

# CRITICAL SEWER AND WATER CHRONICLES



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## ELECTRO SCAN FINDS & MEASURES DEFECTS MISSED BY TV INSPECTION

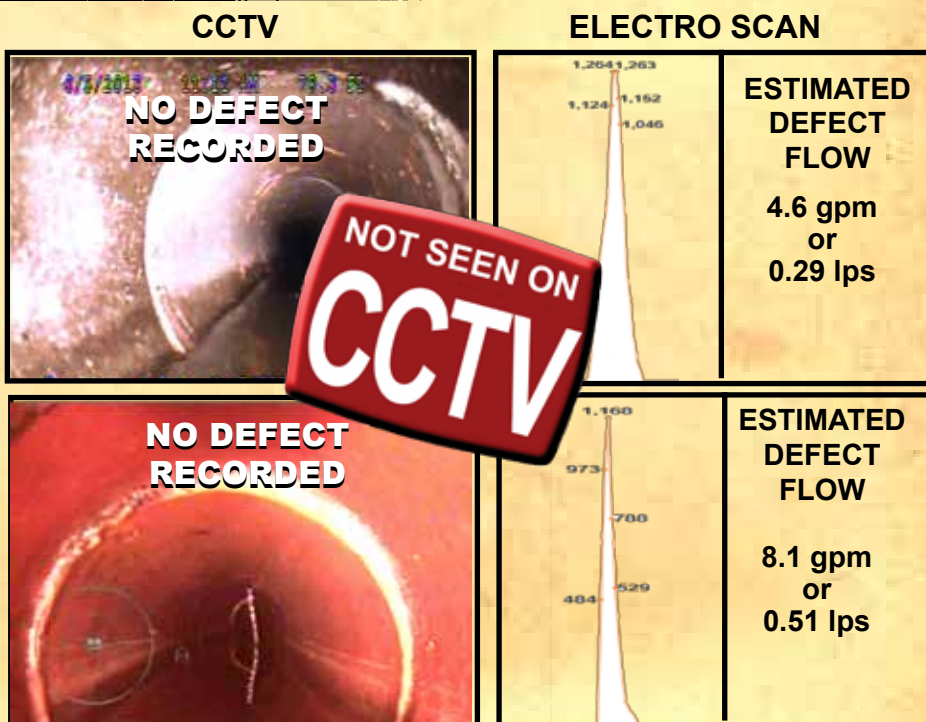
### Retrofitting Your CCTV Truck To Certify CIPP & New Pipes\*

#### Modifying Your Existing Cable & Reel to Handle Both Electro Scan & CCTV

The impact of Electro Scan's inclusion in the 7th Edition, *Operations & Maintenance of Wastewater Collection Systems, Volume 1*, cited by a number of EPA Handbooks and Manuals is already having a sweeping effect on SSES, CMOM, and CIPP specifications.

Co-written & edited by the late **Dr. Ken Kerri** (April 25, 1934 - December 15, 2014), Electro Scan is transforming how sewer utilities, consulting engineers, and sewer contractors are conducting condition assessments, prioritizing critical pipes, and certifying that repairs and rehabilitation are delivering on their promise of leak-free renewal projects.

Designed to *plug and play* with the most popular CCTV cables and reels, Electro Scan looks forward to helping your agency or company implement this new standard for evaluating sewer & storm assets and to help you become a certified operator.



\* Identifies location of Start & End of each defect and measures defect flow in GPM or L/S. Each pipe segment shows Defect Flow in Gallon Per Day Per Inch Diameter Mile.

### ONLINE CERTIFICATION FOR ELECTRO SCAN NOW AVAILABLE

Electro Scan has launched its New Online Learning Portal for sewer utilities, consulting engineers, and sewer contractors to receive their Master's Certificate in Electro Scan.

Based on the 7th Edition of the *Operations and Maintenance of Wastewater Collection System, Volume 1*, the new online course allows

students to take their agency or customers to the next level. Changing how sewer and stormwater assets are prioritized and certified for rehabilitation, purchase access to Electro Scan's new online certification course today.

Continued on Page 6 & 7



### Upper Montgomery Joint Authority Completes 2<sup>nd</sup> Electro Scan Project



Led by consulting engineering firm Hazen & Sawyer (State College, PA), and advertised for competitive bid on PennBid, open to certified Electro Scan sewer contractors only, Precision Industrial Maintenance, Inc (Schenectady, NY),

was selected for Upper Montgomery Joint Authority's (UMJA) Electro Scan project.

Working with Glen Quinn, UMJA's Executive Superintendent, the project surveyed 15,145 ft of sanitary sewer and represented UMJA's second Electro Scan project in a year.

Continued on Page 8

### Services Industriels de Genève First to Trial Electro Scan

After one of the wettest summers in memory, Oliver Aki Kleiner, Manager, SIG - STEP Aire II, in Genève, was kind enough to accept Electro Scan's invitation to be the first sewer authority in Switzerland to trial its services.

An acclaimed manager and educator that routinely teaches wastewater operations & maintenance classes, as part of a continuing accreditation program, Mr. Kleiner, Aki to his friends, arranged a large group to observe Electro Scan's first survey in Switzerland.

Genève is unique in Switzerland because it is one of the few regions that have a statutory requirement to clean each sewer every five years and to televise each sewer every ten years, with 32 of 45 regions required to develop a condition assessment.

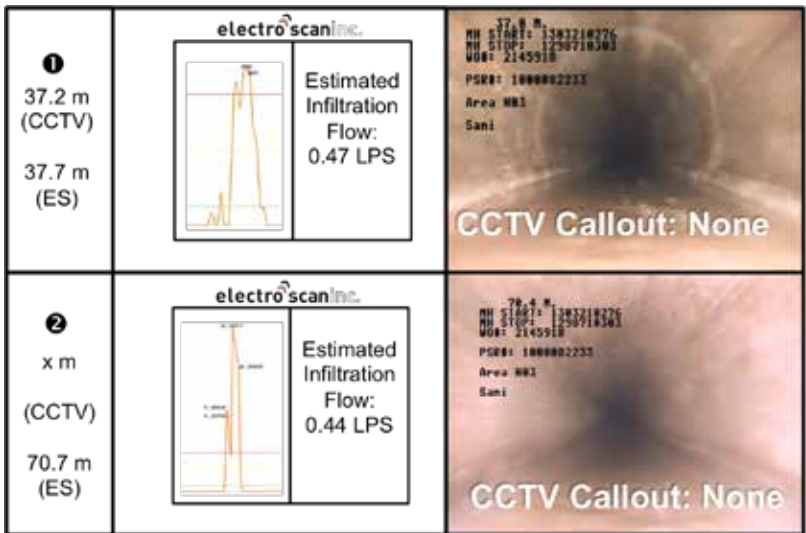
Continued on Page 9





# Surrey, BC Project Results

Continued from Page 12



Partnered with Superior City Services, Ltd., Electro Scan Inc. assessed a total of 27 sewer mains ranging from 150-400mm in diameter and a total of 65 sewer laterals, connecting homeowners and businesses to their respective sewer mains, ranging from 100-150mm in diameter.

The Electro Scan Assessment included 102 municipal facilities, representing a total of 2.237 kilometers of sewer pipe.

Electro Scan found 1,055 Total Defects. Measured by the amount of peak defect current able to exit through the inside of the sewer and connect directly to the surrounding soil, i.e. pipe defects representing possible sources of infiltration. Defects included 959 Small Defects, 80 Medium Defects, and 26 Large Defects.

However, defect counts do not take into consideration the total size of the opening, only a peak measurement, so municipalities and engineers, must base rehabilitation decisions on the estimated size or defect flow. Electro Scan found Total Defect Flow 28.86 Litres Per Second as part

of its total study area, with the majority found in Sewer Mains.

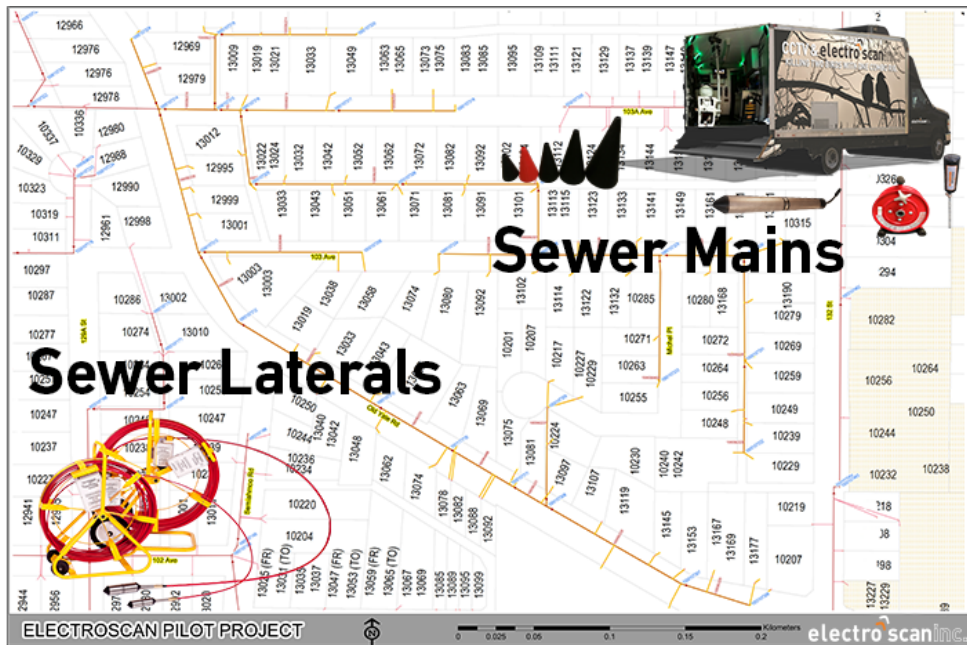
### Sewer Main Assessment

Electro Scan assessed 1.7 kilometers (1,754,924mm) of sewer mains. During its investigation, it found 801 Total Defects with a combined estimate of 23.53 litres per second (l/s) of Defect Flow, with many of the defects related to the porosity and degradation of AC pipe. One sewer main measured a Defect Flow of 4.00 l/s or 17% of Total Defect Flow from all Sewer Mains.

