro Scan-CCTV combo truck and training began the week of April 20th. United Septic prides itself on providing an array of products, from sewer cleaning to

the latest in sewer main leak detection.

Electro Scan is delighted to have United Septic, Chicagoland’s leading septic, lateral, and sewer cleaner for over 30 years, as its customer.

Please contact United Septic with all Electro Scanning needs in the Chicago area.



1327 Beecher Road W
Bristol, IL 60512

Phone: +1 888 301 1118
Email: info@unitedseptic.com
Visit: www.unitedseptic.com



In Memory of Ken Kerri

April 25, 1934 - December 15, 2014

By Chuck Hansen

It was just a year ago that Ken gave his last public presentation, titled The Evolution of Collection System Best Practices, at WEFTEC in New Orleans.

Steve Tilson, Laurie Chase, and I had the opportunity to co-write the paper, but it was all about Ken and what he had accomplished.

We met at the Electro Scan offices before Ken and his wife, Judy, took off on their trip to Scotland, where he was joined by members of his church. Ken had frequently stopped by our offices, which were home to where I started Hansen Software, which later turned into Hansen Information Technologies Inc., with my Dad and older brother. Ken was interested in how we were developing our software and what new features were being added.

It seemed like old times when I started Electro Scan in the same offices we started Hansen. In fact, Ken was on our original due diligence team before buying the technology, when he famously told me that, “if the technology did half of what people say it can do, it will change the industry.”

Ken co-wrote the Electro Scan chapter that will be appearing in the next edition of Volume 1 of the O&M Manual, and urged us to modify the technology so we could find leaks in water mains, like we were finding in sewers.

Like my own Dad, Ken was a visionary and his insight, human kindness, and rye sense of humor will be sorely missed.

The world was a better place with Ken in it, and I hope his light will be a guide for all of us as we move forward in our journeys.

- Chuck



Dr. Kerri at Electro Scan headquarters checking out the integration of the ES-620 into existing CCTV van.

Separating Good Point Repairs from the Bad

Lately, Electro Scan has been seeing a lot of point repairs that should never have been done - like finding CIPP projects that leak more than their pre-CIPP condition. Sewer agencies and consulting engineers expect many of these repairs to bring their pipes up to a 'like new' condition that they can highlight on their Geographic Information System (GIS) and report to their City Council or Board.

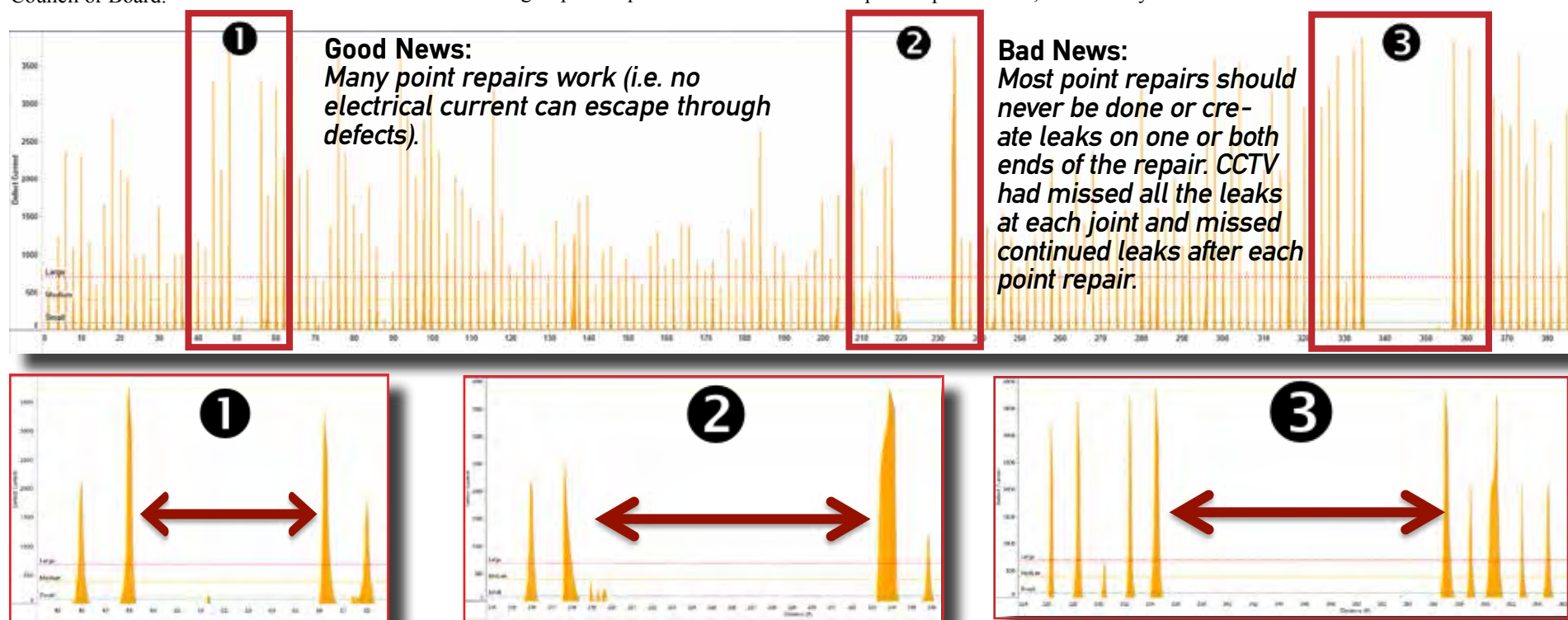
However, unless a sewer agency has completed an emergency point repair resulting from a blockage, many sewer mains are ticking time-bombs that more than likely had a number of defects not seen by their CCTV operator, before or after the repair.

One city in Ohio actually told us they had a backlog of point repairs in the

hundreds, based on CCTV inspections, but currently Electro Scan testing indicates almost 75% of all point repairs should never be done in the first place. A good rule of thumb: if more than 15% of your sewer main has severe defects, another rehab method should be recommended and pursued.

