What is Electro Scan & How Can it Help SAM?

Sewer Authority Mid-Coastside Board Meeting

July 22th, 2019

Carissa Boudwin
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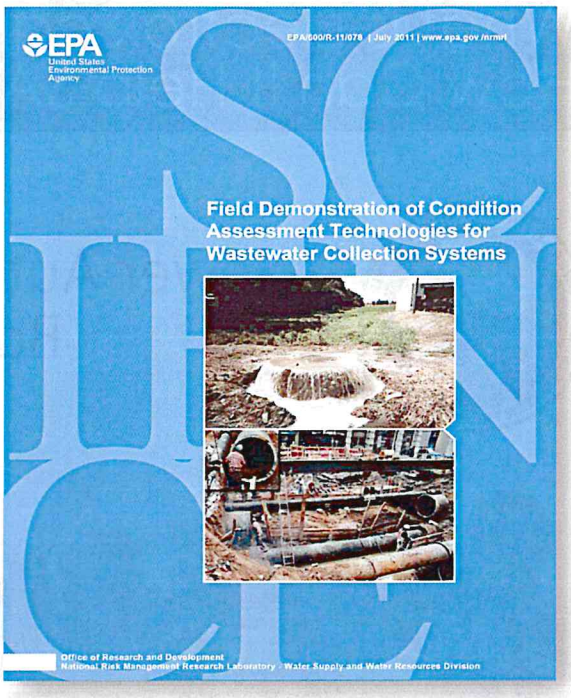
electro scan inc.

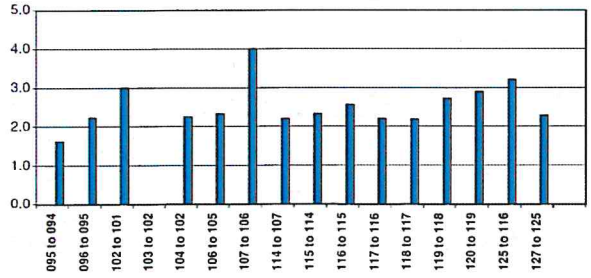
electro scan inc.

What Are We Missing? 👀

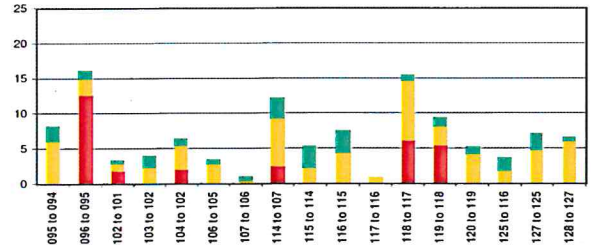
2010 EPA Study



2010 EPA Study

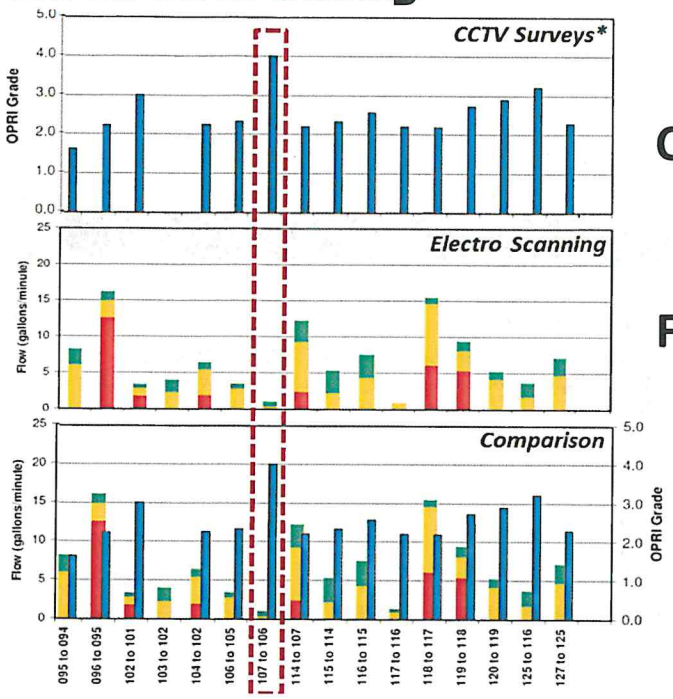


CCTV ■ OPRI



FELL ■ Large ■ Medium ■ Small

2010 EPA Study

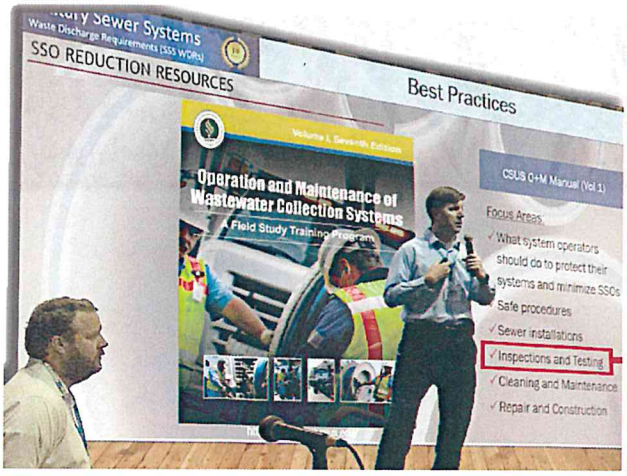


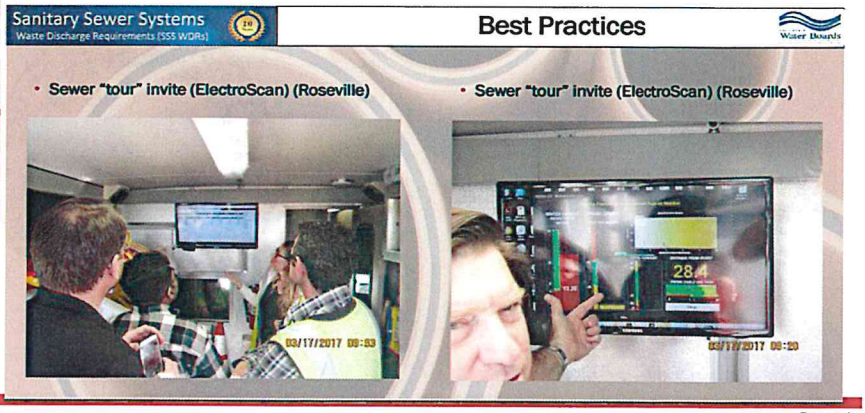
CCTV OPRI

FELL Large Medium Small

"CCTV was not a good indicator of sources of infiltration. In fact, it recorded even fewer infiltration related defects after cleaning."

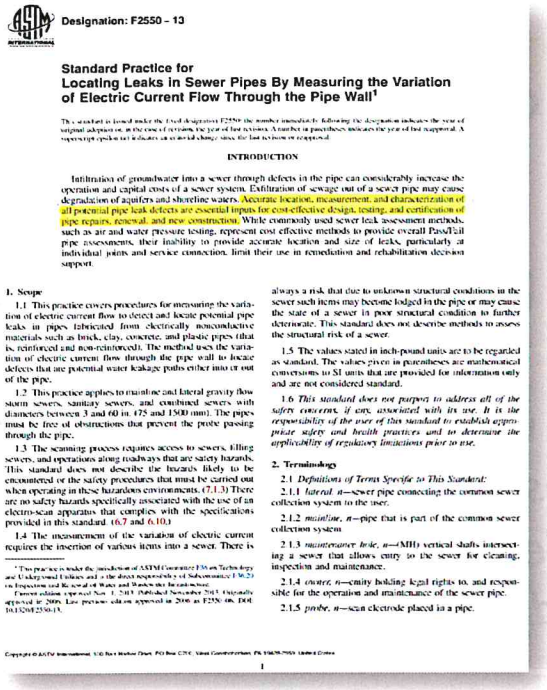
April 27, 2017 California EPA Office of Enforcement





Best Practice

ASTM F2550-13 (2018)



Designation: F2550 – 13

Standard Practice for Locating Leaks in Sewer Pipes By Measuring the Variation of Electric Current Flow Through the Pipe Wall[1]

INTRODUCTION

Infiltration of groundwater into a sewer through defects in the pipe can considerably increase the operation and capital costs of a sewer system. Exfiltration of sewage out of a sewer pipe may cause degradation of aquifers and shoreline waters. Accurate location, measurement, and characterization of all potential pipe leak defects are essential inputs for cost-effective design, testing, and certification of pipe repairs, renewal, and new construction. While commonly used sewer leak assessment methods, such as air and water pressure testing, represent cost effective methods to provide overall Pass/Fail pipe assessments, their inability to provide accurate location and size of leaks, particularly at individual joints and service connection, limit their use in remediation and rehabilitation decision support.

1. Scope

1.1 This practice covers procedures for measuring the variation of electric current flow to detect and locate potential pipe leaks in pipes fabricated from electrically nonconductive materials such as brick, clay, concrete, and plastic pipes (that is, reinforced and non-reinforced). The method uses the variation of electric current flow through the pipe wall to locate defects that are potential water leakage paths either into or out of the pipe.

1.2 This practice applies to mainline and lateral gravity flow storm sewers, sanitary sewers, and combined sewers with diameters between 3 and 60 in. (75 and 1500 mm). The pipes must be free of obstructions that prevent the probe passing through the pipe.

1.3 The scanning process requires access to sewers, filling sewers, and operations along roadways that are safety hazards. This standard does not describe the hazards likely to be encountered or the safety procedures that must be carried out when operating in these hazardous environments. (7.1.3) There are no safety hazards specifically associated with the use of an electro-scan apparatus that complies with the specifications provided in this standard. (6.7 and 6.10.)

1.4 The measurement of the variation of electric current requires the insertion of various items into a sewer. There is always a risk that due to unknown structural conditions in the sewer such items may become lodged in the pipe or may cause the state of a sewer in poor structural condition to further deteriorate. This standard does not describe methods to assess the structural risk of a sewer.