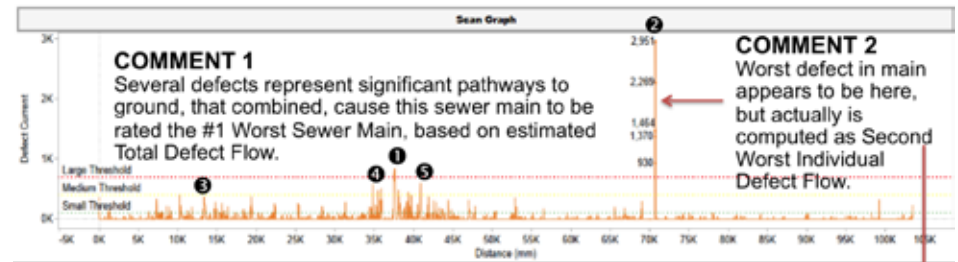
An analysis of the ten (10) sewer mains with the largest measured defect flow, Electro Scan found 16.62 l/s or 71% of defect flow from the total twenty-seven (27) sewer mains evaluated.

### Sewer Lateral Assessment

Electro Scan measured an estimated defect flow from sewer laterals of 5.44 l/s, with the 15 largest defective laterals representing 4.84 l/s or 91% of Total Defect Flow.



Jamie Johnson, Electro Scan's Senior Analyst, responsible for client reports and quality control.



### Major Individual Defects Ranked By Defect

Flow	Defect Start (mm)	Defect End (mm)	Defect Length (mm)	LPS FLOW
L	37,606	37,850	244	1
L	70,701	70,777	76	2
S	13,347	13,614	267	3
M	35,858	36,057	199	4
M	40,864	41,001	137	5

No.	City of Surrey Facility ID	Diameter in MM	Length in MM	Defect Count				Litres Per Second				Cumulative Defect Flow	% Total
				Small	Med.	Large	Total	Minor Defect Flow	Mod Defect Flow	Severe Defect Flow	Total Defect Flow		
1	1000082233	150	103,492	85	7	2	94	1.63	1.46	0.91	4.00	4.00	24%
2	1000082237	200	62,238	30	15	6	51	0.82	1.94	0.00	2.76	6.76	41%
3	1000082238	150	63,498	44	3	4	51	0.78	0.94	0.00	1.72	8.48	51%
4	1000082214	150	91,740	51	1	1	53	0.55	0.08	0.94	1.57	10.05	60%
5	1000082219	150	59,087	76	3	0	79	1.18	0.20	0.00	1.38	11.43	69%
6	1000082230	150	100,775	51	3	0	54	0.76	0.46	0.00	1.22	12.65	76%
7	1000082222	150	92,037	26	3	2	31	0.44	0.41	0.29	1.14	13.79	83%
8	1000082229	150	46,488	46	2	0	48	0.88	0.12	0.00	1.00	14.79	89%
9	1000082232	150	55,027	36	2	0	38	0.44	0.49	0.00	0.94	15.73	95%
10	1000080850	150	82,323	30	2	1	33	0.64	0.26	0.00	0.90	16.62	100%
TOTAL (Worst Sewer Mains)			756,705	475	41	16	532	8.12	6.37	2.14	16.62	71%	
TOTAL (Other Mains)			998,219	246	17	6	269	3.48	3.18	0.25	6.91	29%	
GRAND TOTAL			1,754,924	721	58	22	801	11.59	9.54	2.39	23.53	100%	

Sewer Mains		#	% of Total Length	Length in MM	Defect Count				Litres Per Second				% of Total Defect Flow
					Small	Med.	Large	Total	Minor Defect Flow	Mod Defect Flow	Severe Defect Flow	Total Defect Flow	
1	Top 10 Worst Mains	10	43%	756,705	475	41	16	532	8.12	6.37	2.14	16.62	71%
2	Other Sewer Mains	17	57%	998,219	246	17	6	269	3.48	3.18	0.25	6.91	29%
TOTAL		27	100%	1,754,924	721	58	22	801	11.59	9.54	2.39	23.53	100%

### Sewer Laterals

1	Top 15 Worst Laterals	15	25%	119,333	188	11	4	203	2.43	1.22	1.19	4.84	91%
2	Other Sewer Laterals	60	75%	363,690	50	1	0	51	0.49	0.00	0.00	0.49	9%
TOTAL		75	100%	483,023	238	12	4	254	2.92	1.22	1.19	5.33	100%



# Hamilton Township Municipal Authority, Pennsylvania Hosts Annual BBQ & Features New Electro Scan Rig

A big THANK YOU to Hamilton Township Municipal Authority's Sharon Purnell, Manager, for inviting the Electro Scan crew to their Annual BBQ & Pig Roast, held October 8, 2014. Ms. Purnell became Manager in 2011 and has been with the Authority for +29 years!

"We're proud of the fact that we have never been operating under an EPA consent order," states Purnell. "But, HTMA has taken a proactive and progressive approach to I&I issues."

"Don't be fooled by the size of HTMA" states Macy Grubbs, Electro Scan's Manager of Technical Services. "Despite managing only 60 miles of sewer main, they've scanned nearly 16,000 ft since their purchase & installation in August 2014."



Macy Grubbs, Electro Scan's Director of Field Services, reviews Electro Scan retrofit to HTMA's UEMSI CCTV unit. UEMSI is one of five cable & reel manufacturers certified to be retrofit with Electro Scan's groundbreaking defect detection instrumentation. Call for details.

## Electro Scan UK & GmbH Offer Contract Services

**London, England** -- Given the importance of finding sources of infiltration as a key objective of AMP6, Electro Scan has formed Electro Scan (UK) Limited and has begun providing its services directly to UK Water and Sewer Companies (WASCs).

"Wessex Water was first to allow us to trial Electro Scan with a project in 2012," states Chuck Hansen, Managing Director of Electro Scan (UK) Limited. "It was Julian Britton, Rehabilitation Manager, at Wessex Water - WECS Utilities, that first advised us on modifying our probes for UK standard pipes and using it for post-CIPP evaluation."



England

**Frankfurt, Germany** -- Successful projects in Stuttgart and Dresden, following Electro Scan's first appearance at IFAT in Munich, led the company to file the necessary papers to create Elektro Scan GmbH.

With its head office in Frankfurt, Elektro Scan GmbH expects a busy 2015 as it begins projects throughout Germany.



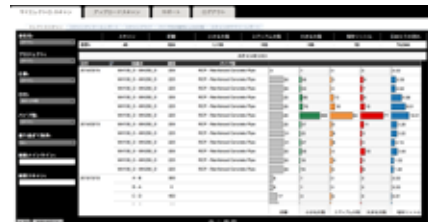
## WHERE TO FIND US?

## First Installation in Japan "Goes Live" in Dec. 2014

**Tokyo, Japan** -- After numerous demonstrations, attendance at national tradeshow, and support at regional seminars, Electro Scan has completed its first installation in Japan. In addition to translating all its training materials, field guides, and examinations, Electro Scan staff also deployed its Japanese version of Critical Sewers®.



Brandon Harlow, Lisle Wilkerson, and Mark Grabowski in Japan.



**Indianapolis**  
February 24-26 2015  
INDIANA CONVENTION CENTER

Highlights from the 7th Edition of Operation and Maintenance of Wastewater Collection Systems Manual  
'New Chapter on Electro Scan'

Municipal Sewer & Water Technology Track  
Wednesday, Feb. 25, 9:30am-10:30am, Room 237-239  
Speaker Chuck Hansen - Electro Scan Inc.

Visit Booth # 2062

The Jumeirah Beach Conference & Exhibition Centre, Dubai  
9 & 10 March 2015

Chuck Hansen to Present Several International Case Studies on the Changing Standards of Assessing Pre- and Post-CIPP Sewers

2015

TRENCHLESS MIDDLE EAST

للاتصال شركة "الكترو سكان" جاتين مولينيكس هاتف: +1 916 779 0660 البريد الإلكتروني: info@electroscan.com

**Wastewater Innovation 2015**  
Cutting edge solutions for sewer networks and wastewater treatment

**London, England**  
5 & 6 March  
Le Méridien Piccadilly

<http://marketforce.eu.com/events/water/wastewater-innovation-2015>

**Martin Kane**  
Chief Engineer  
Severn Trent

**Lawrence Gosden**  
Managing Director  
Wholesale Wastewater  
Thames Water

**Simon Chadwick**  
Wastewater Services  
Director  
United Utilities

**Chuck Hansen**  
Managing Director  
Electro Scan (UK) Ltd.

**Matt Wheeldon**  
Head of Wastewater  
Strategy  
Wessex Water

**Richard Gilpin**  
Head of Wastewater  
South West Water

**Steve Kaye**  
Head of Innovation  
Anglian Water

**Sass Pledger**  
Flood & Water Manager  
Cambridgeshire County  
Council

**NASTT/No-Dig**  
Denver Convention Center  
March 15-19, 2015

Don't Miss  
Monday, March 16, 3:45 PM - 4:10 PM  
Sharon Purnell, Hamilton Township Municipal Authority  
Mark Grabowski, Electro Scan, Inc.

Small Agency, Big Ambition - How a Pennsylvania Township Authority Chose New Technology to Begin Addressing Their Infiltration Issues

06.05.2015-08.05.2015, Kassel, Germany

**RO-KA-TECH**  
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elektro scan GmbH



# Limitations of TV Inspection Brings Changing of the Guard

## Inability to Find Leaks & Limited Use During Wet Weather Conditions Paves Way for New Solutions

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 the 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 the industry with better performance 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.

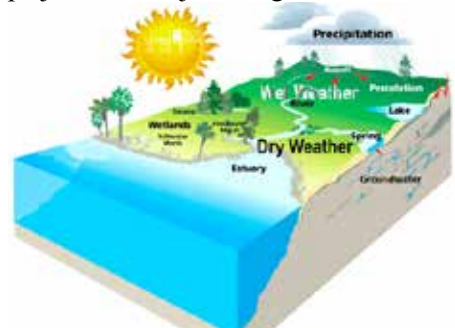
Still have doubts? Have your best two TV operators independently review and rate the same CCTV videotape.

Why The Industry Is Shifting To Better Solutions

### The Top Ten Limitations of CCTV Inspections

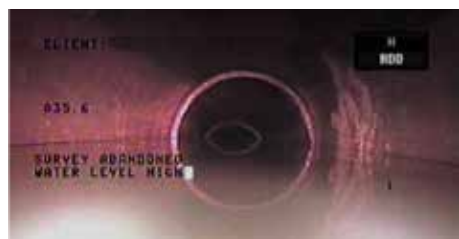
#### 1. CCTV Only Useful During Low Flow

Everyone knows that sewer leaks generally occur during wet weather events, tidal inflows, and high groundwater conditions; yet CCTV is generally only used when sewer mains are at their lowest flow, resulting in the missed identifications of active leaks, and a key reason many CIPP lining projects miss major leakage locations.