If a point repair is done, make sure you

specify low voltage conductivity testing to make sure that your repair has not created leaks at both ends of your point repair. As shown in the example below from a Northern California sewer agency, the point repairs eliminated the majority of leaks, but left larger defects at the end points, and probably should never have been done in the first place.



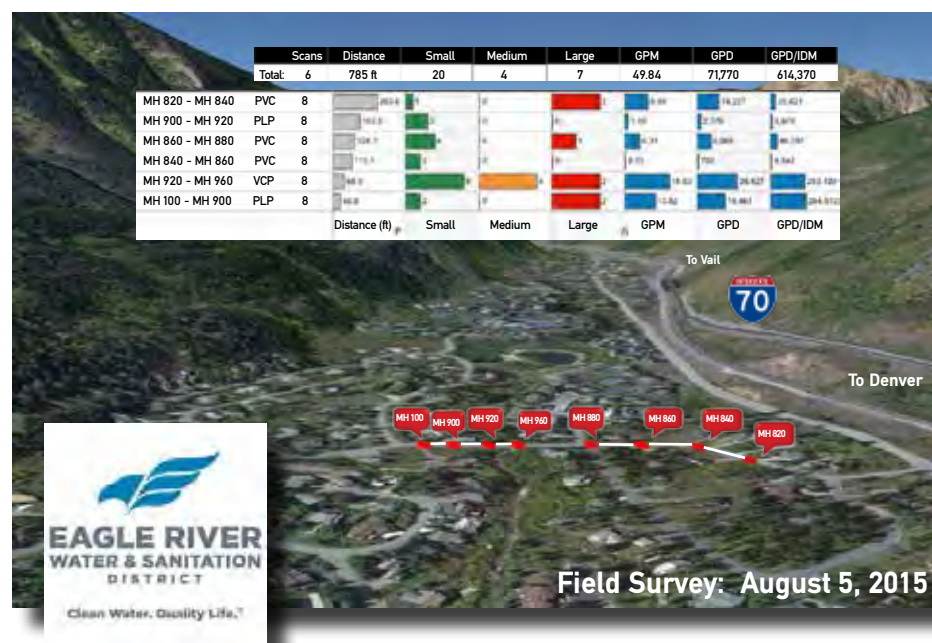
Eagle River Water & Sanitation District Challenges Electro Scan, Leads to 50,000 Foot Project

VAIL, CO -- After attending the Electro Scan Trenchless Technology Webinar in June, the friendly folks at Eagle River Water & Sanitation District (ERWSD) invited Electro Scan to stop by if ever in the neighborhood.

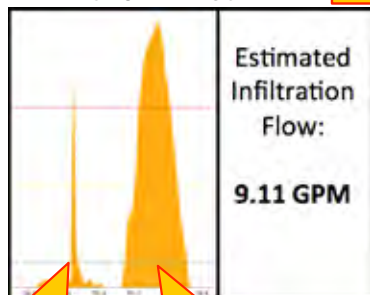
Dropping in August 5, 2015, it was clear that ERWSD had done their homework. Pre-selecting pipes to have us scan, they already knew the defects that they wanted to see if Electro Scan could detect, and had a

'hard to televise' sewer main that ran under a creek and always seemed to be running full [NOTE: See MH 920 to MH 960]. After results were delivered the same day, ERWSD requested a proposal for 50,000 ft of Electro Scan testing to be completed in October, 2015.

A warm thank you to Eagle River Water & Sanitation District's I&I Team for their hospitality and time. We look forward to working with you in the near future.



MH 920 to MH 960



Crack in Pipe

Defective Lateral



Crack in Pipe

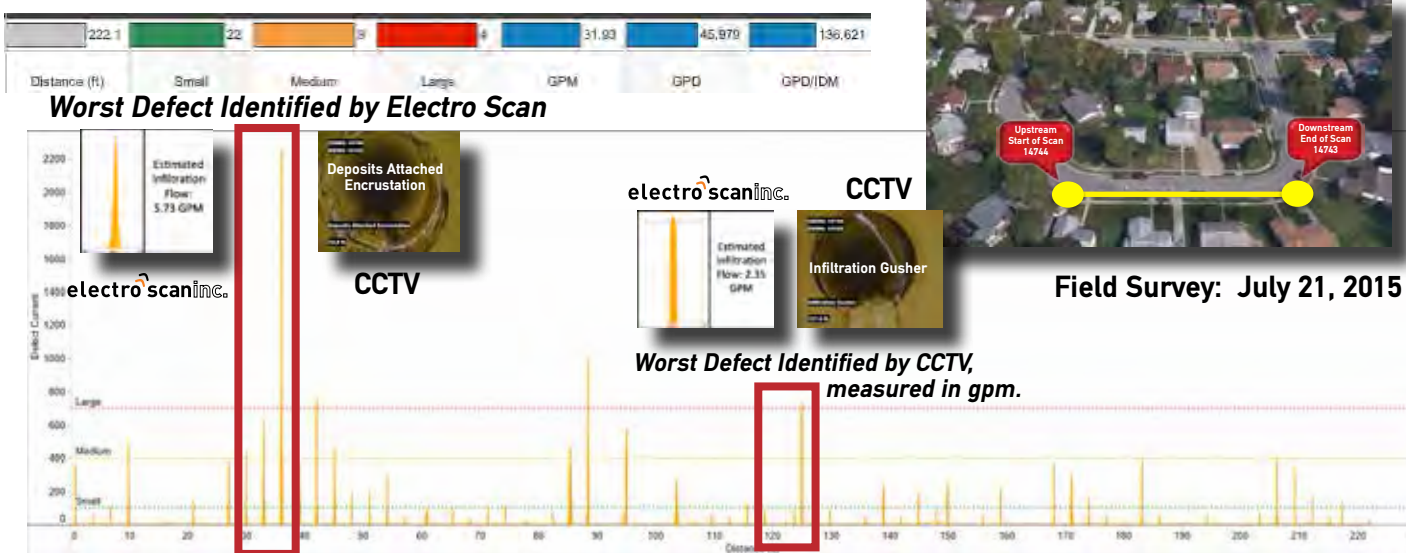
Defective Lateral

Electro Scan Draws Crowd of Engineers in Baltimore County, MD

PARKVILLE, MD -- Electro Scan was hosted by engineers from Baltimore County, including special guests from Washington Suburban Sanitary Commission, where an 8" diameter, 222 ft, Vitrified Clay Pipe (VCP) was assessed and compared to a previous Closed-Circuit Television (CCTV) inspection.