1.5 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.6 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and to determine the applicability of regulatory limitations prior to use.*

2. Terminology

2.1 *Definitions of Terms Specific to This Standard:*

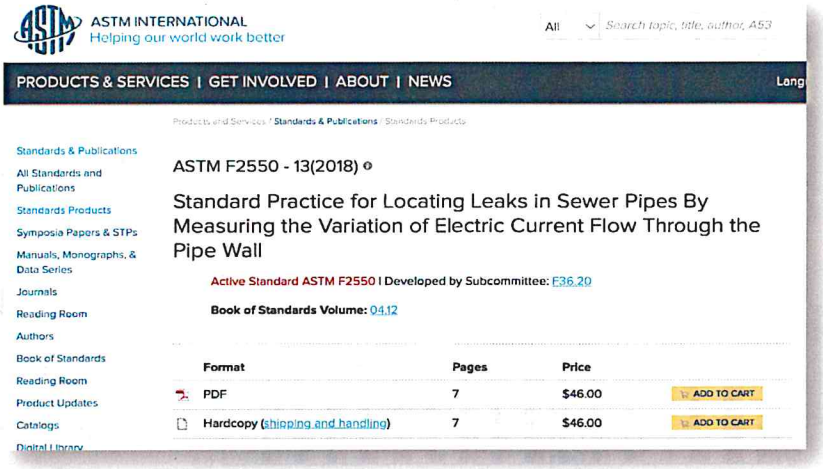
2.1.1 *lateral, n*—sewer pipe connecting the common sewer collection system to the user.

2.1.2 *mainline, n*—pipe that is part of the common sewer collection system.

2.1.3 *maintenance hole, n*—(MH) vertical shafts intersecting a sewer that allows entry to the sewer for cleaning, inspection and maintenance.

2.1.4 *owner, n*—entity holding legal rights to, and responsible for the operation and maintenance of the sewer pipe.

2.1.5 *probe, n*—scan electrode placed in a pipe.



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ASTM F2550 - 13(2018)

Standard Practice for Locating Leaks in Sewer Pipes By Measuring the Variation of Electric Current Flow Through the Pipe Wall

Active Standard ASTM F2550 | Developed by Subcommittee: F36.20

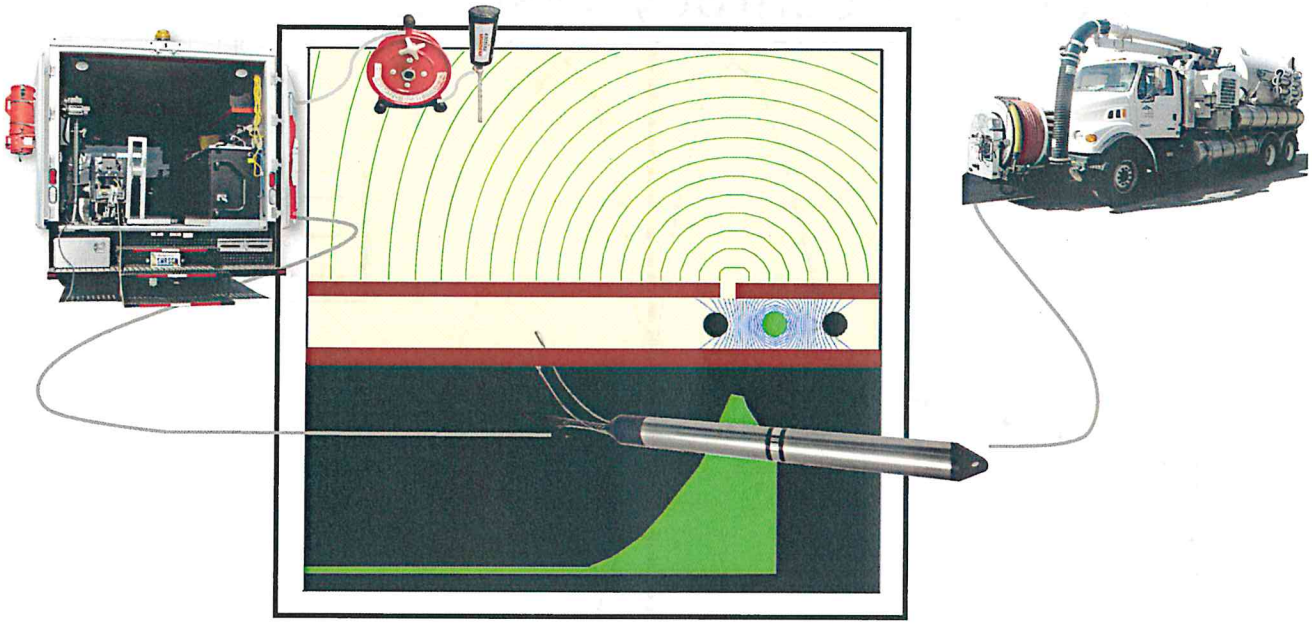
Book of Standards Volume: 04.12

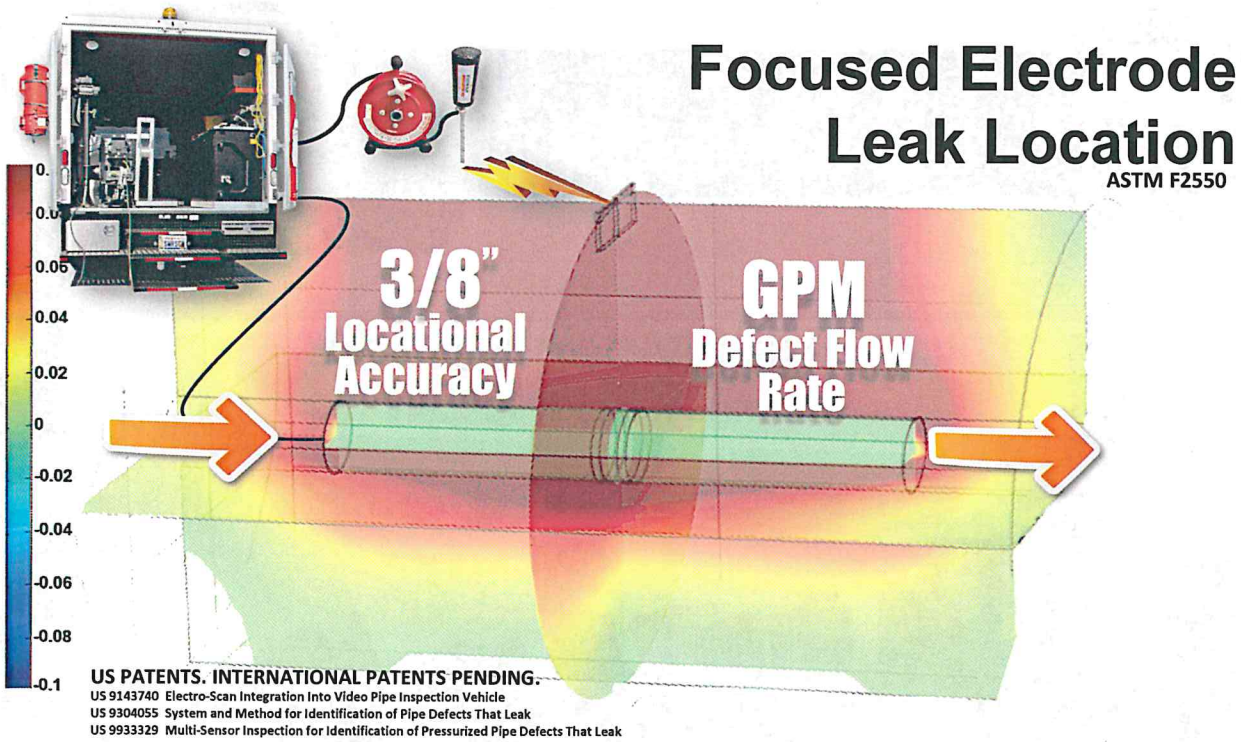
Format	Pages	Price	
PDF	7	$46.00	ADD TO CART
Hardcopy (shipping and handling)	7	$46.00	ADD TO CART

electroscaninc.

Electricity Mimics Water with Path of Least Resistance

SEWER AUTHORITY MID-COASTSIDE
WASTE WATER TREATMENT FACILITY

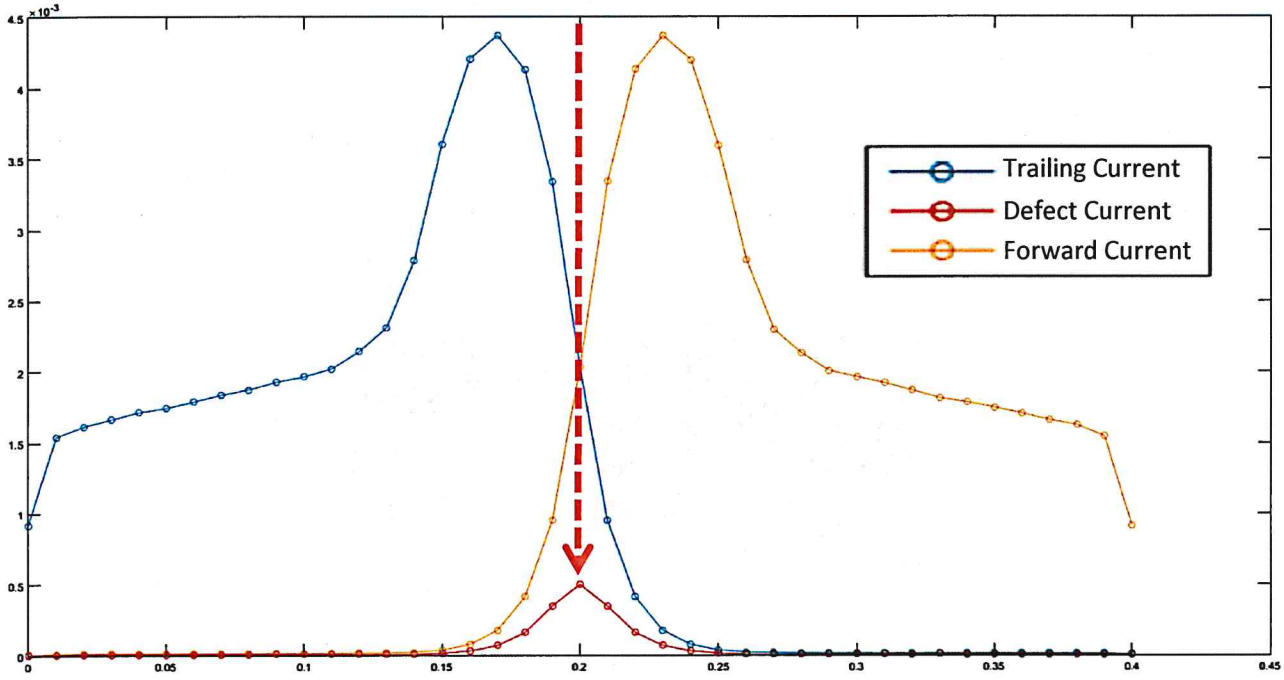




US PATENTS. INTERNATIONAL PATENTS PENDING.