#### 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 callout for certified TV operators, it often disguises structural problems that may only be assessed if the pipe is thoroughly cleaned.

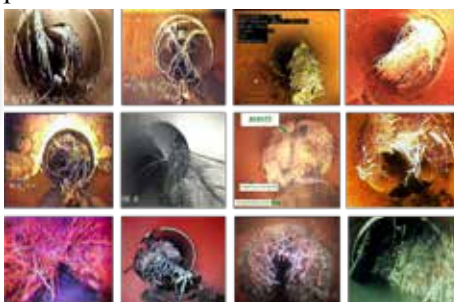
In contrast, Electro Scan does not require a clean pipe to assess, even in cases of light to medium grease. Since grease represents a non-conductive material, Electro Scan's low voltage current is able to assess the pipe wall, with or without the presence of grease.



#### 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.

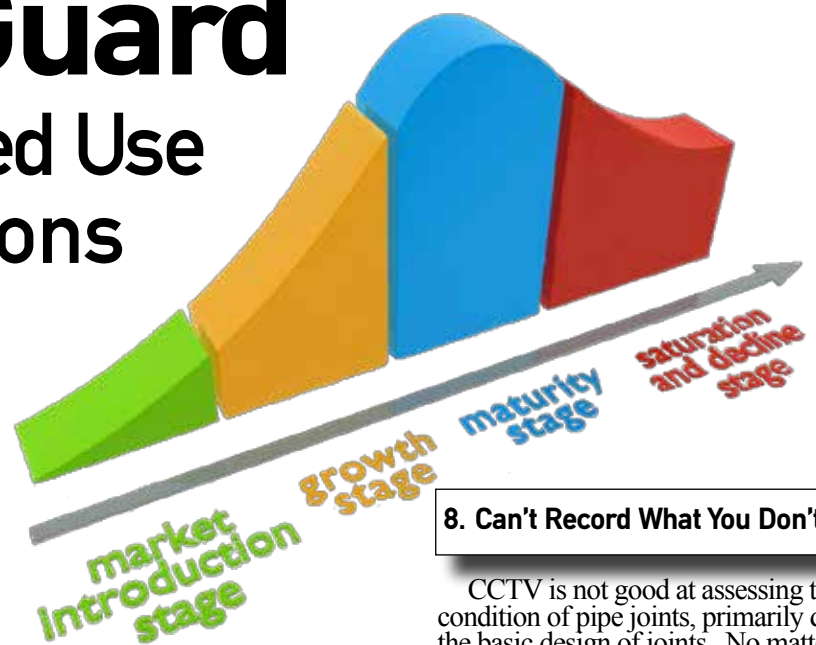
As a non-conductive material, Electro Scan measures the size of the opening allowing roots to flourish and is able to measure an estimated gallon per minute of defect flow too.



#### 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.



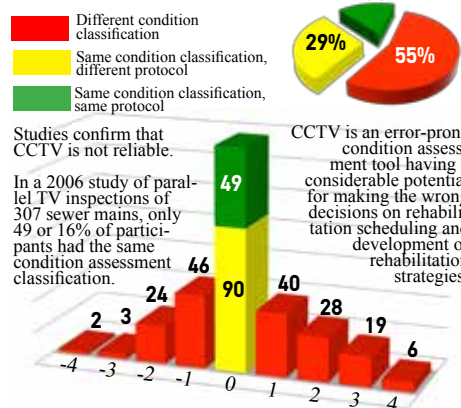
Below -- A sample series of encrustation callouts that passed a pressure test and found in good condition.



#### 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.

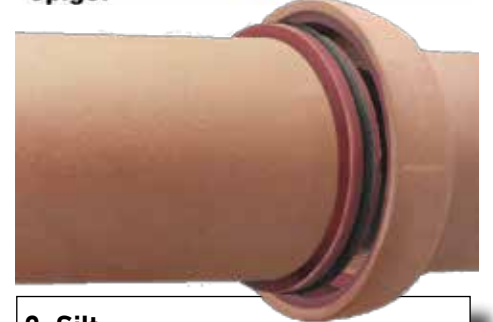
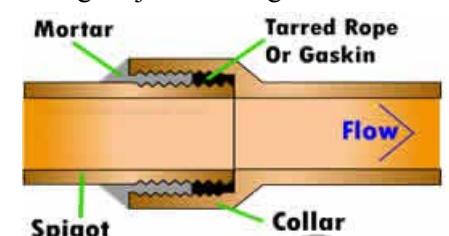
#### 7. Same Code, Different Defects

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 for widely different defects, creating highly questionable Overall Pipe Rating Index (OPRI) metrics frequently used to determine rehabilitation priorities.

#### 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. As a non-conductive material, Electro Scan's low voltage current goes 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 compared 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.





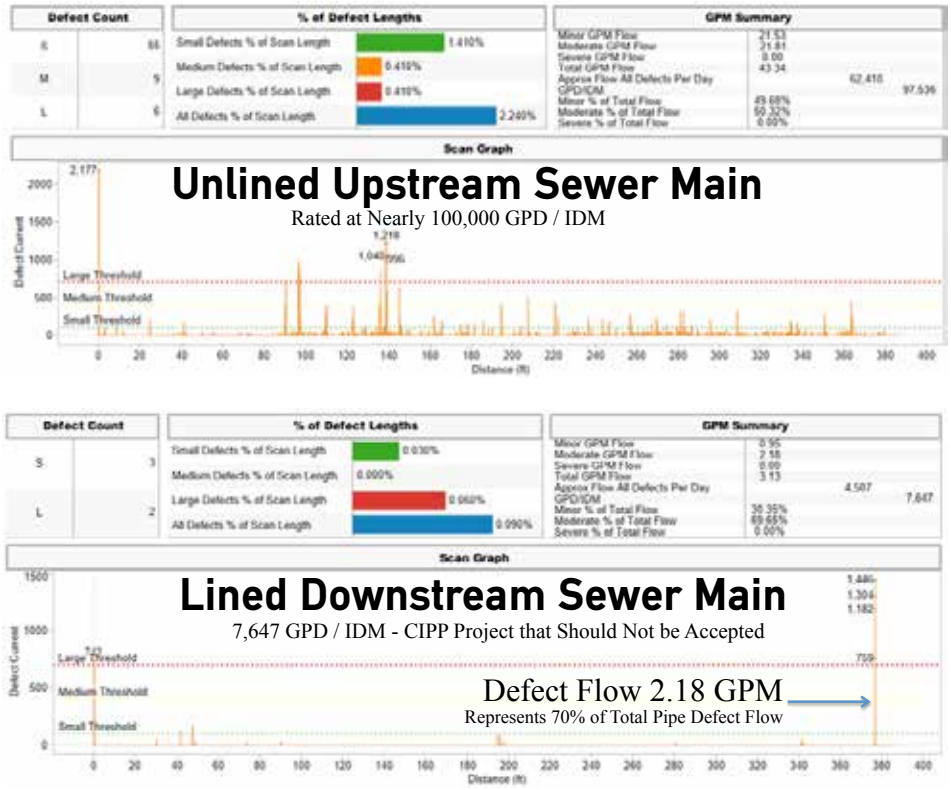
# Adjacent Pre- and Post-CIPP Surveys Help Sewer Agencies Fix Undocumented Problems & Lining Companies Add Revenue from Change Orders

Electro Scan May Increase Lining Revenue on Missed Diagnostics of Upstream & Downstream Lines, But Contractors Must Deliver Good Work

Scan 1	389.0	3	0	2	3.13	4,507	7,647
Scan 2	422.3	55	9	6	43.34	62,410	97,536
	811.3	58	9	8	46.47	4,507	7,647
	Distance (ft)	Small Defects	Medium Defects	Large Defects	GPM	GPD	GPD/IDM

As more and more sewer utilities are including Electro Scan in their specifications for CIPP acceptance, lining companies are finding that a little quick work during their pre-

CIPP survey may generate a change order to fix badly needed pipes -- in some cases worse than the pipes they are relining.



## GPD/IDM Emerges as New Standard To Assess Pipes Before & After Rehab

Sewer condition assessments are undergoing a major change with the inclusion of specific Gallon Per Day Per Inch Diameter Mile (GPD /IDM) requirements for the acceptance of post-rehabilitated pipes.

GPD/IDM is not new. ASTM C969 – Standard Practice for Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines, most recently renewed in 2009, states that 200 gallons/inch diameter mile is an acceptable allowance; however, several State Department of Natural Resources (e.g. Missouri) have lowered this total allowable to 100

gallons/inch diameter mile, with Miami-Dade Water and Sewer's upcoming RFP for field investigations rumored to dictate 50 gallons/inch diameter mile.

"I think we are seeing a changing of the guard," says Chuck Hansen, Chairman of Electro Scan and Chair of ASTM's Subcommittee F36.20 on Inspection and Renewal of Water and Wastewater Infrastructure. "The sun has set for allowing sewer contractors to visually inspect or pressure test non-service connected pipes and claim it has 'no defects.' Pass/Fail ratings using GPD/IDM is becoming the new standard of pipe acceptance."

Defect Count	Defects % of Scan Length	GPM Summary
S: 40	Small Defects: 10.100%	Minor GPM Flow: 6.03
M: 10	Medium Defects: 5.430%	Moderate GPM Flow: 66.81
L: 3	Large Defects: 2.450%	Severe GPM Flow: 137.47
	All Defects: 17.970%	Total Gpm Flow: 210.31
		Approx Flow All Defects Per Day: 302,846
		<b>GPD/IDM: 768,677</b>
		Minor % of Total Flow: 2.42%
		Moderate % of Total Flow: 26.85%
		Severe % of Total Flow: 70.73%

# Industry Veteran Shifts Allegiance From CCTV Inspection To More Accurate, Reliable Technology

"TV cameras have been a great tool to assess the condition of sewers," states Chuck Hansen, industry pioneer and former Chairman of Hansen Information Technologies where customers collected over 1 million CCTV inspections and 7 million Defects in software bearing his famous last name. "Henry Gregory, Jim Witt, Phil Farley, and I even went so far as to develop the industry's first expert system, known as COMP-ARES, that took CCTV defects and was able to automatically recommend specific methods of rehabilitation, including Point Repairs, Sliplining, FRP, and CIPP"

Rehabilitation, still cited in many EPA Consent Decrees and Administrative Orders, CCTV has had a good long run at helping our industry 'see' its major issues.