Interested readers should contact Electro Scan for a copy of the 51-page report. Side-by-side comparisons of Electro Scan vs. CCTV were not only supplied for the worst defects as identified by CCTV, but also the worst defects as identified by Electro Scan.

As expected, and shown in multiple EPA and other benchmark comparisons, Electro Scan not only identified and quantified defect flows for each CCTV defect, but also identified and quantified defect flows not found by CCTV. Total Combined Estimated GPM Leakage Rate: 31.93.



THE GOOD, THE BAD, AND THE UGLY OF CIPP

Successful CIPP

- Zero Leaks
- Zero Conductivity Spikes
- Zero Defect Flow Rating



Unsuccessful CIPP

- Leaks, Liner Tears, Wrinkles, Over-Cook Boil Marks, etc.
- Defective Service Re-Connections
- Defect Flow Rating > 50 GPD/IDM



CIPP "Do Over"

- Post-CIPP Defect Flow > Pre-CIPP Defect Flow



THE GOOD



THE BAD



THE UGLY



Electro Scan’s low voltage conductivity technology has forever changed how CIPP projects are accepted and certified for leakage, before and after rehabilitation.

While high resolution closed-circuit television (CCTV) inspection has been the preferred inspection standard by manufacturers supplying their recommended specifications, recent USEPA studies, Utility Customers, and Consulting Engineers have consistently found defects not found by visual inspection techniques.

It is not surprising that pipe manufacturers, lining suppliers, specialty contractors, and engineers are looking for ways

to improve their product’s quality control procedures in response to a growing number of owners specifying advanced diagnostic techniques, like the use of Electro Scan, to ensure pipe wall integrity.

Owners are recommended to include the following on their upcoming CIPP and Point Repair RFPs:

“The City reserves the right to certify all Point Repairs and Cured-In-Place-Pipe lining using low voltage conductivity testing instrumentation in accordance with ASTM F2550-13 and USEPA benchmarks.”

As stated in ASTM F2550-13, Standard Practice for Locating Leaks in Sewer Pipes By Measuring the Variation of Electric Current Flow Through the Pipe Wall (Section 8.5.1):

“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.”

A. Things We See & Hopefully Have The Contractor Fix



B. Things We See, But Don't Know If We Should Fix



Time to specify Electro Scan.

C. Things We Don't See & Don't Know We Need to Fix



Electro Scan finds leaks not detected by CCTV inspection.

Get Certified Online Today

“We hope to educate & certify Directors, Consulting Engineers, and Sewer Contractors to take advantage of our game-changing technology.”

Director of Sales & Marketing





Helpful Illustrations or Video Clips

Variety of Formats Multiple Choice True or False Polling

Based on nearly 300 Electro Scan projects, it is estimated that TV inspection misses from 40% to 100% of all defects related to finding leaks. While televising of sewer generally occur during dry weather conditions, Electro Scan’s ability to simulate wet weather conditions represents a breakthrough in modern pipe condition assessment. As shown below, the certification of lined CIPP using Electro Scan has many advantages over CCTV inspection.



\$495.⁰⁰ per person

Contact us directly to get a quotation for a multi-user discount for more than five (5) people from the same sewer agency. International orders are welcome.





Susan Aguirre



Another Hat Trick for Electro Scan: Revenues Triple (Again)

In sports, achieving a feat three times in a game, or other accomplishment, is often called a hat trick. Electro Scan has done it again. Growing international acceptance to certify CIPP lining projects, the ability to retrofit additional CCTV cables & reels, and added seat licensing to access Electro Scan's Critical Sewers® software-as-a-service cloud application, continues to drive revenues to record levels.

elektro scan GmbH

Lyoner Straße 14,
Frankfurt, D-60528

Telefon: +49 69 6655 4132
Company Number: HRB 100935



electro scan (europe) limited

St. Mary's Place
Dublin D07 P4AX, Ireland

Tel: +35 3 (0) 1 687 4514
Company Nr: IE 3237750VH



electro scan australia pty ltd

365 Little Collins Street, Suite 504
Melbourne VIC 3000
AUSTRALIA

Tel: +61 3 8609 1246
ACN: 603 205 885



electro scan (uk) limited

71-75, Shelton Street
Covent Garden, London, WC2H 9JQ
ENGLAND

Tel: +44 (0) 20 7692 8729
info@electroscan.co.uk
Company Nr: 9211607



City of Rialto Utility Commissioners Host Electro Scan

The City of Rialto is part of a fast growing trend in the municipal sewer and water market called a 'P3' or Public-Private Partnership. In 2012, Rialto finalized its new 30-year partnership program with, private equity firm, Table Rock Capital.

This partnership relieves the City of maintenance, upgrading, and management responsibilities. Table Rock awarded Veolia North America the primary care contract for the duration of the partnership.

Veolia began investigating Electro Scan technology and a demo was completed in June of 2015. Electro Scan, in association with Veolia Water, surveyed three pipe segments, at two separate locations, finding a total of 23 Large, 8 Medium, and 47 Small Defects.

The first of the two VCP pipes was in relatively good shape, but the same could not be said for the second. The second pipe showed major defects with approximately 82% of the defects found in the last 50 feet of the pipe, as was confirmed by Veolia's CCTV inspection results.

The last pipe was CIPP and estimated that this 654ft segment was lined nearly 20 years ago, the original pipe being VCP. Over nineteen (19) Large Defect locations were found indicating a complete failure of the liner.

Electro Scan wishes to thank the City of Rialto and Veolia for the hospitality and a great day of scanning.



Clarence Mansell, GM, City of Rialto, June D. Hayes, Vice Chair, Utilities Commission of Rialto, Daniel Villanueva, PE, Contract Manager, City of Rialto, Matt Campos, West Coast Field Tech, Electro Scan Inc., Paul Herman, Collection System Manager, City of Rialto, Robert Eisenbeisz, PE., Directory/Chief Engineer, City of Rialto

Scott Hansen, Electro Scan Inc., pre-programs manhole ID's and prepares to start and stop scans.