US 9143740 Electro-Scan Integration Into Video Pipe Inspection Vehicle
US 9304055 System and Method for Identification of Pipe Defects That Leak
US 9933329 Multi-Sensor Inspection for Identification of Pressurized Pipe Defects That Leak

Positional Accuracy Testing



Electro Scan Demo Report

Half Moon Bay, CA

Field Work: July 15th, 2019

electro scan inc.

Electro Scan Field Results

Electro Scan Inc. conducted its field demonstration on Monday, July 15th, 2019 including two (2) sewer mains.

As shown in Table 1, **Electro Scan surveyed 834 linear feet of pipe finding 342 pinholes and 27 individual defect locations contributing an estimated 287.01 gallons per minute (GPM) of defect flow or 413,294 gallons per day (GPD).**

Table 1: Half Moon Bay Electro Scan Demonstration Summary Results

	Scans	Footage	Pinholes	Total Defects	GPM	GPD
Total:	**2**	**834**	**342**	**27**	**287.01**	**413,294**

Listed In Inspection Order

Date	Mainline ID	Pipe ID	Pipe Type	Diameter	Distance (ft)	Pinhole	Small	Medium	Large	GPM	GPD	GPD IDM
7/15/2019	MH 21 - MH 22	MH 21 - MH 22	CIPP	21	430.84	342	2	0	0	270.37	389,333	227,204
	MH 20 - MH 21	MH 20 - MH 21	VCP	21	402.84	0	25	0	0	16.64	23,962	14,955

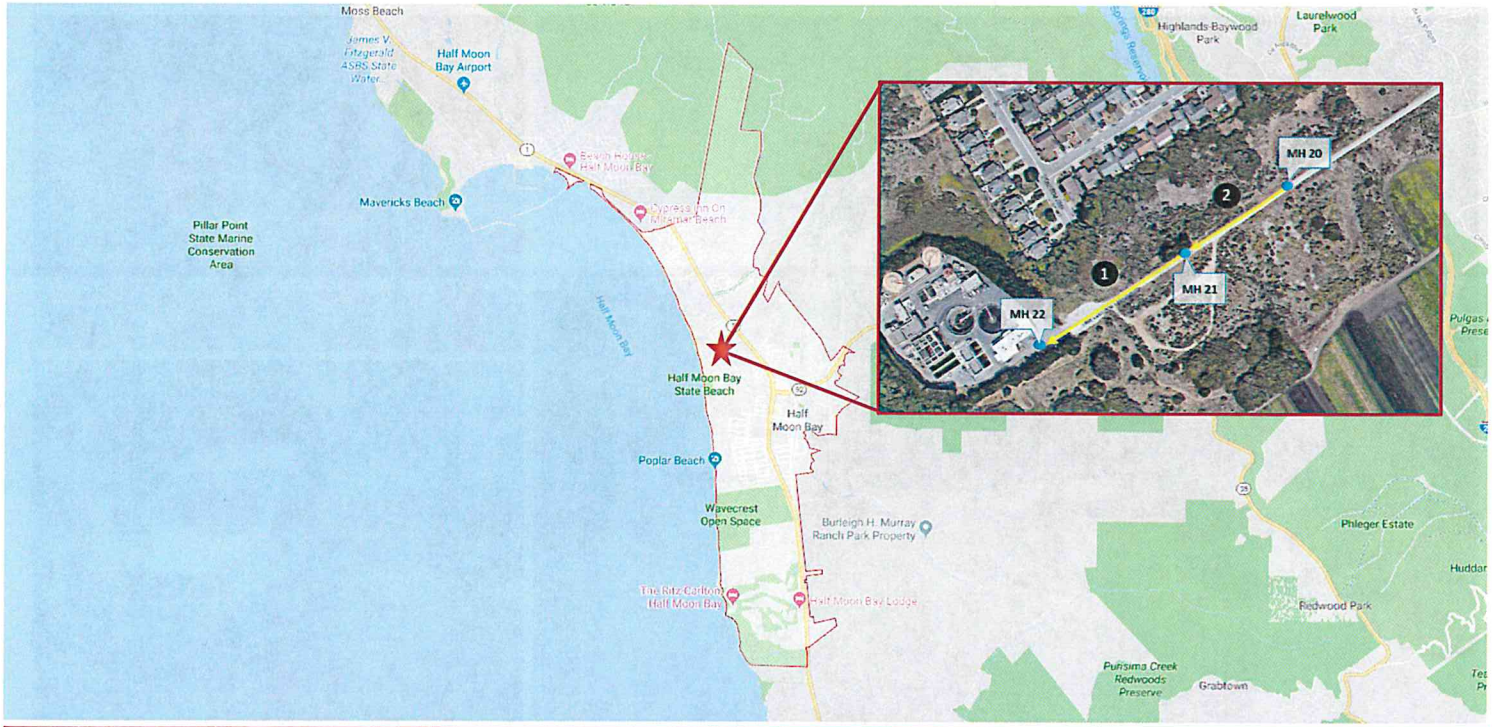
Note: Due to low water height in pipe, defects could be more numerous & more severe than stated in report.

Summary

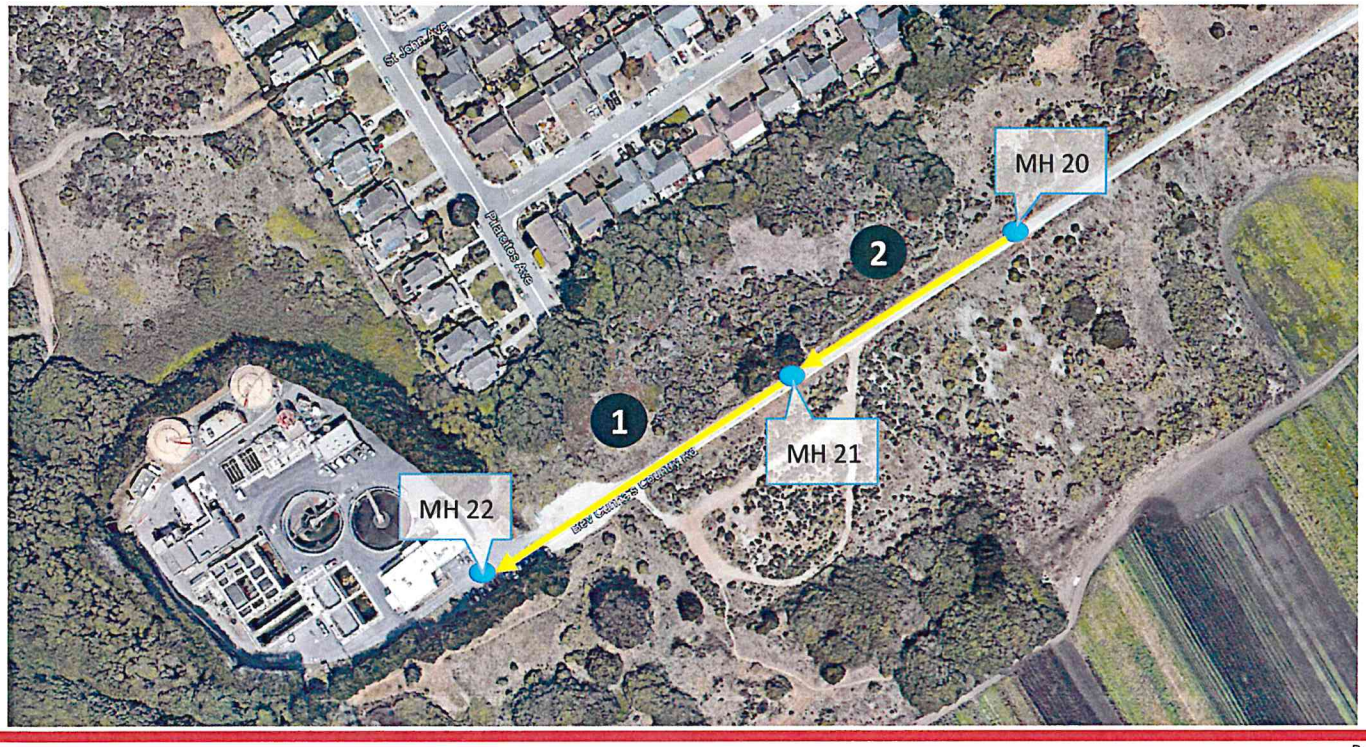
While CCTV inspection provides a visual recording of internal pipe conditions, Electro Scan's findings confirm that Electro Scan represents a more dependable method to find and measure defects in the wall of sewers and at joint fittings. Please refer to the Appendix for additional information.