But, while still a good tool for observing alignment, crossbores, grease, roots, and cave-ins, other solutions are displacing it as the tool of choice. Not only is CCTV unable to accurately and consistently locate and measure defect flows, but you can't fix problems you can't see.

"It's not like TV camera operators are doing a bad job or that cameras don't have high enough resolutions or range of sight," states Chuck, "but our internal pipe conditions hide or conceal the wall of the pipe. Technologies using lasers to automatically measure the surface dimensions of cracks, still don't tell you if water can pass through to the surrounding ground."

*CCTV standards co-developed by Henry Gregory, Jim Witt, Phil Farley, and Chuck Hansen, used by over 250 TV trucks on the City of Houston SSES Project.*

"While the cost of Electro Scan may be a bit higher than CCTV, especially with the addition of a water jet truck, its 4 to 1 daily production advantage over CCTV is further increased by the elimination of unnecessarily televising lines that don't leak, pushing up its return on investment to nearly 10 to 1 (\$10 return for every \$1 invested). Add to that the ability to certify CIPP lining and accurately locate defects and their defect flows, estimated at  $\pm 40\%$ , and you have a very compelling argument to begin surveying your entire network using Electro Scan."

Chuck Hansen may have to return to the work order business. Since Electro Scan should be used to survey sewer mains & laterals, before television inspection, clients are asking Chuck to generate CCTV-specific work orders from his cloud-based Critical Sewers® application so CCTV operators will know footage locations to capture images, whether operators 'see' defects, or not.

*Charles Wilmut, former Founding Partner of GSW Engineers, a key contractor on the City of Houston SSES Project, now Special Advisor to Electro Scan.*

## Included as part of the 1991 EPA Handbook, for Sewer System Infrastructure Analysis and That Was Then...



**City of Houston, Texas (1990)**

Project Highlights	
Miles Televised	3,800
CCTV Reports	67,603
CCTV Defects	889,932
Manhole Inspections	72,900
Miles Smoke Tested	3,180



## ...And, This Is Now!





# Get Certified on the Web

**Carissa Boudwin**  
Director of Sales  
& Marketing



Hello and welcome to the world of Electro Scan. I am Carissa Boudwin, Director of Sales and Marketing at Electro Scan, here to introduce you to our New Online Learning Portal and to help you earn your Master's Certificate in Electro Scan.

Electro Scan's next generation Online Learning Portal is not for everyone. But, if you are looking to be a Subject Matter Expert (SME) in sewer & stormwater pipeline diagnostics, then you will want to be certified through our innovative course.

Developed by industry experts with over 30 years in the

industry, including professional engineers, contractors, and operators, you are going to learn how the industry has evolved from using legacy inspection techniques to the adoption of sophisticated technologies that specialize in the location and measurement of defect flows.

Our course is a departure from learning a series of condition codes and matching them to a video or photograph.

Instead, we deliver a program to help you find and fix your critical infrastructure, not to mention ensure you are getting the most out of your CAPEX program by certifying

your rehabilitation, repairs, and renewal programs.

RFPs, RFQs, and a host of international tenders, are now requiring project personnel that have Electro Scan credentials. Whether to certify CIPP lining projects, CMOM, or SSES projects, Electro Scan can help.

Let us help you expand your business, grow your professional services practice, and distinguish your resume.

I look forward to having you join the Electro Scan family of experts.



## Learn Valuable Information You Will Use Every Day.

- What Your Consulting Engineer Should Focus on as part of their Next Contract.
- How Electro Scan Data Fits Into Your CMMS, GIS, and Hydraulic Model.
- Why Sewer Utilities are Adding Electro Scan to SSES, CMOM, and CIPP Projects.
- How Field Crews Will Change their Daily Work.
- Why EPA & State Water Quality Boards Support the adoption of Electro Scan.

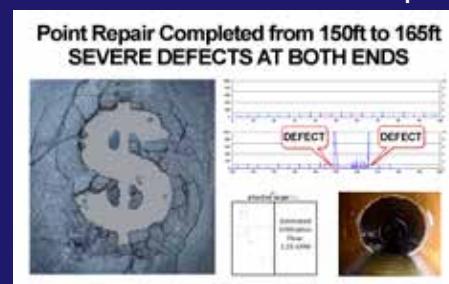
## Best Practices

Jet Nozzle Removal and  
Funnel Cone Attachment



## New Standards

Certification of Point Repairs



## Level 5 - Practical Applications





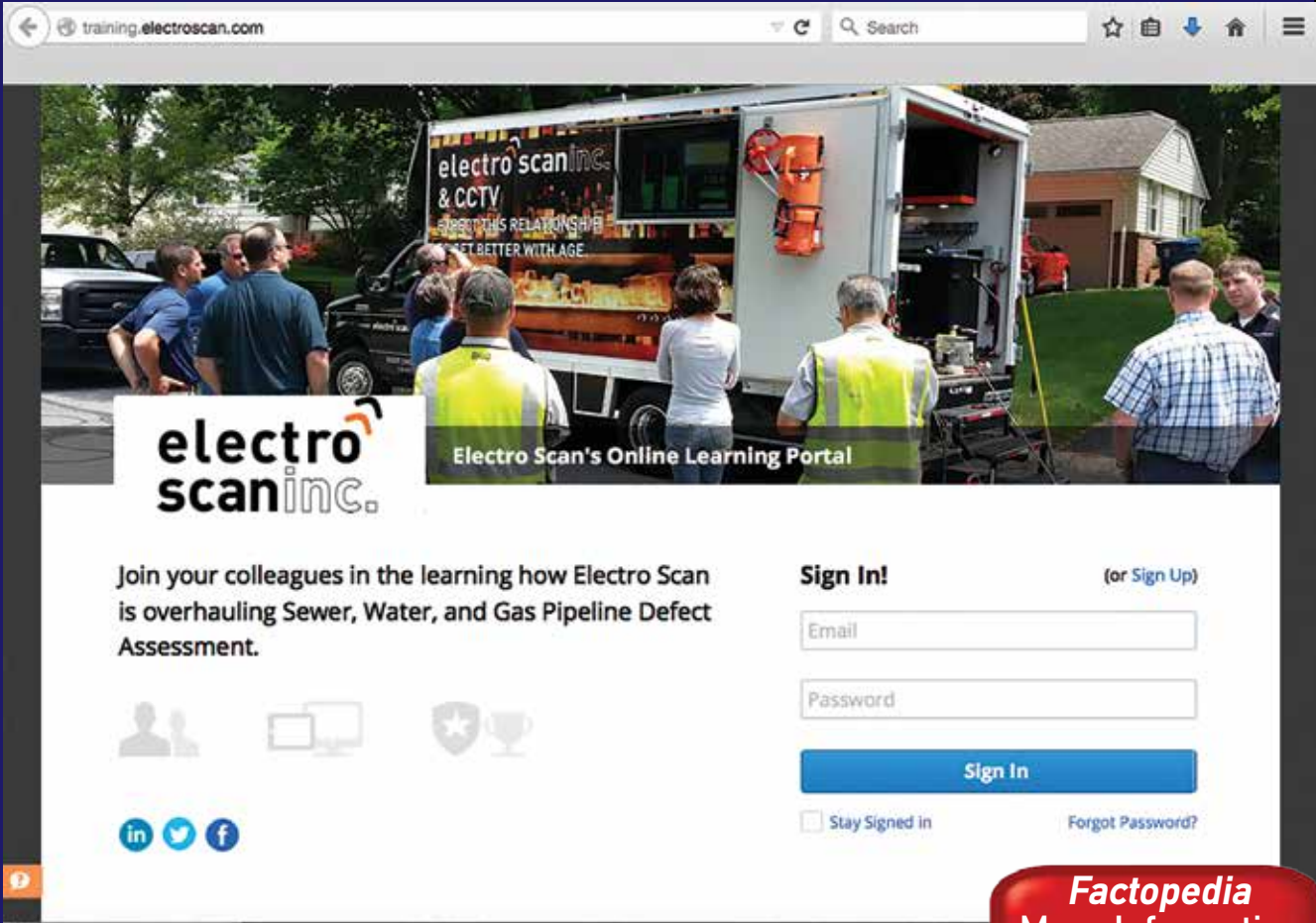
# and not in a Classroom.

Electro Scan is the most exciting technology in 40 years and we're lucky to be able to bring this to you. Get ready to change how you locate, prioritize, and certify your pipes to be ready for operation.

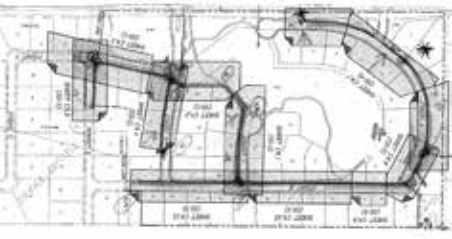
We hope to educate & certify Directors, Consulting Engineers, and Sewer Contractors to take advantage of this game-changing technology.