D.M. Robichaud Associates Ltd. To Offer Exclusive Electro Scan Services in Ontario Province, CANADA

There have been several firsts with D.M. Robichaud - they are the first Canadian Contractor to offer Electro Scan Services as well as the first contractor to be granted Contractor Exclusivity in a territory, that being where they are headquartered in the Province of Ontario. D.M. Robichaud prides itself on offering the highest level of products and services, and quickly became the ideal contractor to bring Electro Scan technology to the Canadian market.

"We want like-minded companies that are willing to seek out and offer the best technologies in the trenchless industry, and D.M. Robichaud does just that. It has been great working with their diligent staff," commented Macy Grubbs, Director of Field Operations, Electro Scan Inc. "We are happy to have our technology with a company that pushes its clients to look outside of legacy technologies, bringing them the latest and greatest in sewer leak detection and condition assessment with Electro Scan."

Propelling their clients forward by providing "turn-key" solutions, D.M. Robichaud added Electro Scan technology to its trenchless arsenal, completing training during the last week of June.

"We pride ourselves on providing the most innovative and cutting-edge technologies to all of our trenchless customers, so adding Electro Scan was a must," commented Shane Magee, CEO, D.M. Robichaud. "We have long been working with Ontario's largest municipalities, and are delighted to bring Electro Scan to help combat their I&I issues."

Please contact D.M. Robichaud for all of your trenchless needs in Canada.



(Above) D.M. Robichaud's friendly staff.

D.M. Robichaud Associates Ltd.
Specialists in Trenchless Sewer Rehabilitation

627A Wentworth Street East
Oshawa, Ontario L1H 3V8

Phone: +1 905 433 1261
Fax: +1 905 432 2809
Email: info@nodig.ca
Visit: www.nodig.ca

(Below) Electro Scan training and demonstration with D.M. Robichaud field crews in Ontario, Canada.



Short Elliot Hendrickson Inc. Engineers Host Demo Tour of MN, Leading to Electro Scan Testing Projects

After meeting with Electro Scan reps at a No-Dig Conference, Paul Pasko Principal and Project Manager for Short Elliot Hendrickson Inc. (SEH®), spent some time doing his due-diligence on the technology. Feeling very optimistic with what he learned, he invited Electro Scan's Pete Dannenberg to Minnesota for a full week of demos at the end of April.

Needless to say, Paul and his associates at SEH were anything but disappointed. After effectively demonstrating Electro Scan technology to Minnesota municipalities Eagan, Golden Valley, Edina, Mankato, and Chanhassen, Paul immediately began working Electro Scan technology into pre- and post-condition assessment projects.

The City of Golden Valley had a problem that demanded immediate attention, and once they saw what Electro Scan could do, they knew it could help them out with the issue. As it turns out, the mayor of Golden Valley wanted to construct a community center, but unfortunately, the sanitary sewers in that sub-basin were already at capacity due to excessive infiltration. Knowing they had to locate, quantify, then remediate the infiltration, Golden Valley immediately had SEH and Electro Scan begin scanning with a 21" interceptor located at Laurel Avenue. This pipe was in a known wet-soil condition area and was a highly suspected infiltration issue.

Of the almost 1,700 lf scanned, Electro Scan was able to locate 291 defects with a combined estimated infiltration

rate of 469,872 gallons per day. In spite of the pipe running half-full, which would have caused excessive delays and costs for most other technologies like CCTV, Electro Scan was able to complete the work in a single day, while SEH had a film crew document and highlight Paul's work with Electro Scan technology.

Please visit www.sehinc.com to watch the video and learn more about how SEH is using Electro Scan.

Since the pre-assessment of Laurel Avenue, the decision was made to rehab the pipe segment using a CIPP liner. Electro Scan technology has been chosen to certify that liner once the installation is complete.

Starting the week of August 10, Electro Scan was back on site with SEH in the City of Golden Valley to investigate other areas of potential infiltration within the same sewer shed as the previous 21" interceptor. Electro Scan testing of 27 mains totaling 7,200 ft was performed in 1.5 days. Almost 1,300 defects were detected, measuring a combined estimated potential infiltration flow of over 721 gallons per minute (gpm), including locating some defects in circumspect locations that were quickly considered "high contributors".

One of the biggest advantages of using Electro Scan technology is being able to quickly find and address the worst pipes based on potential defect flows. In the case of the Laurel Avenue Project, the worst 8 sewer mains were responsible

for 568 defects and 60% of the defect flows.

As an example, if Golden Valley only rehabilitated the worst 8 pipes, or 30% of the total project, they could expect to reduce their potential infiltration by 60%. Rehabilitating the 8 pipes that are in the best condition might be saved for another time, as the City could find other areas to where money could be better spent on rehabilitating pipes with greater flows.

Golden Valley is considering integrating Electro Scan onto an existing Cues CCTV truck in 2017.



(Above) ES-620 for Sewer Mains, Grounding Reel, and Sliding Funnel Plug.



(Above) Paul Pasko, Project Manager for the Laurel Ave. Project alongside Pete Dannenberg, Electro Scan Inc., with film crew on site.

Electro Scan Awarded 'Best Project' UK Society of Trenchless Technology

BIRMINGHAM, ENGLAND, UK -- Electro Scan (UK) Limited has won the 2015 Best Project Award as announced by the United Kingdom Society for Trenchless Technologies (UKSTT), completed in partnership with CPS Environmental on behalf of Severn Trent Water Plc.

The project was the largest and most comprehensive comparison of the Electro Scan technology and Closed Circuit Television (CCTV) inspections using the WRc Manual of Sewer Condition Classifications.

The award was presented at the UKSTT's Annual Dinner & Awards Ceremony held April 24, 2015 in Birmingham, England.

"I am proud that our UK company was selected for this prestigious award," states Mark Grabowski, General Manager of US-based Electro Scan Inc.

Working under the guidance of Severn Trent's in-house engineers and project managers, the project was conducted in an English village that had experienced persistent and unexplained sewer flows.