All work was completed in accordance with the Seventh Edition, Volume 1, of the Operations and Maintenance of Wastewater Collection Systems manual, with all locations accurate to within 1 cm (0.4m in) and ±30% accuracy of its defect flow calculations which assume a 1ft head and 1% pipe gradient. All reporting was prepared in accordance with ASTM F2550.

Demo Location



Demo Location: Bev Cunha's Country Rd



Field Photos: July 15th, 2019

Thanks For A Great Day! The Electro Scan Team

1

MH 21 – MH 22
Cured-In-Place Pipe (CIPP)

1

MH 21 – MH 22

DEFECTS		LENGTHS
Large	0	0.0000
Medium	0	0.0000
Small	2	0.0044
Pinhole	342	0.9942
All Defects	344	0.0879

GPM SUMMARY	
Severe	78.180
Moderate	91.860
Minor	82.900
Total GPM	270.3700
GPD	389,333
GPD IDM	227,204
Severe %	28.92%
Moderate %	33.98%
Minor %	30.66%

DIAMETER & DISTANCE

21

431.00 ft

0 100 200 300 400

OPERATOR INFO

Tech Electroscan

Project

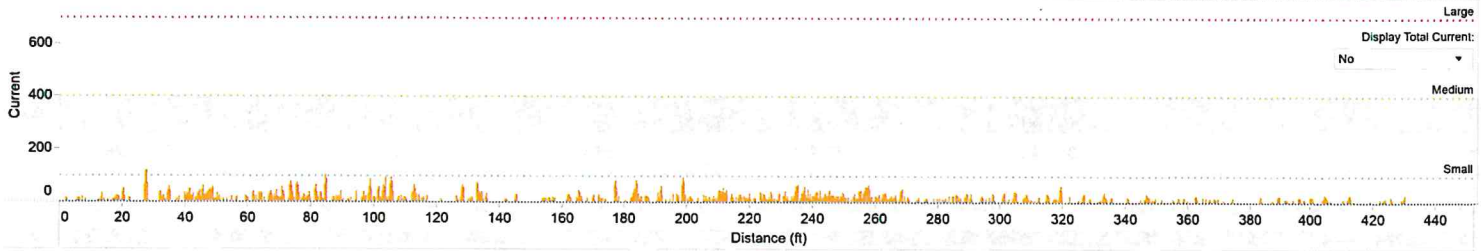
Demo

Job

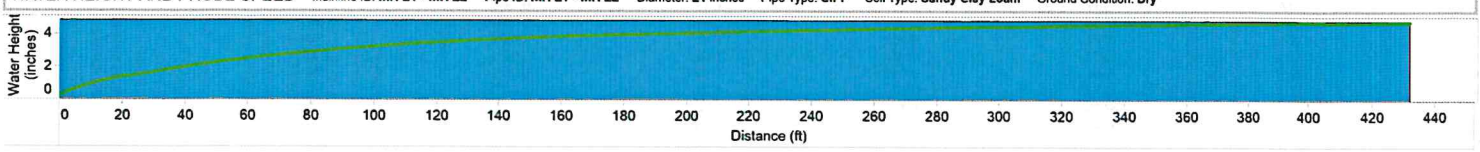
Demo

Atmospheric Test	Scan Start
7/15/2019 11:46:07 AM	7/15/2019 11:47:20 AM

DEFECT CURRENT Mainline ID: **MH 21 - MH 22** Pipe ID: **MH 21 - MH 22** Diameter: **21** inches Pipe Type: **CIPP** Soil Type: **Sandy Clay Loam** Ground Condition: **Dry**



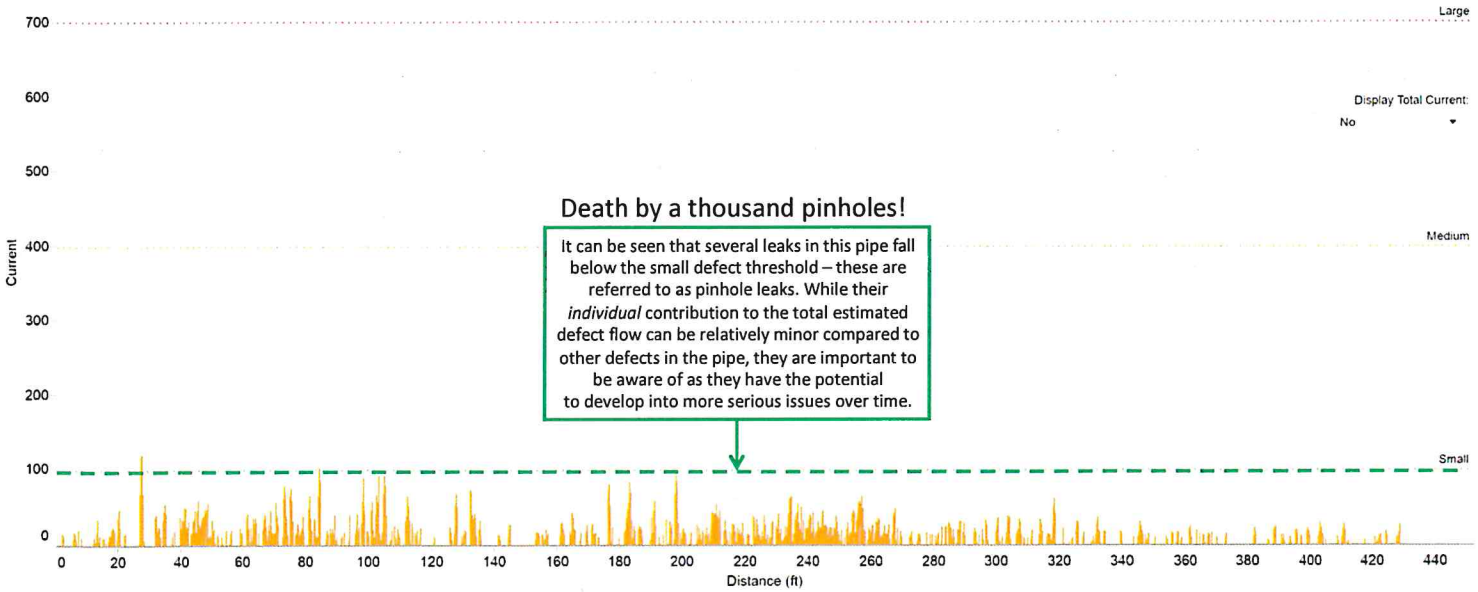
WATER HEIGHT AND PROBE SPEED Mainline ID: **MH 21 - MH 22** Pipe ID: **MH 21 - MH 22** Diameter: **21** inches Pipe Type: **CIPP** Soil Type: **Sandy Clay Loam** Ground Condition: **Dry**



1

MH 21 – MH 22 – Defect Current

DEFECT CURRENT Mainline ID: **MH 21 - MH 22** Pipe ID: **MH 21 - MH 22** Diameter: **21** inches Pipe Type: **CIPP** Soil Type: **Sandy Clay Loam** Ground Condition: **Dry**



1

MH 21 – MH 22 – Defect Chart

2 Small Defects = 4% of Estimated Defect Flow

	Defects	Length of Defects (f..	GPM	% of GPM	GPD	GPD/IDM
Total:	**2**	**1.909**	**11.130**	**4%**	**16,027**	**9,353**

DEFECT BY LOCATION Mainline ID: **MH 21 - MH 22** Pipe ID: **MH 21 - MH 22** Diameter: **21** inches Pipe Type: **CIPP** Soil Type: **Sandy Clay Loam** Ground Condition: **Dry** **Pinholes Not Included**

Defect Grade	Defect Start (ft)	Defect End (ft)	Length of Defects (ft)	GPM	% of GPM	GPD	GPD/IDM
S	27.50	28.71	1.21	6.11	2.26%	8,798	5,135
S	84.34	85.03	0.70	5.02	1.86%	7,229	4,219

Pinholes = 96% of Estimated Defect Flow

	Defects	Length of Defects (f..	GPM	% of GPM	GPD	GPD/IDM
Total:	**342**	**35.941**	**259.210**	**96%**	**373,262**	**217,826**