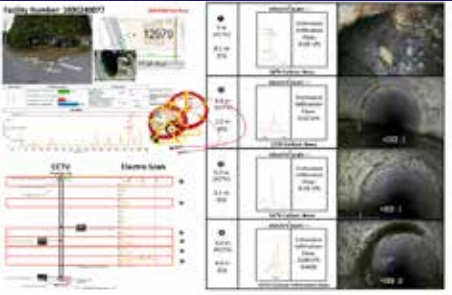
**Mark Grabowski**  
Vice President & General Manager



**Assessing New Property Development**



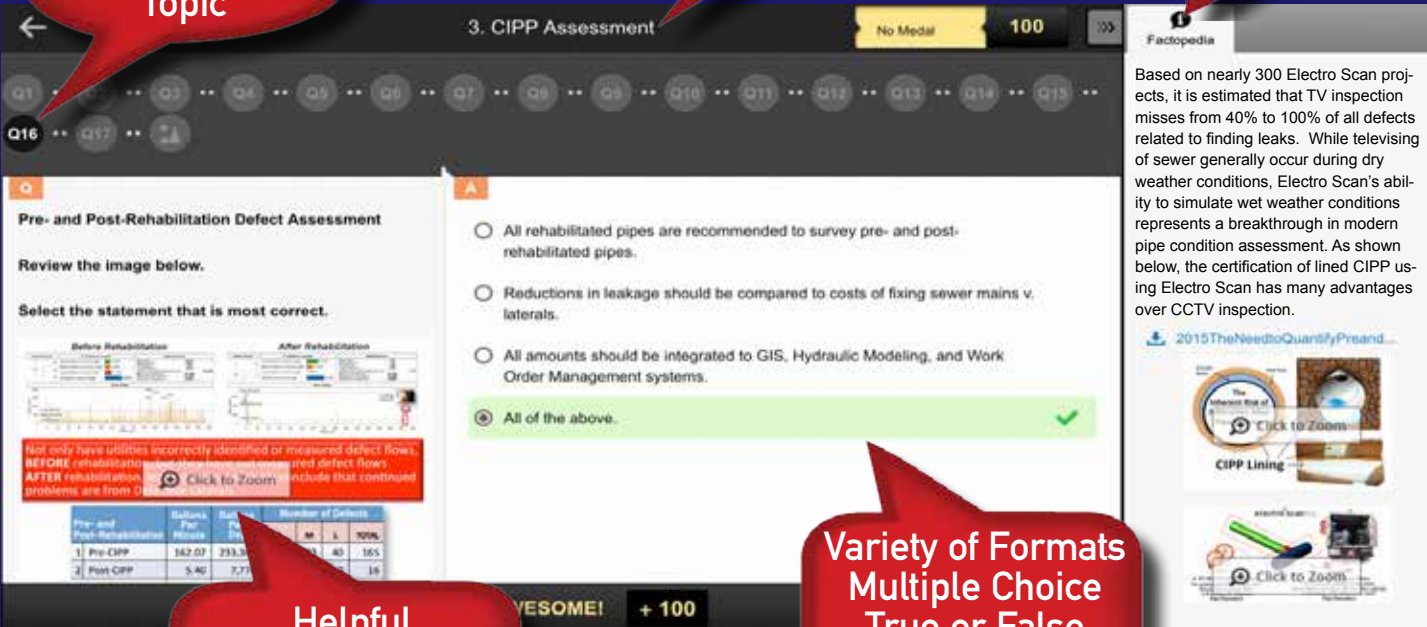
**Assessing Sewer Laterals**



Selected 'Knowledge' Topic

Selected Lesson

Factopedia  
More Information  
Displayed After  
Selected Answer



Helpful  
Illustrations or  
Video Clips

Variety of Formats  
Multiple Choice  
True or False  
Polling

- Masters Certificate in Electro Scan - Approximately a 10-hour self-paced course.
- Logically organized Lessons & Topics.
- Assorted Test Formats, including Multiple Choice, True-False, Matching, Guess Words, etc.
- Gamification, Points, and Rewards.
- Expanded Practical Applications.

**\$495.00** per person, plus Calif. sales tax.

Contact us directly if your agency is not subject to sales tax or 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**





# Dual Funnel Cone Helps Evaluate Low & No-Slope Sanitary Sewers

Low slope and *no-slope* pipes, with zero or a relatively small slope, may be a challenge for field operators to maintain a fully surcharged pipe surrounding the Electro Scan probe. Now, with a dual funnel cone configuration, crews will have an easier time maintaining water around the probe.

While CCTV cameras rely on a pipe to be dry or with little or no water, in contrast, Electro Scan's low voltage electrical current requires water to serve as the conductor to properly evaluate the 100% of the pipe wall.

For most gradients having a 1%, 2% or 3% gradient or slope, a single funnel cone or kite may be sufficient to temporarily backfill water to surround Electro Scan's probe.

For pipes with less than a 0.5% gradient, Electro Scan recommends a dual funnel cone configuration to encapsulate water between two funnel cones. Contact Electro Scan for project references.

Upstream

Low Voltage Current

Dual Funnel Cone Configuration

Trailing Funnel Cone

Leading Funnel Cone

Probe

Downstream

Water pressure requirement may be less with a dual funnel cone.

Operator's Real-Time Console

Proprietary algorithms locate and measure the start & end of defect openings, defect current, distance, probe speed, and water height.

# UMJA, Pennsylvania Expands Electro Scan Assessment Project After Successful Trial

Continued from Page 1

### The Dirty Dozen

Twelve (12) sewer mains contributed an estimated fifty-five percent (55%) of total defect flow. Referred to as 'The Dirty Dozen' the top 12 worst sewer mains represented ninety percent (90%) of the total estimated defect flows.

Electro Scan's field work was completed in less than four days.

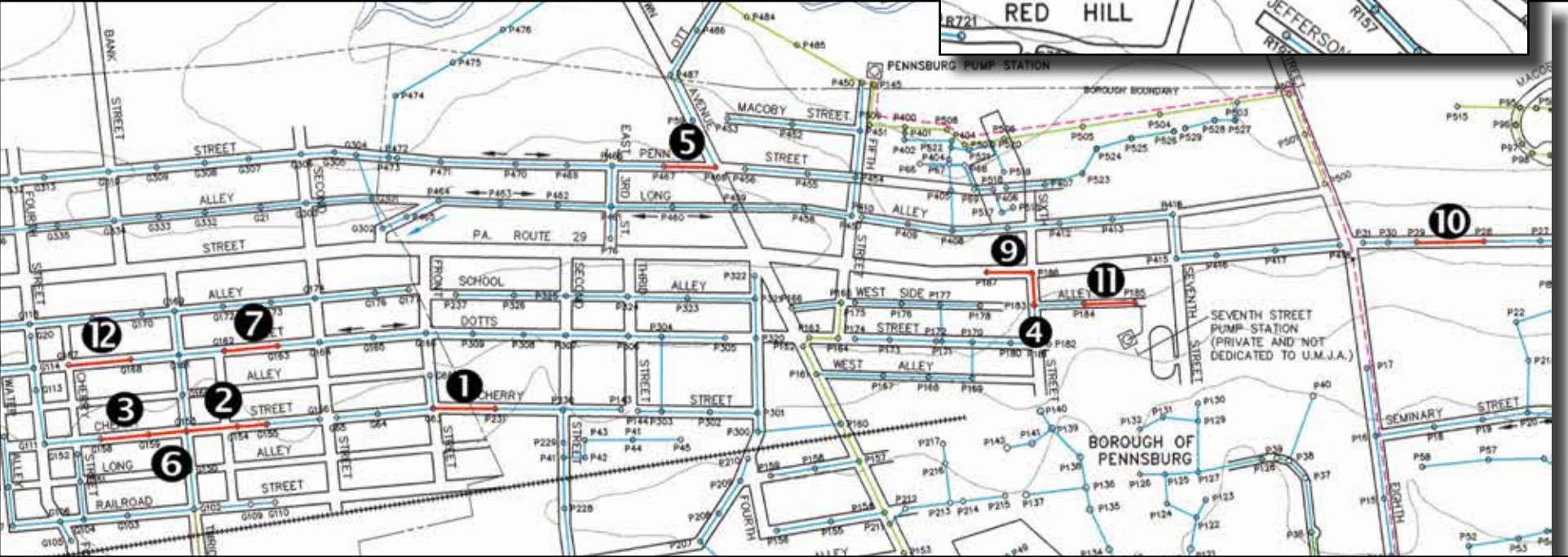
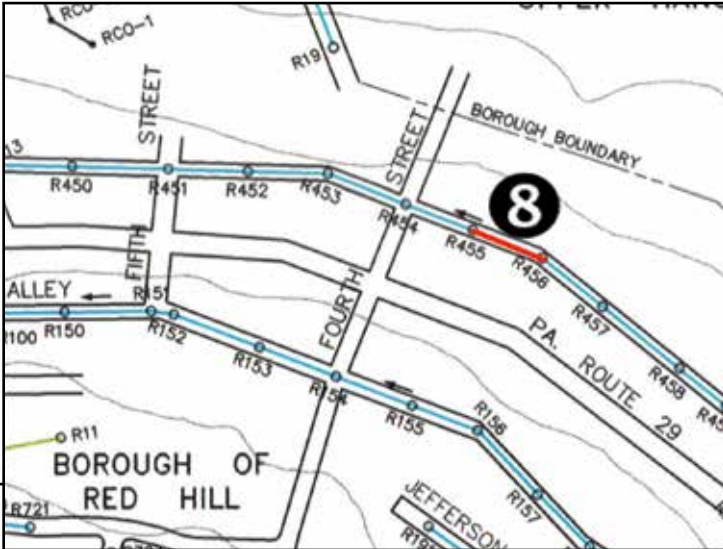
Project Day	Number of Sewer Mains	Ave. Distance Per Main	Footage Scanned
1	11	264	2,906
2	19	239	4,548
3	25	197	4,935
4	10	276	2,756
TOTAL	65	233	15,145

	Sewer Main	Length	Small	Medium	Large	GPM
1	G63 - P231	349	1	1	4	42.6
2	G155 - G153	399	53	2	3	36.3
3	G158 - G159	228	34	5	10	35.2
4	P186 - P183	180	34	4	3	30.8
5	P467 - P468	244	11	6	3	23.1
6	G159 - G153	256	37	3	1	18.8
7	G163 - G162	247	31	3	1	15.7
8	R456 - R455	189	1	1	3	14.0
9	P187 - P186	266	14	2	2	13.7
10	P29 - P28	293	17	1	1	13.3
11	P185 - P184	264	12	2	2	13.1
12	G167 - G168	255	14	4	1	12.9