CCTV had been used on multiple occasions so a key objective of the project was to determine if Electro Scan could identify and measure defects not found by previous visual observations.

"Debris, surcharged pipes, and fats, oils and grease (FOG) make it difficult, if not impossible, to use CCTV to accurately determine defects or their severity," states Grabowski. "By using our [Electro Scan] low voltage leak detection technology we allow users to automatically locate and estimate defect flows."

Result: Electro Scan's international patent-pending technology not only identified a number of potential sources of infiltration, not seen by previous CCTV inspections, but provided estimated defect flows for each sewer main and each identified defect.

While Electro Scan completed 100% of the survey area, by comparison CCTV completed only 75% of the same area, due to numerous survey abandonments.

Leakage rates were estimated in litres per second (l/s) with results available within minutes from the Company's Amazon Web Services (AWS) Critical Sewers® cloud application.

"Electro Scan, it's the future," comments Neil Walton, Managing Director of CPS Environmental, based in Southwell, Nottinghamshire, East Midlands.

"The cost of incorrectly diagnosing pipe conditions using legacy inspection techniques can neg-



Pictured Left to Right. Ian Ramsey, Chairman, UKSTT and Director of Fluvius, Chuck Hansen, Mark Aspinall, Sales Manager, Vp plc, Neil Walton, Consultant Property Services Ltd., and Chris Packham, Naturalist.

atively impact a water utility's CAPEX, OPEX, and TOTEX," says Chuck Hansen, Managing Director, Electro Scan (UK) Ltd.

The UKSTT's Best Project Award (Small Scheme Category) is based on technical or professional excellence as well as demonstrated innovation and protection of the environment.



Over 500 Attend Electro Scan Trenchless Technology Webinar

Electro Scan wishes to thank all of its online participants that attended its June 3rd webinar, especially its guest speakers:

Rod Lovett, Chief of Wastewater Collections, Miami-Dade Water & Sewer Department, FL

Casey Smith, Executive VP, Compliance EnviroSystems, LLC, Baton Rouge, LA

Sharon Purnell, Manager, Hamilton Township Municipal Authority, PA

For those of you that missed attending our first ever Trenchless Technology Webinar, we will be scheduling a follow-up, including information on our new Water Leak Detection Services and 4-in-1 Low Voltage Conductivity Probe in early 2016.

In the meantime, if you would like to download a copy of the 78-page slide stack, in either PPT or PDF format, just email us at info@electroscan.com and we will be delighted to share a link.

Thank you for making this event a success!



Trenchless TECHNOLOGY

Webinar

Pre- and Post-Rehabilitation Condition Assessment Using Electro Scan

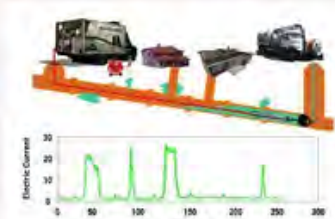
Registration URL:
<https://attendee.gotowebinar.com/register/5684592029709852929>

Gain deeper understanding of how Electro Scan technology is used to prioritize rehab projects and certify newly installed pipe and liners in sewer mains and laterals. Get first hand small agency, large agency, and contractor perspective of their experience with Electro Scan technology and how it is being implemented into their SSES and CMOM programs.

Highlights will include applications, comparisons to other assessment techniques, lessons learned, and how the technology is changing the way sewer systems are being evaluated.

Electro Scan, governed by ASTM F2550-13, is changing the pipeline inspection market by locating defects and measuring (in GPM) their potential for infiltration during wet weather events. For the first time, Owners are able to prioritize rehab projects based on GPM defect flows to get the biggest reduction in infiltrating wastewater treated in their facilities and avoiding regulatory repercussions from SSOs.

Allowable infiltration thresholds are now becoming the basis of how Owners are certifying and accepting rehab projects. Additionally, participants will learn how Electro Scan is being used to help identify locations of potential exfiltration in sensitive ecological areas.



Date: Wed., June 3, 2015

Time: 2:00 PM - 3:00 PM EST

Cost: Free for attendees

[READ MORE INFORMATION OR REGISTER](#)

Seating is limited, so register now to secure your spot in this educational opportunity. We hope to see you online!

Once enrolled, you will receive confirmation with login instructions and a link to the live event. Please test your system prior to the webinar date to ensure any updates or downloads are completed.

NEWS BRIEF

Bristol, ENGLAND -- 20 October, 2015, Electro Scan (UK) Ltd's Chairman, Chuck Hansen, is guest presenter at UKSTT's Road Show.

California State Water Quality Board -- Pete Dannenberg & Carissa Boudwin Electro Scan Inc., presented findings of the Dana Point Baby Beach Project on behalf of Mark Grabowski, GM, Electro Scan Inc., to the Beach Water Quality Working Group in both Costa Mesa and Castro Valley, California.

Carmel, CA -- Reported that conservation efforts have been so successful in Carmel-By-The-Sea that wastewater has been reduced to the point that Pebble Beach is looking for more water as it reuses all the treated sewage that Carmel can produce.

Coos Bay, OR -- September 16, 2015, City Council members approve the purchase of an Electro Scan ES-620 for Sewer Mains system.

EBMUD, CA -- The USEPA included the Focus Electrode Leak Locator (FELL), also known as Low Voltage Conductivity and Electro Scan, as part of East Bay MUD's 2014 Consent Decree.

Hamilton Township, PA -- On August 5, 2015, Hamilton Township Municipal Utility Authority completed 5,551 ft of scanning, in addition to dealing with an emergency dig & replace of a collapsed pipe. Congratulations for the new record for *Total Distance Scanned in a Single Day!* Chuck Hansen looks forward to attending the Annual BBQ Wednesday, October 14th.

Huber Heights, OH -- New specifications for CIPP will be issued requiring the sewer lining contractor to have its sewer mains scanned pre- and post-CIPP.

Gelsenkirchen, GERMANY -- September 8-9, 2015, IKT attendees gets a glimpse of Electro Scan's 4-in-1 solution for pressurized water mains.

Muscataine, IA -- On September 8, 2015, City Council members approve Low Voltage Conductivity Testing project.