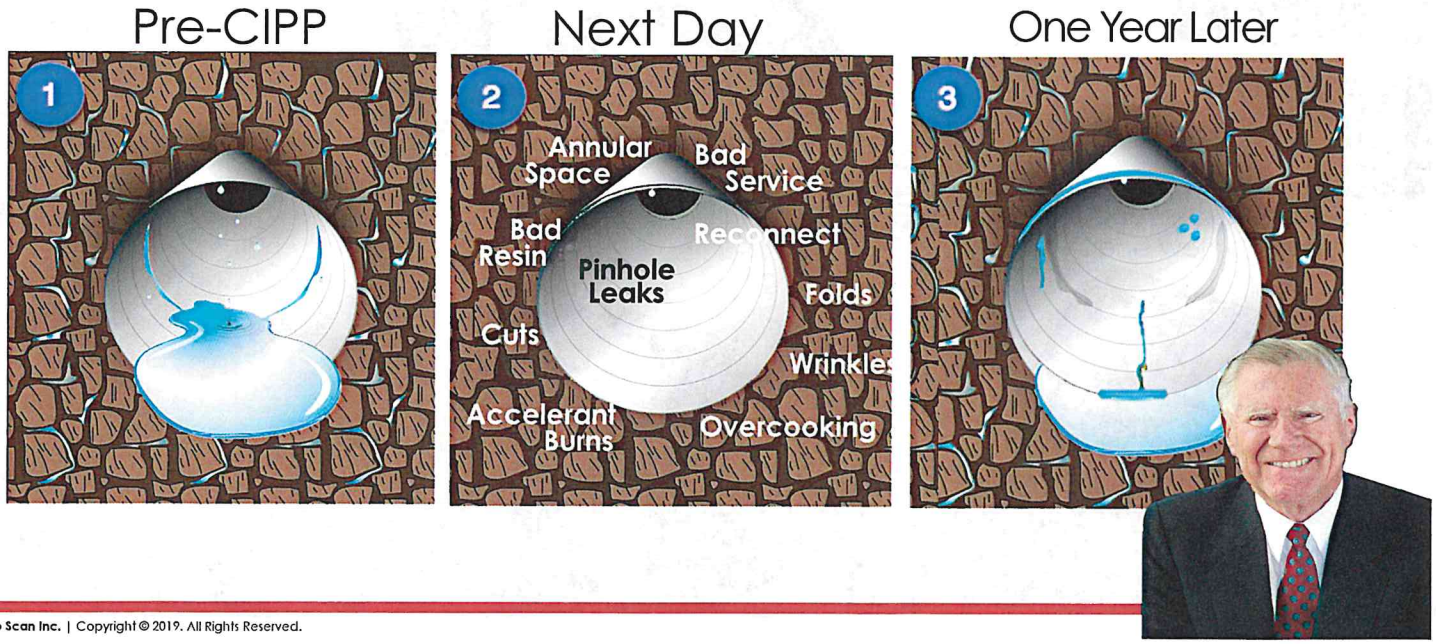
DEFECT BY LOCATION Mainline ID: **MH 21 - MH 22** Pipe ID: **MH 21 - MH 22** Diameter: **21** inches Pipe Type: **CIPP** Soil Type: **Sandy Clay Loam** Ground Condition: **Dry** **Pinholes Only**

Defect Grade	Defect Start (ft)	Defect End (ft)	Length of Defects (ft)	GPM	% of GPM	GPD	GPD/IDM
X	7.20	7.20	0.00	0.12	0.04%	173	101
X	13.37	13.44	0.08	0.62	0.23%	893	521
X	18.17	18.17	0.00	0.11	0.04%	158	92
X	18.47	18.54	0.08	0.42	0.16%	605	353
X	18.74	18.74	0.00	0.10	0.04%	144	84
X	20.30	20.77	0.47	2.66	0.98%	3,830	2,235
X	20.65	20.65	0.00	0.13	0.05%	187	109
X	31.78	31.83	0.05	0.38	0.14%	547	319
X	32.08	32.55	0.47	2.62	0.97%	3,773	2,202
X	33.02	33.12	0.10	0.65	0.24%	936	546
X	34.43	34.51	0.08	0.63	0.23%	907	529
X	35.08	35.67	0.59	4.00	1.48%	5,760	3,361

"My former students are experiencing CIPP & VCP leaks that were OK'd by CCTV. Do you know any device that can find leaks in CIPP liners?"

2010

Ken Kerri, Ph.D., P.E.



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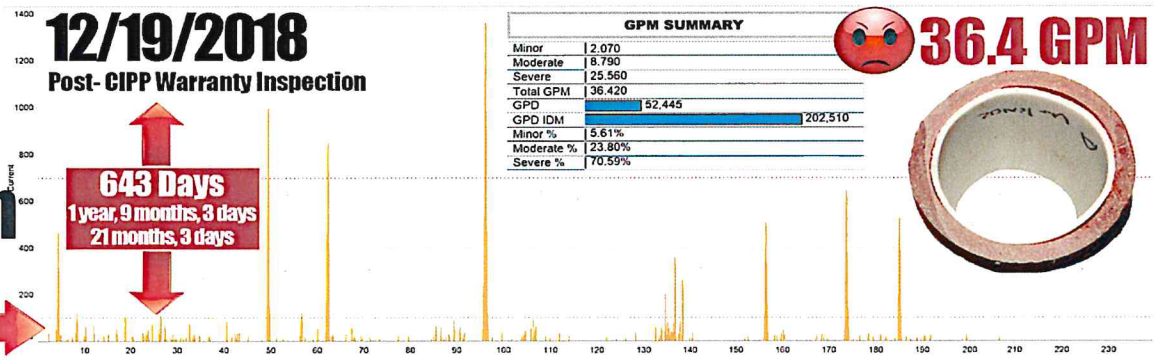
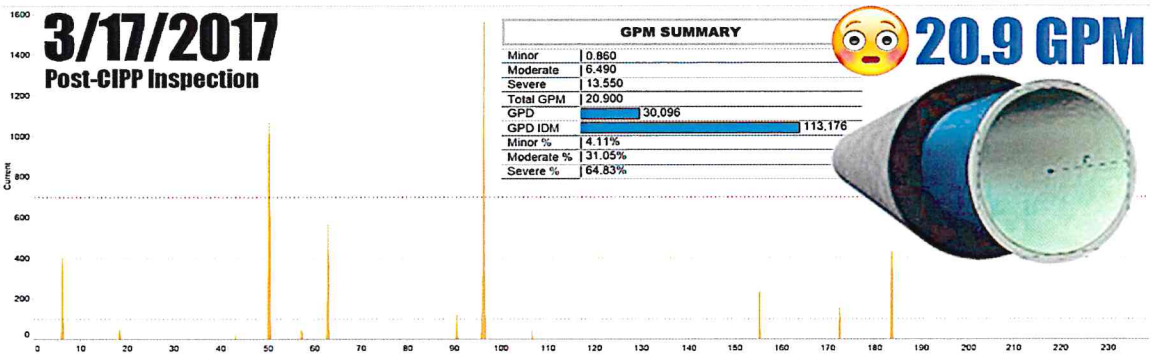
Post-CIPP Warranty Inspection



Post-CIPP



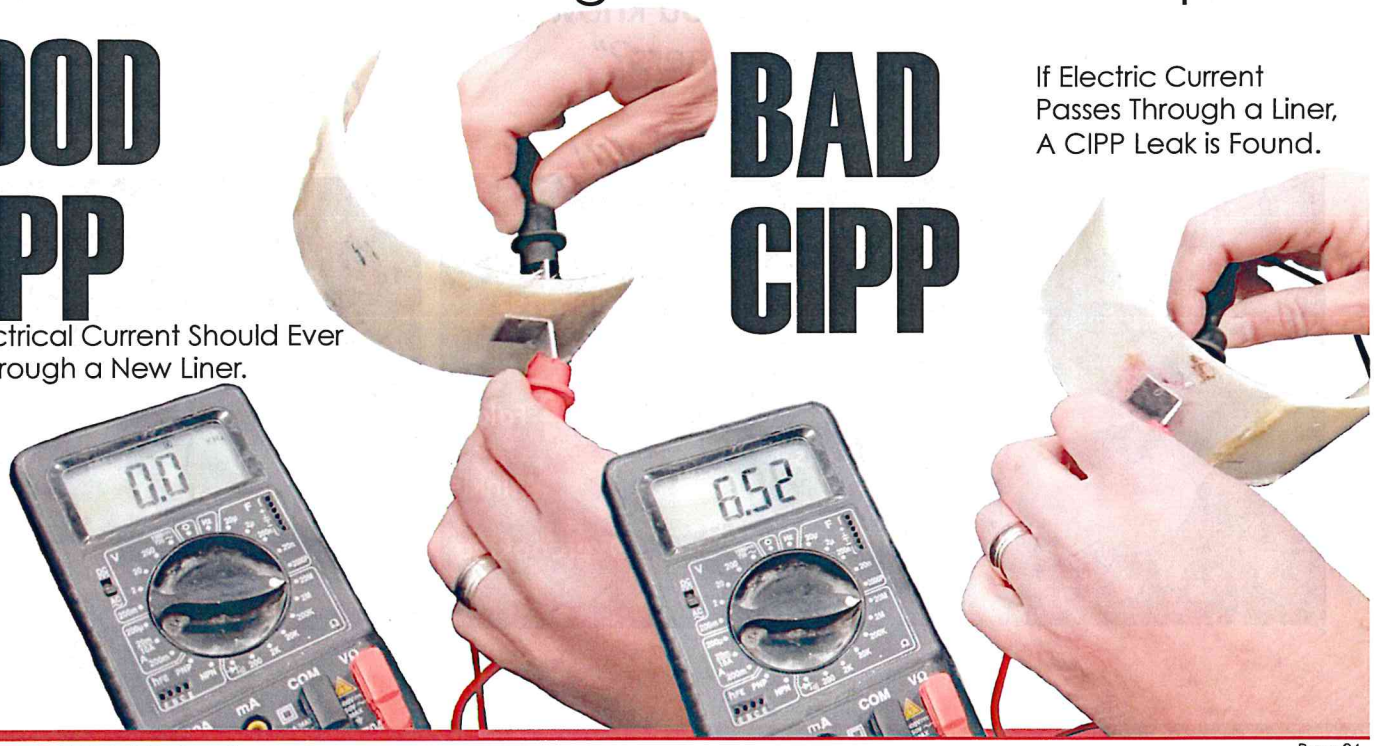
CIPP Should Be Watertight. After All It's a Pipe!

GOOD CIPP

No Electrical Current Should Ever Pass Through a New Liner.

BAD CIPP

If Electric Current Passes Through a Liner, A CIPP Leak is Found.