					Number of Defects					GPM				GPD	GPD
#	Scan ID	From	To	Diameter	Distance (Feet)	Small	Med	Large	Total	Minor Flow	Mod. Flow	Large Flow	Total Flow	Defect Flow Per Day	% of Total Defect Flow
PROJECT TOTAL -- 65 TOTAL SEWER MAINS					15,041	716	62	71	849	197.35	161.97	130.73	490.05	1,195,722	100%
DIRTY DOZEN -- 12 WORST SEWER MAINS RANKED BY GPM					3,170	259	34	34	327	76.43	75.63	117.23	269.29	657,068	55%
1	dcu1_00000178_dec022014_052649AM	G63	P231	8	349.1	1	1	4	6	0.88	1.7	40	42.58	103,895	8.7%
2	dcu1_00000174_dec012014_145527PM	G155	G153	8	399.5	53	2	3	58	14.34	4.63	17.31	36.28	88,523	7.4%
3	dcu1_00000172_dec012014_140400PM	G158	G159	8	228.1	34	5	10	49	10.03	20.06	5.14	35.23	85,961	7.2%
4	dcu1_00000228_dec042014_102544AM	P186	P183	8	179.5	34	4	3	41	12.88	7.68	10.21	30.77	75,079	6.3%
5	dcu1_00000230_dec042014_120840PM	P467	P468	8	243.8	11	6	3	20	5.96	12.48	4.68	23.12	56,413	4.7%
6	dcu1_00000173_dec012014_142758PM	G159	G153	8	256.0	37	3	1	41	10.21	1.09	7.45	18.75	45,750	3.8%
7	dcu1_00000167_dec012014_090719AM	G163	G162	8	247.3	31	3	1	35	6.45	9.21	0	15.66	38,210	3.2%
8	dcu1_00000218_dec032014_130601PM	R456	R455	8	188.8	1	1	3	5	0.98	3.48	9.51	13.97	34,087	2.9%
9	dcu1_00000229_dec042014_104345AM	P187	P186	8	266.5	14	2	2	18	3.18	3.07	7.4	13.65	33,306	2.8%
10	dcu1_00000226_dec042014_073605AM	P29	P28	8	292.7	17	1	1	19	3.3	0	10	13.3	32,452	2.7%
11	dcu1_00000208_dec032014_075546AM	p185	P184	8	263.8	12	2	2	16	2.49	5.08	5.53	13.1	31,964	2.7%
12	dcu1_00000170_dec012014_123357PM	G167	G168	8	254.8	14	4	1	19	5.73	7.15	0	12.88	31,427	2.6%
NOTES															
a. 12 Worst Sewer Mains or 21% of Sewer Mains (by Length 3,170 divided by 15,041) Contributing 55% (658,068 divided by 1,195,722) of Total Defect Flow.															
b. Worst Sewer Main G63 to P231 is a CIPP.															

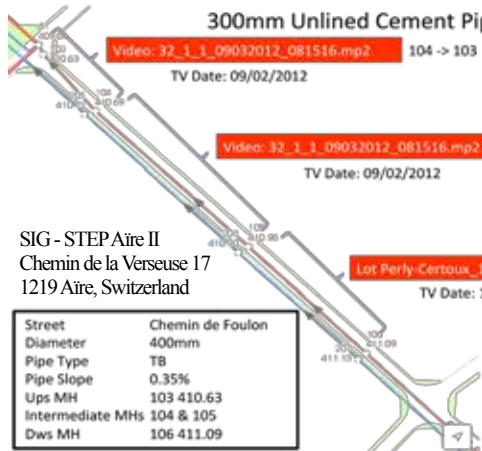
NOTES  
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b. Worst Sewer Main G63 to P231 is a CIPP.





# Services Industriels de Genève (SIG) Completes First Electro Scan Technical Project in Switzerland

Continued from Page 1



SIG manages 153 km of SIG's primary treatment & transportation system, ranging from 300mm to 3m in diameter. Forty-five (45) communes or districts, including the City of Genève, flow into SIG's network, representing 1,300 km of secondary networks. SIG also manages 8 water treatment plants and 33 pumping stations.



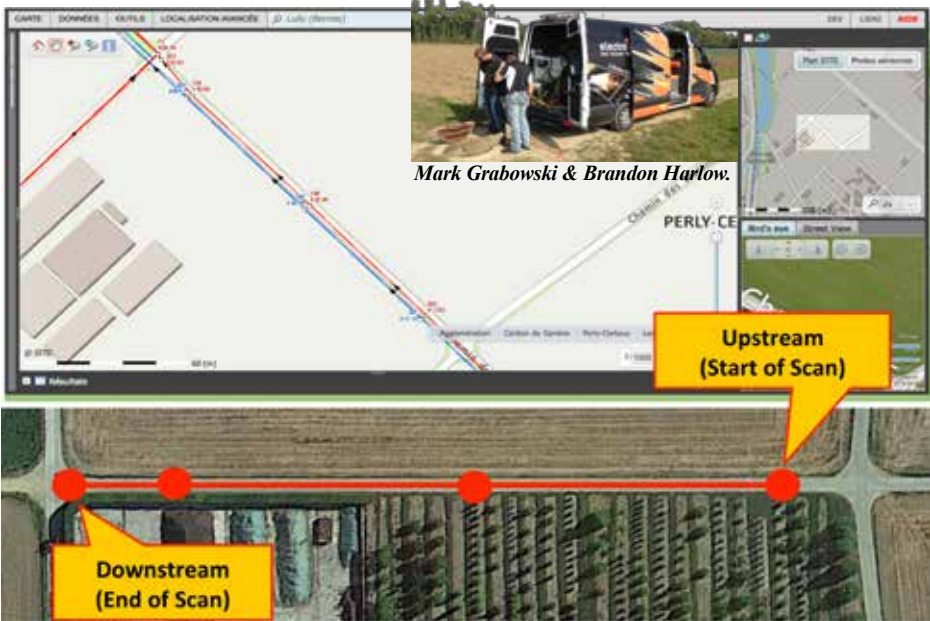
## Project Results...

**1. 400mm Lined Pipe**  
Good news. The Lined pipe scanned showed no measureable defect flows or openings to ground.

**2. 300mm Unlined Cement Pipe**  
Although there were 96 Small Defects and 14 Medium Defects found during scanning, the quantity of the small defects is common in cement and asbestos cement pipes where hydrogen sulfide has caused corrosion of the interior of the pipe.

While each of the Medium Defects were associated with pipe joints, the high number of small defects and review of CCTV indicated Moderate Corrosion throughout the pipe.

**3. 500mm Fiberglass Pipe (GUP)**  
The fiberglass pipe showed defects at each 6m joint. CCTV did not indicate any defects when televised in 2006, indicating that problems at each joint either occurred since 2006 or television inspection was not adequate in identification of any gaps or finding openings to ground surrounding the pipe.



Scan 2. 300mm Unlined Cement Pipe represented three pipe segments, surveyed at a single time.



Mark Grabowski & Brandon Harlow.

Brandon Harlow opens a Swiss manhole with his American-made 'pook'—i.e. a pick & hook.



Continued from Page 12

# City of Watervliet's Head-to-Head Comparison



## U.S. Benchmark Compares CCTV Inspection & Electro Scan

It's not often that Electro Scan is invited to the same town where the parents of our Vice President, Mark Grabowski, enjoy their summer home, located in Watervliet, Michigan.

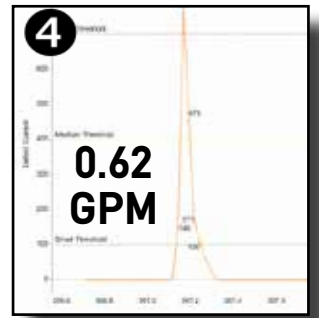
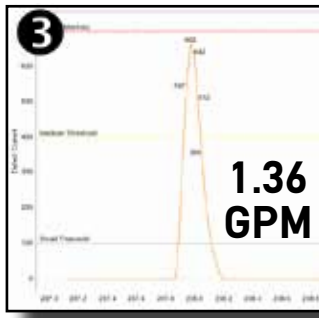
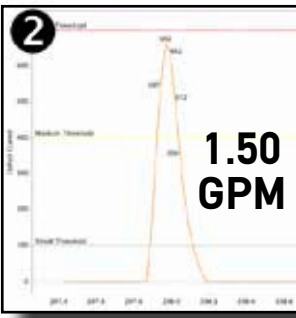
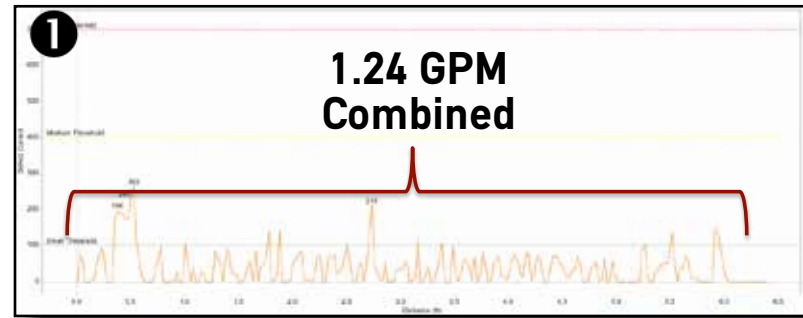
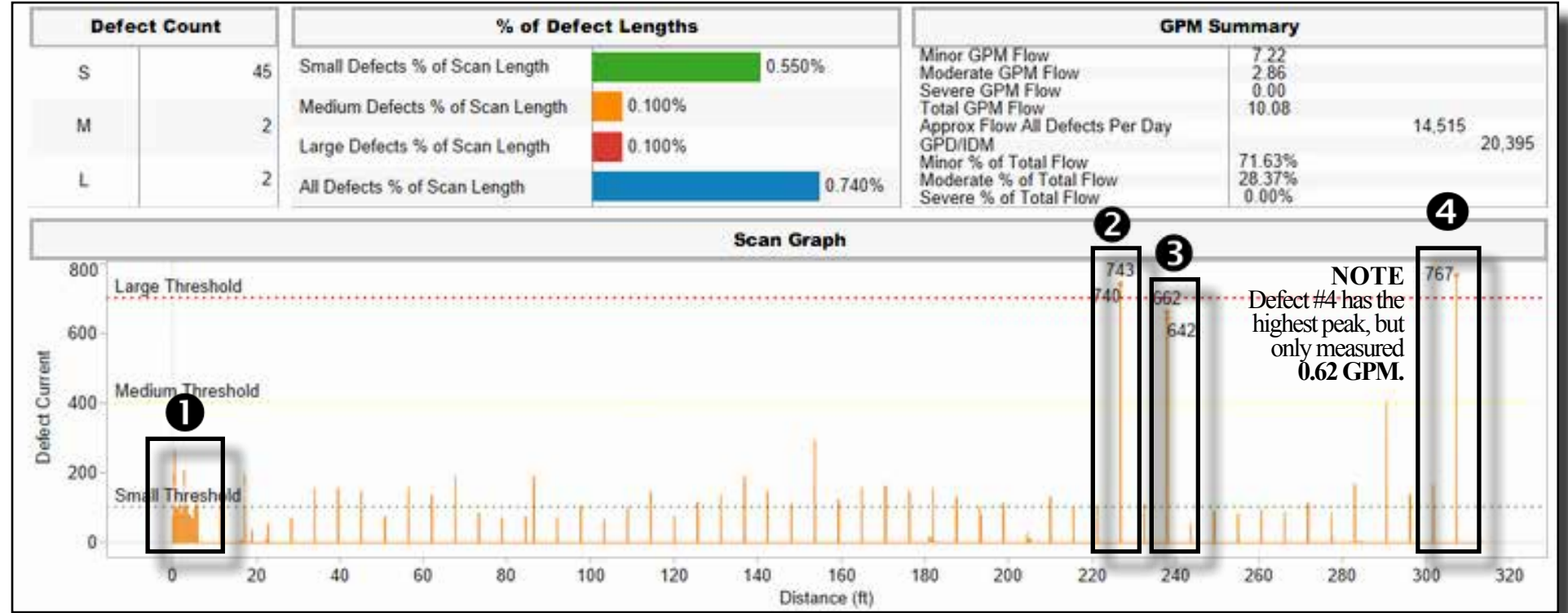
Invited to demonstrate its product by Portage, MI-based consulting engineers, Wightman & Associates, Inc., Electro Scan was surprised to arrive and find that a Sewer Contractor was also on site to demonstrate a new CCTV camera on the same sewer main.