NASSCO -- Jerry Weimer, formerly with Metropolitan Sewer District of Greater Cincinnati, has joined Jack Doheny Companies as Director of Doheny Technical Institute and is also Chair of NASSCO's Industry Standards Committee where he begin making revisions to operating manuals to include Electro Scan.

Richmond, BC, CANADA -- Mark Grabowski and Carissa Boudwin will be in BC at the Trenchless Technologies Roadshow, and scheduling demonstrations in BC before and after the meeting.

Sacramento, CA -- Electro Scan Announces Game Changing Water Leak Detection Technology. 4-in-1 Probe for pressurized water mains features low voltage conductivity, acoustic sensor, pressure sensor, and HD CCTV.

Sacramento, CA -- September 18, 2015, Electro Scan send "Best Wishes" to Susan Aguirre, as she begins her final year at CSUS and begins work at Elk Grove Water District in their Water Treatment Plant Department.

San Francisco, CA -- September 15-16, 2015, Mark Grabowski and Matt Campos begin training SFPUC staff prior to delivery of Electro Scan Leak Detection Van.

Tallahassee, FL -- Electro Scan's Development Team made custom modifications to the City's Critical Sewers® to better identify their manhole locations.

Upper Montgomery Joint Authority, PA -- After completing two Electro Scan projects, UMJA is set to release CIPP specifications to recommended low voltage conductivity testing. Electro Scan will be doing post-CIPP inspection as part of UMJA's acceptance requirements.

Vail, CO -- October 4, 2015, Electro Scan's West Coast Field Team began Electro Scanning 50,000 ft of sewer mains for Eagle River Water & Sanitation District.

YouTube, WaterElectroScan Channel -- September 18, 2015, one week after Electro Scan posted "2015 Announcing the Next Generation in Water Leak Detection" to its YouTube account, the video gains a record 37,396 views!

Electro Scan Testing Finds Potential FIB Sources at California's 'Baby Beach'

The Problem

Baby Beach is a small man-made beach in the northwest corner of Dana Point Harbor, in California. Because of its calm and protected waters, the beach is popular with families with small children and with those who enjoy recreational activities like paddle boarding and kayaking. The Beach had a major closure due to bacteria in 1996 and has continued to experience periodic exceedances of fecal indicator bacteria (FIB) water quality objectives, despite extensive efforts to identify and eliminate bacteria sources. Throughout the year, Baby Beach must be frequently closed due to high FIB levels, especially after rainfall events, for a minimum of 3 days, sometimes more.

Project Approach

As a result, a microbial source identification study was initiated to identify and eliminate anthropogenic sources in accordance with the California Microbial Source Identification Manual: A Tiered Approach to Identifying Fecal Pollution Sources to Beaches developed by the Southern California Coastal Water Research Project.

A phased work plan was developed by Orange County and steps were undertaken to investigate and identify likely anthropogenic FIB sources. Verifying the integrity of sanitary sewage conveyances became a top priority for investigating FIB sources, as human sewage carries a high human bacterial pathogen load relative to non-human fecal sources. In addition, coastal infrastructure in Southern California is typically aged and subject to corrosion from saltwater contact. Another factor can be tidal infiltration, where infiltration occurs through pipe leaks and other openings, causing pipes to fill during high tides then exfiltrate as the tide goes out, taking untreated sewage with it.

Hence, an investigation was initiated to verify that the local sanitary sewer was not leaking onto the beach. Previous investigation efforts at Baby Beach have included CCTV inspections and dye testing of the local infrastructure. After Orange County Environmental Division and California State Water Resource Board Managers learned of Electro



Baby Beach, Dana Point, California

The Baby Beach Bacteria Source Investigation Project study area included all active and accessible sanitary sewer lines (about 1800 lf surrounding the beach). The sanitary sewer system within the area of concern is comprised of a heterogeneous mixture of piping materials including VCP, CIPP, and two types of PVC. In spite of the concern of the possible pollution coming from the adjacent marina, the sensors indicated the marina's water was clean, and the bacteria were present only in the waters at the beach area.

Electro Scan was the inspection method of choice where feasible, due to its accuracy, efficiency, and speed at which testing is carried out. A total of fifteen (15) test segments were evaluated. Results indicated that nine (9) of the fifteen (15) test segments are not "water tight".

Many low-level faults were observed within the test segments, and several more significant faults were identified which require follow-up repair. Orange County determined that the achievement of 100% certainty that no leaks occur in the system would require replacement or slip-lining of the failed test segments.

All of the test segments, their results, and recommendations can be seen in the table below. It can be seen that of the nine (9) test segments scanned with Electro Scan, Electro Scan was chosen as the final result-determining method for seven (7) of the segments. For the nine (9) test segments scanned by Electro Scan, a total of 293 defects were located, which had a combined estimated leakage rate of 291.04 GPM, assuming a 1 ft. head over the pipe.

Why Project is Outstanding

The Baby Beach Bacteria Source Investigation Project had several unique features in terms of industry advancement, interaction and cooperation that set it apart from other projects. These features include the use of newer innovative technology (Electro Scan) in addition to legacy methods, the large variety of technologies used during the project, the great amount of interest by not only companies and public agencies involved with the testing, but with many outside the project, and the use of this project as a model for other coastal cities and agencies.

Electro Scan was chosen to be included in this project due to its accuracy, efficiency, and speed at which testing is carried out. However, there were several other benefits to using Electro Scan that greatly enhanced the execution and results of this project. One such benefit is that the lines did not have to be taken out of service and could remain in use during testing. With the Ocean Institute open seven days a week,

In addition to the significant amount of local agencies with vested interest, the project received a large amount of interest from a plethora of companies and other public agencies. Many different agencies had heard of the project and were on site to witness it, including American Leak Detection, the City of Carlsbad, the City of Huntington Beach, the City of Newport Beach, the City of Oceanside, and Rock Springs. Presentations



Sample Electro Scan Sewer Data, overlaid with map, showing location of worst leaks.

including many nights where they host school groups for educational sleep-overs, taking sewers out of service would have been difficult. Additionally, as mentioned earlier, speed without a reduction in accuracy is important. With most of the work being located in a busy Orange County beach / park, the pedestrian traffic was high. Having a highly accurate assessment technology that takes only 10-15 minutes per pipe segment was beneficial for speed of production, allowing for minimal park disruption and for minimal traffic (vehicular and pedestrian) control.