Perfect CIPP Liner

DEFECTS		% OF DEFECT LENGTHS
Small	0	0
Medium	0	0
Large	0	0
All Defects	0	0

GPM SUMMARY	
Minor	0.000
Moderate	0.000
Severe	0.000
Total GPM	0.000
GPD	0
GPD IDM	0
Minor %	0.00%
Moderate %	0.00%
Severe %	0.00%

DIAMETER & DISTANCE

8

293.00 ft

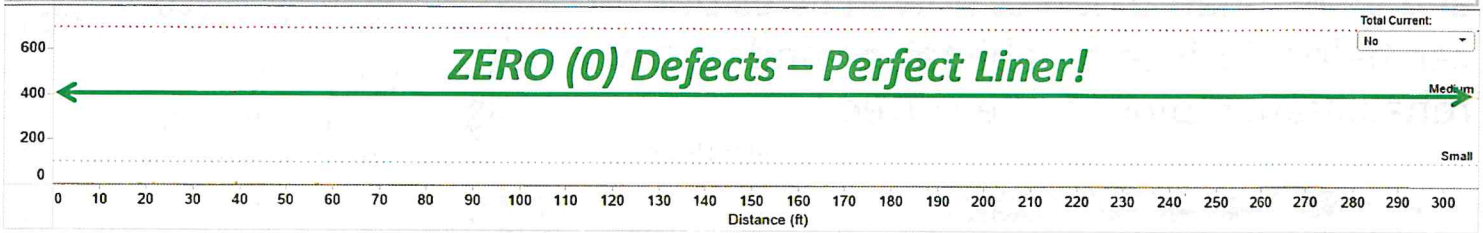
0 100 200 300

OPERATOR INFO

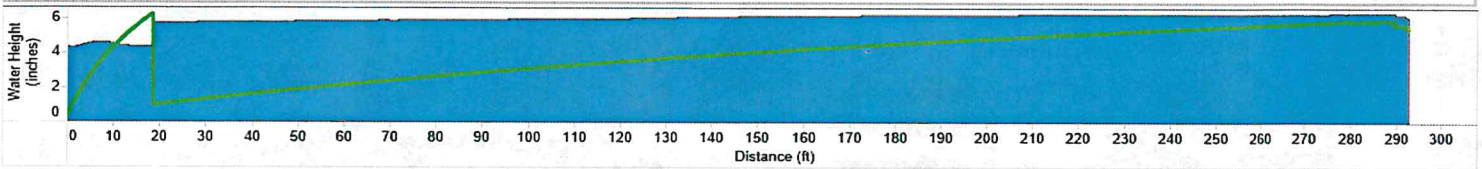
Tech Electroscan
Project
Demo
Job
Demo

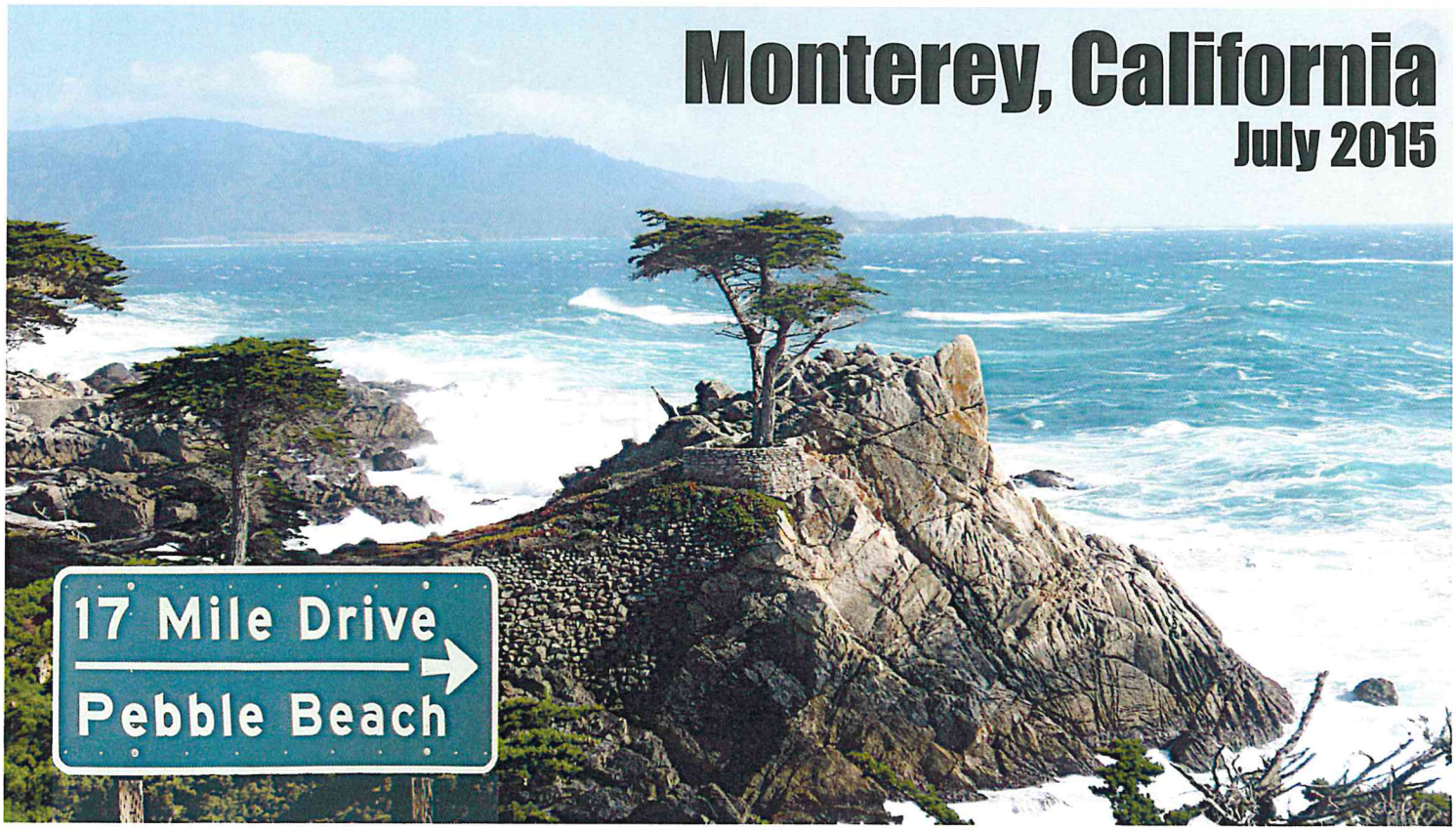
Atmospheric Test	Scan Start
2/21/2018 3:01:02 PM	2/21/2018 4:04:59 PM

DEFECT CURRENT Mainline ID: 118-203434 - 188-203433 Pipe ID: 118-203434 - 188-203433 Diameter: 8 inches Pipe Type: CIPP Soil Type: Ground Condition:



WATER HEIGHT AND PROBE SPEED Mainline ID: 118-203434 - 188-203433 Pipe ID: 118-203434 - 188-203433 Diameter: 8 inches Pipe Type: CIPP Soil Type: Ground Condition:



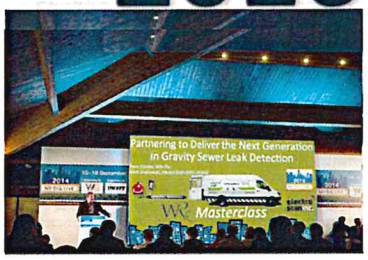


Masterclass on Electro Scanning Inspection

2016

This presentation highlights new technology and its recent results from British water clients, showing how it provides specific locations for each defect and an estimated defect flow in litres per second can help prioritize rehabilitation and certify newly rehabilitation pipes as 'leak free.'

Peter Henley, WRc



WRc Delivers the Next Generation in Sewer Leak Detection

by Peter Henley of WRc and Mark ...rabowski of Electro Scan Inc.

2

MH 20 – MH 21

Vitrified Clay Pipe (VCP)

2

MH 20 – MH 21

DEFECTS		LENGTHS	
Small	25	0.002900	
Medium	0	0.000000	
Large	0	0.000000	
All Defects	25	0.002900	

GPM	
Minor	11.930
Moderate	
Severe	0.000
Total GPM	16.640
GPD	23,962
GPD IDM	14,955
Minor %	71.69%
Moderate %	28.31%
Severe %	0.00%

DIAMETER & DISTANCE

21

403.00 ft

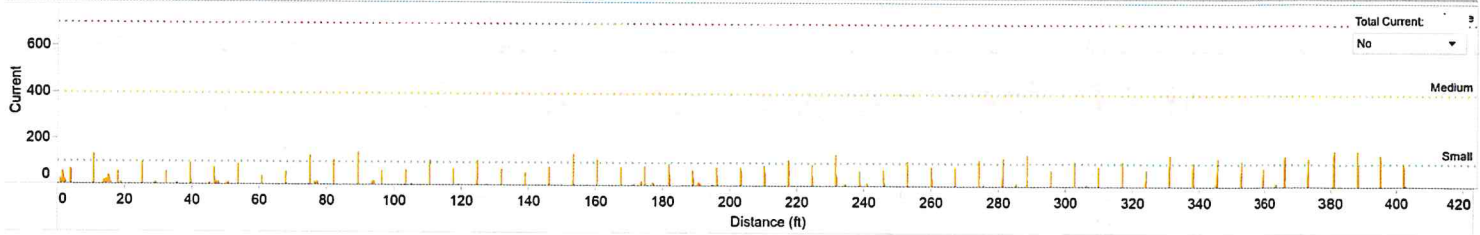
0 100 200 300 400

OPERATOR INFO

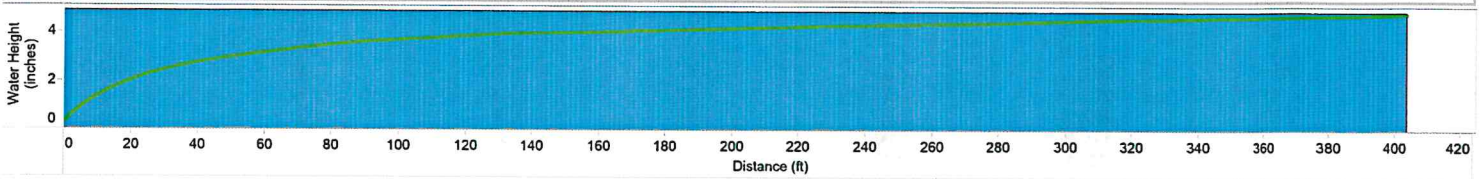
Tech Electroscan
Project
Demo
Job
Demo

Atmospheric Test	Scan Start
7/15/2019 11:46:07 AM	7/15/2019 12:32:21 PM

DEFECT CURRENT Mainline ID: **MH20 - MH21** Pipe ID: **MH20 - MH21** Diameter: **21** inches Pipe Type: **VCP** Soil Type: **Sandy Clay Loam** Ground Condition: **Dry**