Electro Scan found a total of forty-nine (49) defects in this 315 ft, 8" diameter sanitary sewer main, with multiple defects found in the first six feet of the line, with three additional defects representing a total of 4.72 GPM or nearly half (47%) of the total defect flow of 10.08 GPM.

The CCTV camera was only able to transit approximately 60 feet into the sewer main, before it could not go any further and was retrieved.



Sunset over Paw Paw Lake in Watervliet, Michigan.





# British Electro Scan Project Highlights Downside of Abandoned CCTV Surveys

Continued from  
Page 12[illegible]

The English village selected represented an area that had experienced persistent and unexplained high flows. Having been televised on multiple occasions, it was a good candidate to test the use of Electro Scan to see if the technology could add value to the identification and measurement of sources of infiltration.

Electro Scan measures the amount of low-voltage electric current able to pass through the wall of pipes in accordance with ASTM F2550-13, with a  $\pm 40\%$  accuracy, assuming a 1 foot (30.5cm) head and 1% or less pipe gradient.

## Electro Scan Provided a More Accurate, Dependable and Quantitative Assessment Than CCTV Inspection.

Electro Scan not only identified a number of potential sources of infiltration, not seen by CCTV, but provided an estimated litres per second (l/s) defect flow for both individual sewer mains and each identified defect. Data was available within a few minutes from the company's Critical Sewers® cloud application.

Electro Scan was able to inspect 100% of all sewer lines. By comparison, CCTV recorded six (6) mains with Abandoned Surveys missing 69% of the total defects from not being able to complete its survey

Total estimated leakage from the 23 sewers inspected using Electro Scan totaled 35.02 litres per second (555.1 gallons per minute), with 7 of the worst pipes contributing 35.02 litres per second (440 gallons per minute) or nearly 80% of the total estimated defect flow.

## CCTV Overlooked 69% of All Defects Compared to the Electro Scan.

Electro Scan identified a total of 572 defect locations compared to 209 total CCTV observations. However, out of the 23 sewer mains surveyed in the benchmark, CCTV only identified one sewer main or 4% of the surveyed pipes with infiltration, noting two infiltration-related observations: 1-Infiltration Dripping and 1-Infiltration Seeping. No observations of either Infiltration Running or Infiltration Gushing were recorded.

Based on a detailed evaluation of each CCTV reports compared to Electro Scan, CCTV missed as much as 92.7% of defects identified by Electro Scan.

## Survey Abandonments Severely Reduced CCTV's Ability to Assess Sewers.

For the 6 sewer mains of the 23 sewers surveyed, CCTV 'Abandoned Surveys' ranged from as little as 1.24% to as much as 88% of pipe section length left un-surveyed by CCTV due to abandonment.

For the six (6) lines that were televised and reported an 'Abandoned Survey,' reverse set-ups were attempted; i.e. CCTV attempted from both Upstream & Downstream Manholes, but 29% of the total pipe lengths were never evaluated.

Of the sections of pipe NOT televised due to Abandoned Surveys, 26 Defects Flows (i.e. defects registering an estimated resultant flow) were identified by Electro Scan.

On average, those portions of the pipe section NOT televised due to Abandoned Surveys contained 63% of the whole pipe length's infiltration potential, despite being only 29.44% of the pipe's total length.

## Conclusions

Those portions of the pipe that go 'un-surveyed' due to Abandoned Surveys may miss significant sources of infiltration. By providing quantitative data without any Survey Abandonments, Electro Scan appears much better suited to assess a pipe's criticality and infiltration potential.

Given that 55% of all CCTV surveys in this sub-basin reported *abandoned surveys*, a very significant amount of data is likely missing from the analysis of this portion of the network.

Updated Infiltration Reduction Plans (IRP) to manage groundwater infiltration and reduce the risk of potential risk flooding should limit the use of CCTV inspection post-Electro Scan identified defects. Besides looking at past *abandoned surveys*, WASCs should review the mix of FOG, Silt, and Root observations that also tend to disguise the integrity of the pipe wall and may tend to misdiagnose critical sewers.

# Severn Trent Releases Innovative Bulletin on Electro Scan

# Innovation Bulletin

SEVERN  
TRENT  
WATER

18<sup>th</sup> February 2014

Ref: AD/C 0000  
(for completion by Severn Trent)

## Electro Scan

The Next Generation in Sewer Leak Detection | Finding Infiltration Missed by CCTV

### Brief description

Electro Scan is a revolutionary technology that locates defects having the potential for causing infiltration into sewers and other pipes. Not dependant upon any visual identification of infiltration at the time of the survey, the solution provides an estimated liters per second (l/s) for each defect. Most sewer pipe materials such as clay, plastic, concrete, reinforced concrete, resin linings, and brick are poor conductors of electrical current. As a result, if a defect exists in the wall of a pipe, then the leakage of electrical current will indicate the source of a potential water leak, whether or not water infiltration or exfiltration actually occurs at the time of the Electro Scan.

Electro Scan has been in the UK for just over a year, and has been adopted by two other UK water companies, after multiple catchment studies. Recently, Severn Trent Services completed two successful trial projects.

### Benefits

The Electro Scan technology is able to:

- Automatically locates sources of infiltration, whether visible or not, in pipes 75mm to 600mm
- Measure and quantify each defect found (estimated LPS of infiltration), no matter the weather conditions
- Provide repeatable, objective data
- Performed without specialized certification
- Help prioritize rehabilitation programs
- Certify relined pipes and repairs as "leak-free"
- Evaluate surcharged pipes (including siphons) without the need to bypass or empty
- Maintain an almost-zero survey abandonment rate
- Perform scans in pipes filled with fats, oils, and grease (FOG)
- Immediately processes data and presents it in a cloud-based application

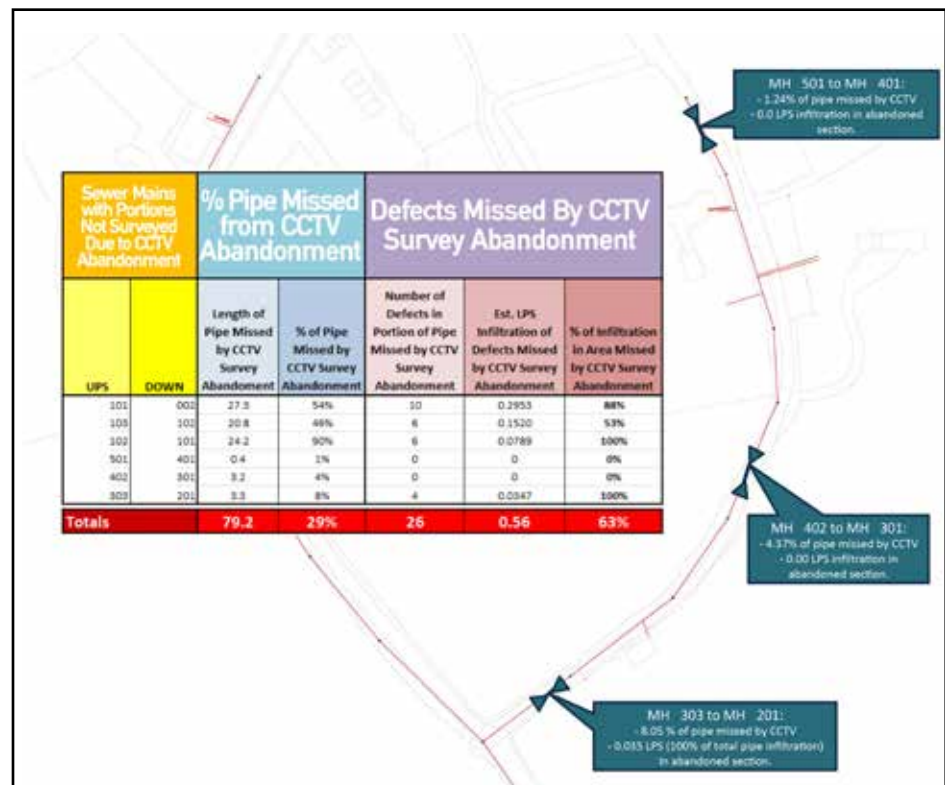
With treatment works processing from 10-40% of water that should drain into rivers & streams, contributes to the reduction of our carbon footprint by reducing pump runtimes. CCTV Truck add-on for large mains or push rod versions available.

### Details

Electro-scanning is carried out by applying an electrical potential (voltage) between an electrode (probe) in an electrically nonconductive pipe and an grounding stake on the surface. The water in the pipe is at a level that ensures that the pipe is full at the probe location, during the survey. The probe is pulled through the pipe at a speed of 10 m/minute and the variation of electric current flowing between the probe and the fixed electrode on the surface is measured. When the probe is close to a pipe defect the electric current increases because the defect decreases the electrical resistance of the pipe wall. All data is automatically collected and sent to a web-based cloud platform for instant processing and display.

### Electric Circuitry of a Sewer Main

For further  
Information contact:  
sean@anthire.com  
or  
info@electroscan.com





## FINAL SCORE

# CCTV Inspection

## Electro Scan

### 0 93

Electro Scan gets asked all the time, 'How does CCTV inspection compare to Electro Scan?' TV operators can always have an off-day. We've all seen the TV video where the camera must have traveled at the speed of Mach 5.