With the ever-worsening California drought, water is becoming more and more precious within the state. Unlike hydrostatic testing which needs the pipe fully flooded, or CCTV inspection where the sewer needs to be cleaned ahead of time, the Electro Scan process utilizes only a small slug of water to surround its probe, which gets moved through the pipe along with the inspection probe, thanks to the design of the Electro Scan Sliding Funnel Plug. This allows for minimal water usage and helps utilize the pipe's effluent flow, which adds up to minimal environmental impact.

Yet most importantly, the main benefit was that the test results obtained by Electro Scan survey far-exceeded conventional testing methods in detail, sensitivity, and efficiency. With the public mains' elevations ranging from 4.72-feet above sea-level to 2.40-feet below sea-level, it can affect whether a defect results in infiltration or exfiltration, and the ability to locate those defects using more traditional methods such as CCTV. For example, if a defect is not actively infiltrating it may not be seen on CCTV and if a defect is a source of exfiltration it may be missed since CCTV can only view the inside of the pipe. However, the Electro Scan test method is capable of identifying areas of both infiltration and exfiltration during the same survey. Electro Scan can also be used in situations where it's difficult to perform other tests. In regards to one lateral tested (Test Segment #9, above), multiple changes in direction prevented installation of a temporary test bladder to properly isolate the segment for hydrostatic or low-pressure air testing, so Electro Scan was used instead.

on the project and its subsequent results have also been provided to many interested parties, including the California State Water Resources Control Board at their annual meeting.

Finally, since the Baby Beach Bacteria Source Investigation Project compared several different technologies against each other, this project can be used as a benchmark for future projects. Baby Beach is far from being the only beach with FIB exceedances, and accurately identifying and quantifying sources of infiltration and exfiltration is a difficulty for many coastal cities and municipalities. Several of these cities have reached out and expressed interest in doing their own projects using the Baby Beach Bacteria Source Investigation Project as a model for their own.

Currently, the rehabilitation of the pipes is being planned based on the Figure 3 chart (left) featuring the Results Summary. Clean out and lateral lines have already been repaired and retested, and have been determined to be "leak free". The two pipes that belong to The Ocean Institute are currently in the process of being repaired with manhole seals and spot lining. Manhole seals and CIPP lining for the mainline sewers will be out to bid shortly by South Coast Water District. Once the work is performed, it is expected that the FIB exceedances at the beach will be a thing of the past.

While the Baby Beach Bacteria Source Investigation Project may not be the largest or most expensive project, it was definitely a unique, exceptional, and outstanding one. The combination of newer innovative technology along with a wide variety of legacy technologies provided a more comprehensive data set since the various technologies had different strengths and weaknesses. Additionally, by comparing these technologies amongst themselves, the project can and will be used as a benchmark and model for future projects by coastal agencies. As a result, the project's execution and results have been of high interest to many different cities, companies, and influencers, setting it apart as a prime example of an outstanding and important project.



Project Map.

Scan, it was recommended to use its low voltage conductivity technology to undertake an advanced inspection survey of the sewer. Using the electrical conductivity test method that Electro Scan utilizes, it would be a more definitive means of determining sewer system leakage. To complement Electro Scan, a combination of other leak detection methods (such as hydrostatic and low pressure air testing) was employed in the study area to verify the condition and integrity of the pipes.

Test Segment	Test Segment Location	Pipe Size & Material	Length of pipe (Feet)	Investigative/ Test Methods	Pass (Y/N)	Severity of Defect/ Result	Recommendations
1	D756-D758A	8"Truss PVC	187-Ft	CCTV, Electro Scan, Hydrostatic	Yes	N/A	No repairs required
2	D758B-D758A	8"SDR-35 PVC	178-Ft	CCTV, Electro Scan	No	Small ³	Seal Manhole 758B pipe connection
3	D758A-D757	8"Truss PVC	127-Ft	CCTV, Electro Scan, Hydrostatic	Yes	N/A	No repairs required
4	D757-D758	8"VCP	243-Ft	CCTV, Electro Scan	No	Large ⁴	CIPP lining and two (2) lateral point repairs
5	D758-D760	8"VCP	241-Ft	CCTV, Electro Scan	No	Large ⁴	CIPP lining
6	D759-D760	8"VCP	156-Ft	CCTV, Electro Scan	No	Large ⁴	CIPP lining
7	D760-D761	8"VCP	334-Ft	CCTV, Electro Scan	No	Large ⁴	CIPP lining
8	D761-D763	8"VCP	341-Ft	CCTV, Electro Scan	No	Large ⁴	CIPP lining
9	Ocean Inst. Gift Store Lateral	4"SDR-35 PVC	62-Ft	CCTV, Flow-Test, Electro Scan, Dye test	No	Small ³	Excavate & repair faulty section
10	Rock Restroom	4"CIP, 4"VCP & 8"VCP	97-Ft	CCTV, Flow-Test, Hydrostatic, Dye test, Electromagnetic Loc.	No	Fail ⁵	Install cleanout, re-test and point repair
11	Six-Pack Restroom	4"SDR-35 PVC	48-Ft	CCTV, Flow-Test, Hydrostatic, Dye test, Electromagnetic Loc.	Yes	N/A	No repairs required
12	Baby Beach Restroom	3"PVC, 4"CIP, 4"VCP & 8"VCP	73-Ft	CCTV, Flow-Test, Hydrostatic, Dye test, Electromagnetic Loc.	No ⁴	Fail ⁵	Repair cleanout and re-test to locate fault
13	Ocean Inst. "West Leg"	4" 6" & 8" SDR-35 PVC	207-Ft	Flow-Test, Hydrostatic, Dye test, Electromagnetic Loc.	Yes ²	Failed ⁵ stub ONLY	Seal Manhole 756 future stub
14	Ocean Inst. "East Leg"	4" & 6" SDR-35 PVC	285-Ft	Flow-Test, Hydrostatic, Dye test, Electromagnetic Loc.	Yes	N/A	No repairs required
15	Pilgrim Lateral	3" & 4" PVC	315-Ft	CCTV, Flow-Test, Hydrostatic, Dye test, Electromagnetic Loc.	Yes	N/A	No repairs required