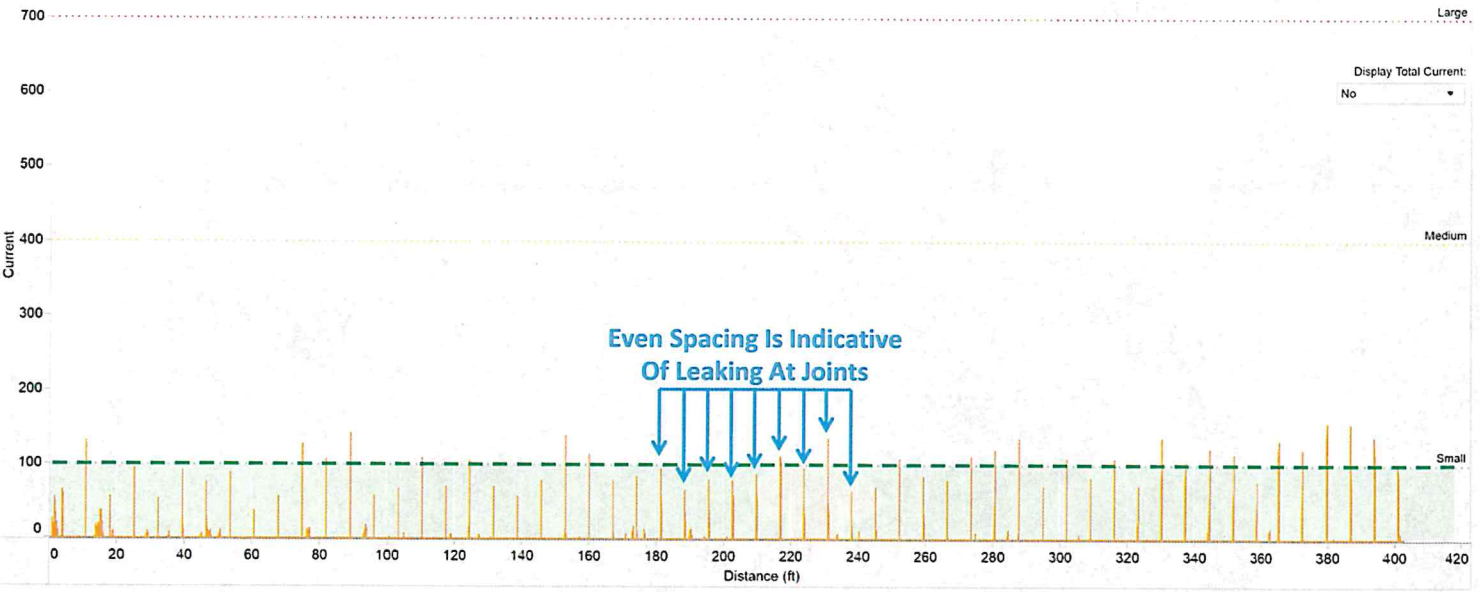
WATER HEIGHT AND PROBE SPEED Mainline ID: **MH20 - MH21** Pipe ID: **MH20 - MH21** Diameter: **21** inches Pipe Type: **VCP** Soil Type: **Sandy Clay Loam** Ground Condition: **Dry**



2

MH 20 – MH 21 – Defect Current

DEFECT CURRENT Mainline ID: **MH20 - MH21** Pipe ID: **MH20 - MH21** Diameter: **21** inches Pipe Type: **VCP** Soil Type: **Sandy Clay Loam** Ground Condition: **Dry**



2

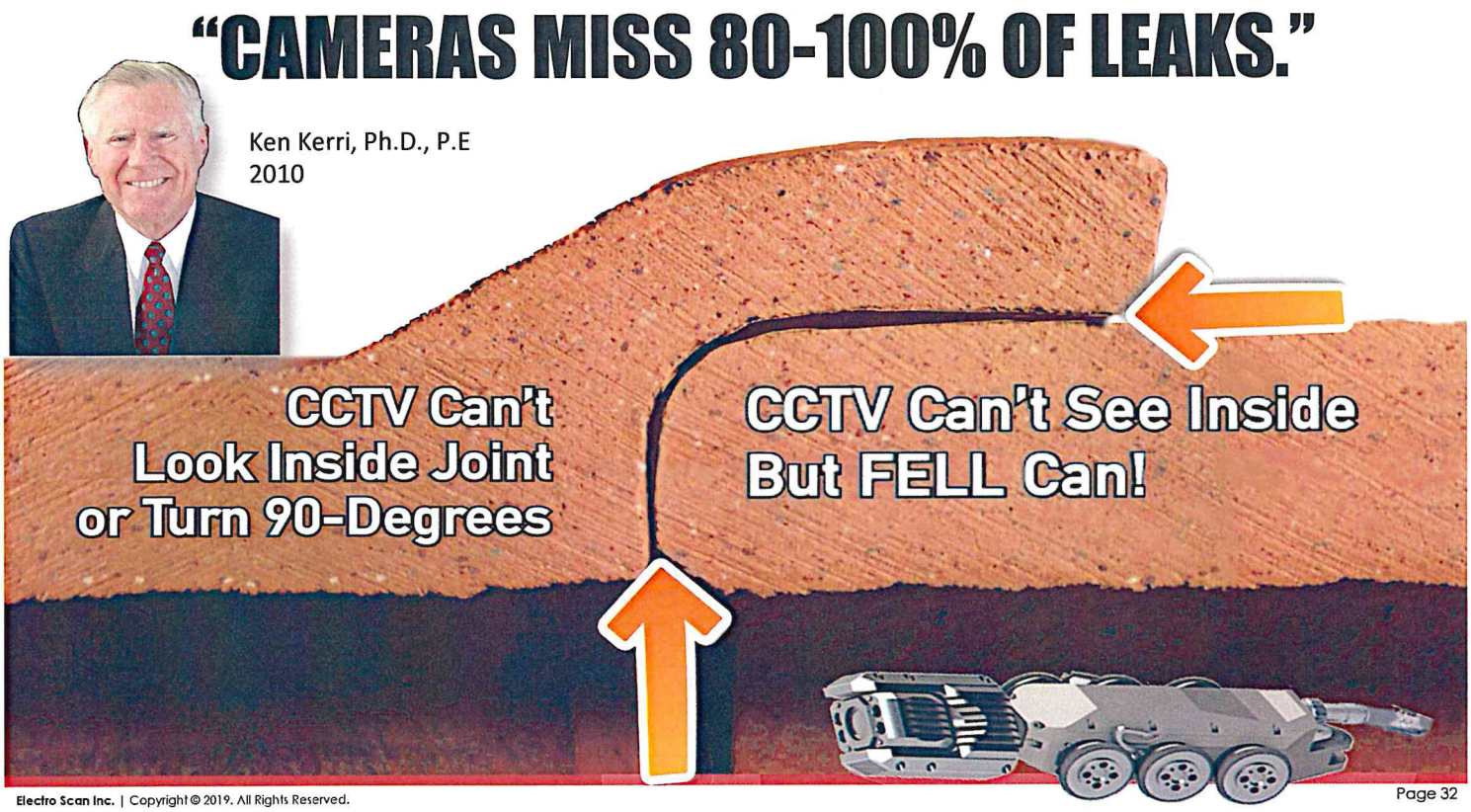
MH 20 – MH 21 – Defect Chart

	Defects	Length (ft)	GPM	% of GPM	GPD	GPD/IDM
Total:	25	1.188	17.080	103%	24,595	15,351

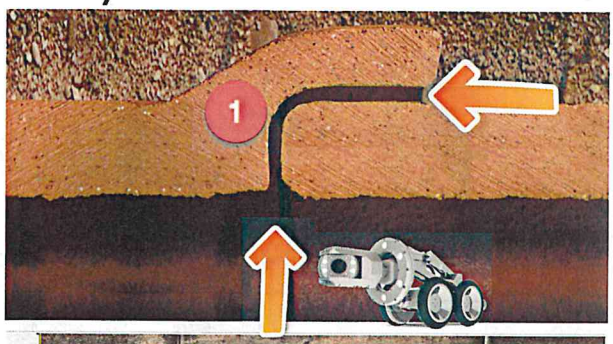
DEFECT BY LOCATION Mainline ID: **MH20 - MH21** Pipe ID: **MH20 - MH21** Diameter: **21** inches Pipe Type: **VCP** Soil Type: **Sandy Clay Loam** Ground Condition: **None** **Ranked By GPM**