But, after over 300 benchmark projects, benchmark demonstrations, and side-by-side comparisons, you can't help to see how challenging it is for a certified camera operator to miss openings at joints, invert, and service connections where water can easily enter or exit a pipe.

CCTV is still an important inspection tool to access the need for periodic maintenance, especially to access grease, roots, and debris. At least until alternative technologies are improved that might automate the process for sensing flow restrictions and stoppages.

Due to the basic construction of sewers, relying on joints that are either set together with mortar and/or Fernco-style fittings, it is impossible for the human eye to look through a joint to determine if a gap exists for water to enter or exit a pipe.

## TV Inspection Report

Completed in accordance with a nationally recognized sewer condition assessment classification standard.

Work order	Position segment ref	Start date/time	Location (street name and number)	Locality
		2013/04/18 13:03	1163 SPRUCETREE	
Further location details:				
Upstream manhole No.	Downstream manhole No.	Run to invert	Grade to invert	Grade to invert
Material	Shape	Material	Ln. method	Pipe joint length
Purpose	Sewer category	Pre-cleaning	Date cleaned	Weather
Grade	Amount of blockage	Blockage	Structural/Functional Blockage	Structural/Functional Blockage
1	0	0	0	0
2	0	0	0	0
3	0	0	0	0
4	0	0	0	0
5	0	0	0	0
Distance (ft)	Video Ref	Group	Defect Severity	Comments
0.0	2	APPH		
0.0	3	MFRL		
24.3	189	TF		
32.2	237	TFA		
46.0	303	TFA		
101.9	448	TFA		
124.9	487	TFA		
135.6	520	TFA		
146.3	578	TFA		
215.4	773	TFA		
231.9	827	TFA		
241.6	856	TFA		
249.4	885	TFA		
305.0	1054	TFA		
325.7	1054	TFA		
338.4	1076	TFA		
343.8	1109	TFA		
390.6	1400	APPH		

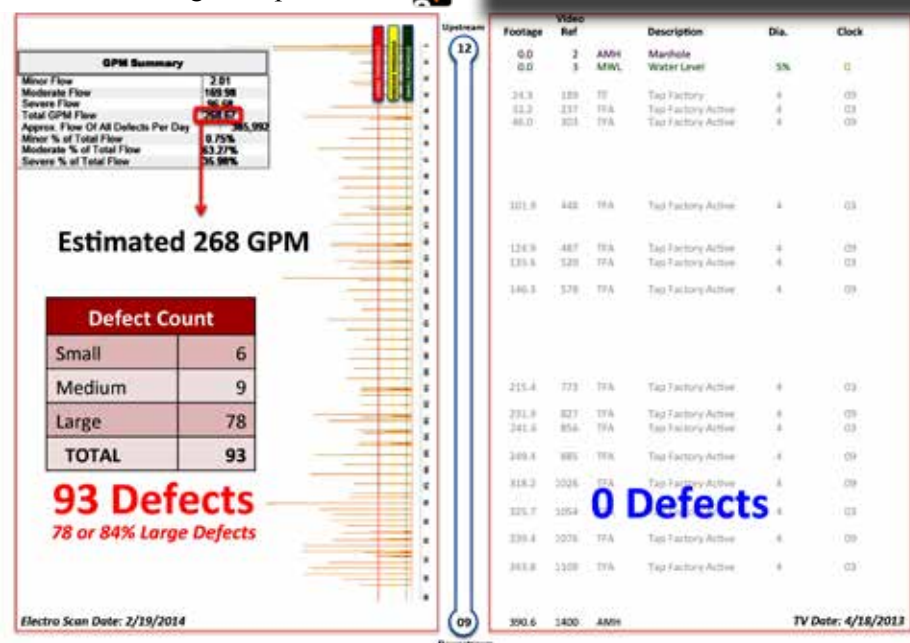
**NO DEFECTS FOUND BY TV INSPECTION**

It's not the fault of TV Operators for not recording defects they can't see. See Page 4

## Summary

While CCTV inspection was completed over a year prior to the Electro Scan survey, Electro Scan found 93 Total Defects, including 78 Large Defects, many of which exceeded our maximum defect flow of 10 GPM per defect.

Total estimated Defect Flow for the entire 365ft, 6in. VCP sanitary sewer main was 269.7 gallons per minute.



## Electro Scan Brings New Technology To England, Europe, and Australia

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Company Number: HRB 100935



### electro scan australia Pty Ltd

365 Little Collins Street, Suite 504  
Melbourne VIC 3000

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



Lisle Wilkerson  
Actress, Voice Artist, and  
Electro Scan Japanese Translator



## Friend & Celebrity, Lisle Wilkerson, Serves as Electro Scan's Cultural Attaché & Translator in Japan

Lisle Wilkerson, the powerhouse behind some of the gaming industry's most popular female fighting characters, such as Nina Williams, Christie Monteiro, and Sarah Bryant, and actress in the Academy Award winning Sofia Coppola film "Lost In Translation," joined the Electro Scan team to help its first installation in Japan.

"Lisle made our trip special," stated Brandon Harlow, Electro Scan Field Engineer. "Her translations helped us communicate our training lessons and it was great having her sign on with our team several weeks before our trip so she could get familiar with our industry."

We had no idea how popular Lisle was

in Japan," stated Mark Grabowski, VP. "Until she said the word 'Panasonic' for whom she was a spokesperson. You had to be there."



Lisle Wilkerson & Bill Murray in "Lost in Translation"





# Electro Scan Achieves ISO-9001 & ISO-14001 International Certification

## Adherence to Standards, Ongoing Innovation, and Environmental Compliance Sets Electro Scan Apart

Electro Scan becomes the first and only vendor to have received ISO certification in compliance with ASTM F2550-13, Standard Practice for Locating Leaks By Measuring the Variation of Electric Current Flow Through the Pipe Wall.

Certification to ISO 9001 and ISO 14001 standards requires an accredited third party auditing organization to thoroughly review the Company's internal quality management system processes and environmental management system, respectively, to ensure that they are capable of consistently delivering a service that

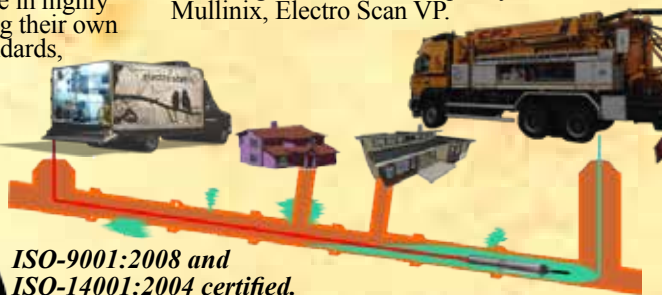
meets customers' needs and expectations.

"As our customers operate in highly regulated industries, requiring their own compliance to advanced standards, it is only fitting that we be a certified international

**Janine Mullinix**  
Vice President  
Administration  
& ISO Technical  
Manager



technology supplier that demonstrates our unwavering commitment to quality," stated Janine Mullinix, Electro Scan VP.



ISO-9001:2008 and  
ISO-14001:2004 certified.



## SURREY, BRITISH COLUMBIA, CANADA COMPLETES ELECTRO SCAN PROJECT

The City of Surrey, BC recently completed its first Electro Scan project. Representing the first Canadian Electro Scan project, Electro Scan Services teamed with Surrey-based Superior City Services, Ltd. to complete.

### About Surrey, BC

The City has one of the largest sanitary sewer networks in British Columbia with over 1,500 km of sewers pipes ranging in diameter from 150mm to 1200 mm, 40 pump stations, 22,000 manholes and 74,000 connections, serving approximately 130,000 customers. The average dry weather flow from Surrey is 143 million liters per day with an annual discharge of 59 million cubic meters.

### The Project

Working with City engineers to scope the project, it was decided to Electro Scan a total of 27 sewer mains ranging from 150-400mm in diameter and a total of 65 sewer laterals, ranging from 100-150mm in diameter.

Including over 100 municipal facilities and representing a total of 2.237 kilometers of pipe, work was conducted from November 17-20, 2014.

"It was great to focus in a single basin or neighborhood," stated Mark Grabowski, Electro Scan VP and Surrey Project Manager.

Continued on Page 2



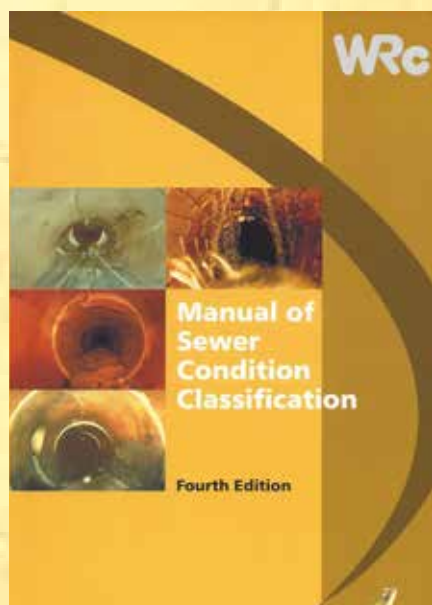
Surrey, BC, CANADA

## Benchmarks in England and US Show Limits of CCTV Inspection

### British Benchmark Highlights Risk of Abandoned Surveys

Electro Scan Services has completed its tenth project in the UK with one of its most recent projects providing a comprehensive comparison of Electro Scan compared with Closed-Circuit Television (CCTV) inspection.

Conducted in December 2013, Electro Scan was asked to survey twenty-three (23) sewer mains for a large British Water and Sewer Company (WASC), all previously televised by one of the UK's largest TV sewerage contractors. All TV inspections were completed in accordance with WRc's Manual of Sewer Condition Classification with the majority of work conducted in June 2013.



WRc Manual of Sewer Condition Classification standards used by a British CCTV contractor for Electro Scan benchmark comparison.

Continued on Page 10

### US Benchmark Finds Camera Unable To Inspect Sewer Main

In a surprise benchmark test arranged by Wightman & Associates, Inc. (Portage, Michigan), Electro Scan went head-to-head surveying the same pipe on the same day, with each vendor invited to demonstrate its product one after the other.

Conducted November 7, 2013 in the City of Watervliet, Michigan, Electro Scan was invited by engineering staff to go first, completing its inspection in less than 45 minutes, including set-up, scanning, and site clean-up.

By comparison, televising of the same sewer main, immediately following Electro Scan, was unable to complete its demonstration, getting stuck approximately 60 ft into the sewer.

Continued on Page 9

The biggest breakthroughs are the ones that alter decisions.



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