Sewer Results Summary

Project Owner: County of Orange
Engineer: Yvette Hanna, P.E.
Contractor: Underground Service Company
Date Project Completed: May 14, 2015

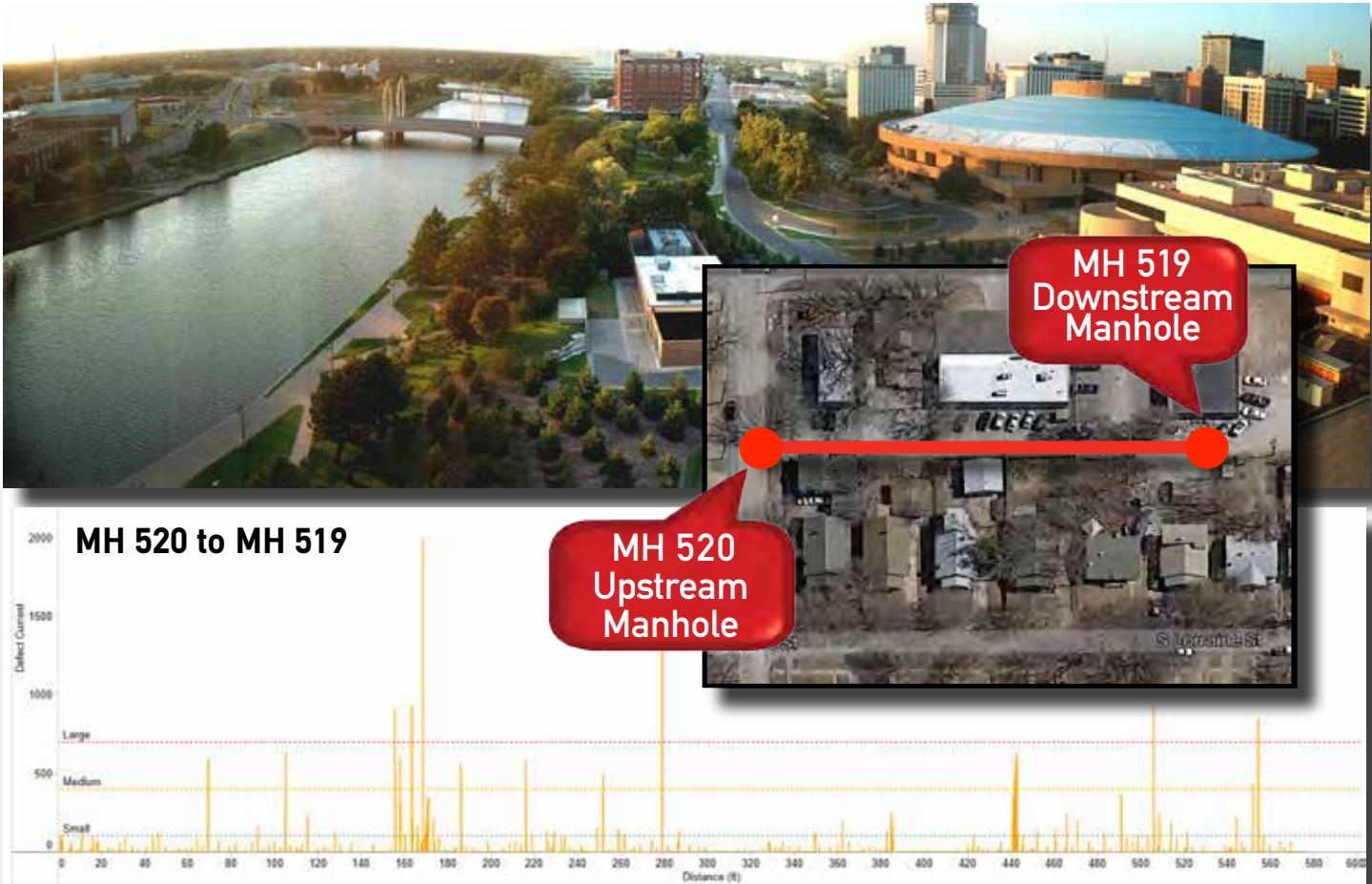
Midwest City Plays Host to Post-CIPP Assessment Using Electro Scan's ES-620

A midwest city has hosted an innovative demonstration project featuring the Electro Scan Low Voltage Conductivity Testing Method to assess post-CIPP sewer mains.

A regional public works innovator that supplies and distributes water and collects and treats wastewater, includes services to maintain a water distribution and wastewater infrastructure systems, treating wastewater, and managing facilities.

On April 1, 2015, Electro Scan was delighted to scan three nominated pipes to Electro Scan and then compare the results with previous television inspections - results for MH 520 to MH 519 are shown below.

Wichita Water Utilities Infrastructure Profile	
Sewer Employees	154
Sewer Customers	133,952
Miles of Sewer Main	2,016
Miles of Stormwater	925
Sewer Lift Stations	59
Treatment Plants	4
Sewerage Treated MGD	38
Max. Treatment MGD	62



Side-by-side comparison of Electro Scan's Low Voltage Conductivity readings to visual Closed-Circuit Television (CCTV) inspection results, show how CCTV only shows part of the story of Cured-In-Place-Pipe lining. In reviewing the ten (10) largest defect flows found by Electro Scan, six of the ten defect flows (or 60% of these defects) had NO CCTV CALL OUT or DEFECT FOUND WITH VISUAL INSPECTION. For Defects #7 & #8, both Electro Scan and CCTV found defects, with Electro Scan quantifying an estimated defect flow rate of 10 GPM and 2.03 GPM, respectively. For Defects #3 & #6, Electro Scan automatically estimated defect flow rates of 10 GPM for each defect - when compared to CCTV these were found to be wye service connections. RECOMMENDATION: Include Low Voltage Conductivity Testing as part of all CIPP acceptance standards.