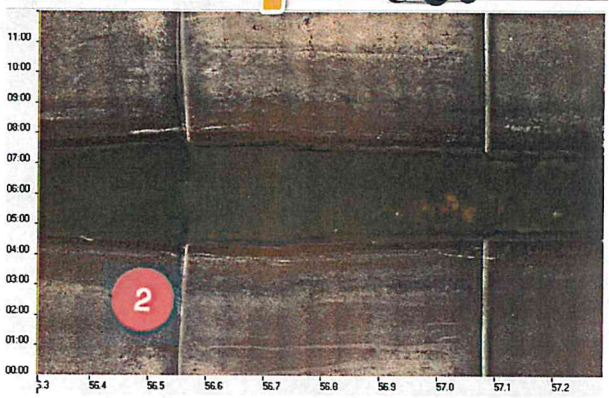
Defect Grade	Defect Start (ft)	Defect End (ft)	Length (ft)	GPM	% of GPM	GPD	GPD/IDM
S	379.92	380.02	0.10	1.33	7.99%	1,915	1,195
S	330.29	330.39	0.10	1.24	7.45%	1,786	1,114
S	152.90	153.00	0.10	1.10	6.61%	1,584	989
S	386.97	387.05	0.08	1.04	6.25%	1,498	935
S	287.74	287.81	0.07	0.96	5.77%	1,382	863
S	89.09	89.16	0.08	0.91	5.47%	1,310	818
S	394.10	394.17	0.07	0.90	5.41%	1,296	809
S	10.99	11.04	0.05	0.73	4.39%	1,051	656
S	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	647
S	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	638
S	365.73	365.78	0.05	0.70	4.21%	1,008	629
S	351.60	351.65	0.05	0.70	4.21%	1,008	629
S	74.88	74.93	0.05	0.67	4.03%	965	602
S	160.03	160.08	0.05	0.66	3.97%	950	593
S	216.97	217.02	0.05	0.65	3.91%	936	584
S	344.47	344.49	0.02	0.48	2.88%	691	431
S	372.86	372.89	0.02	0.46	2.76%	662	413
S	301.97	301.99	0.03	0.46	2.76%	662	413
S	110.35	110.38	0.02	0.46	2.76%	662	413
S	337.37	337.39	0.03	0.45	2.70%	648	404
S	280.61	280.63	0.03	0.45	2.70%	648	404
S	273.60	273.63	0.03	0.44	2.64%	634	395
S	252.36	252.39	0.02	0.42	2.52%	605	377
S	124.49	124.49	0.00	0.22	1.32%	317	198
S	82.01	82.01	0.00	0.22	1.32%	317	198

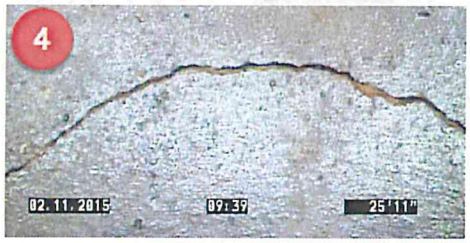
Worst 7 Defects = 45% of Estimated Defect Flow

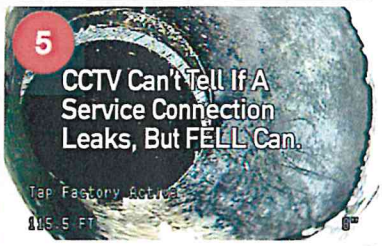


Why Do Cities Electro Scan VCP & Other Pipes?









wrc

Thames Water

Repeatability Test

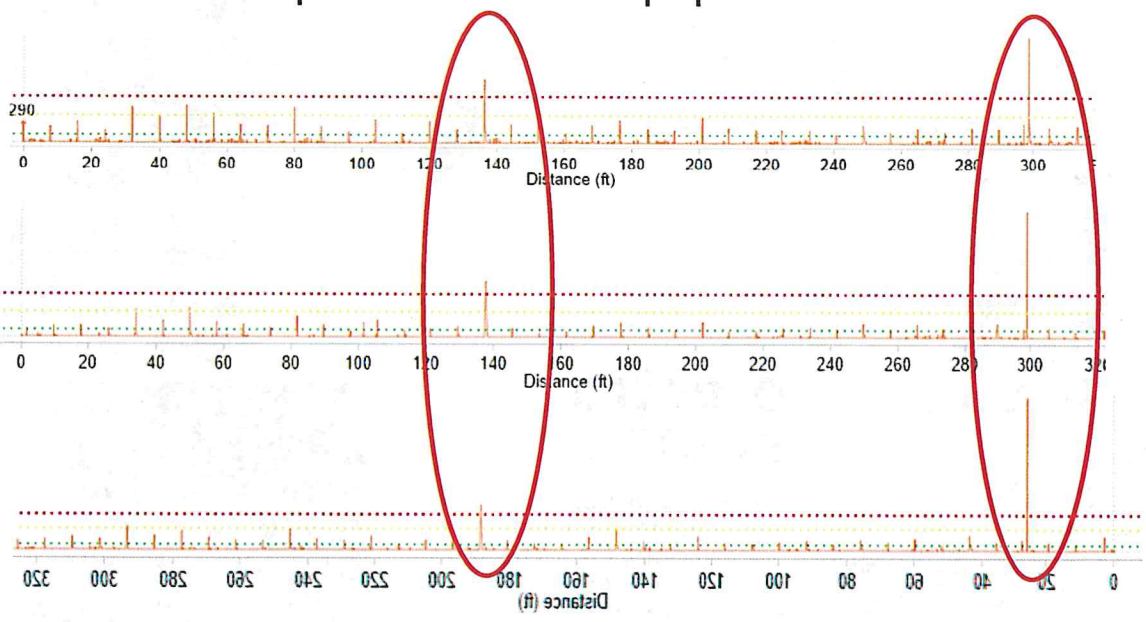
Same Pipe & Same Equipment

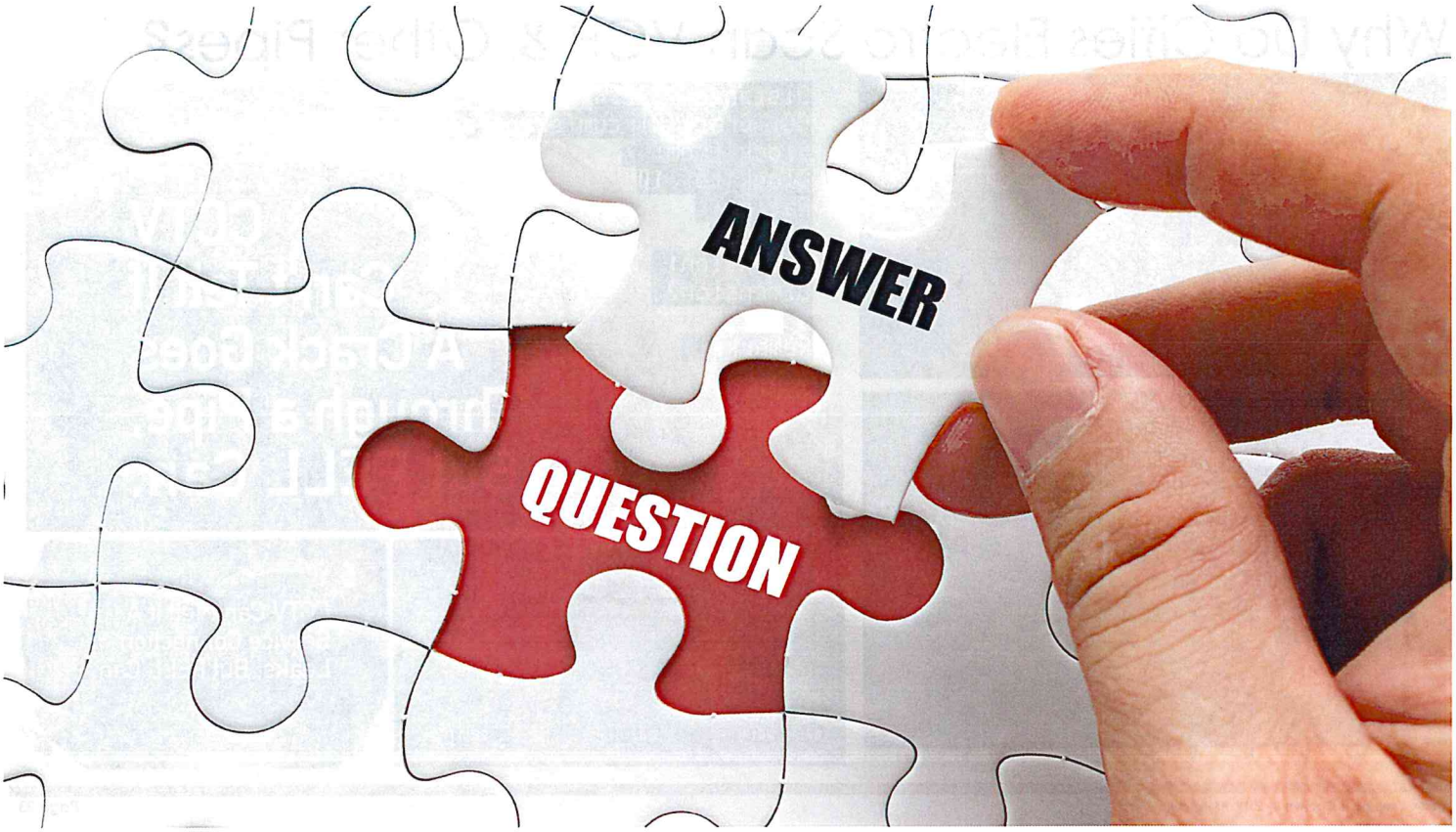
Same Day

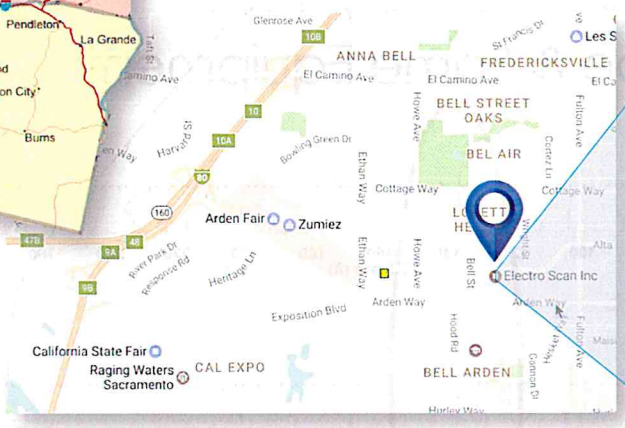
Scan 1

Scan 10

Scan 15







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