

SW 199th Terrace and SW 81st Court
Cutler Bay, FL

Thursday, February 21, 2013

electro
scaninc.



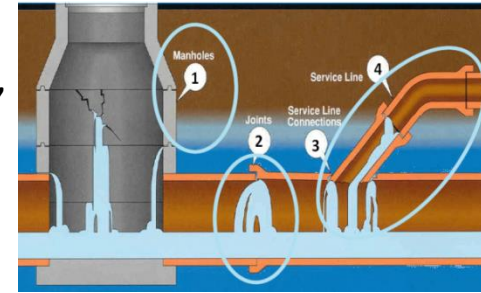
Miami-Dade Water and Sewer
3071 SW 38th Avenue
Miami, Florida 33146
www.miamidade.gov/water



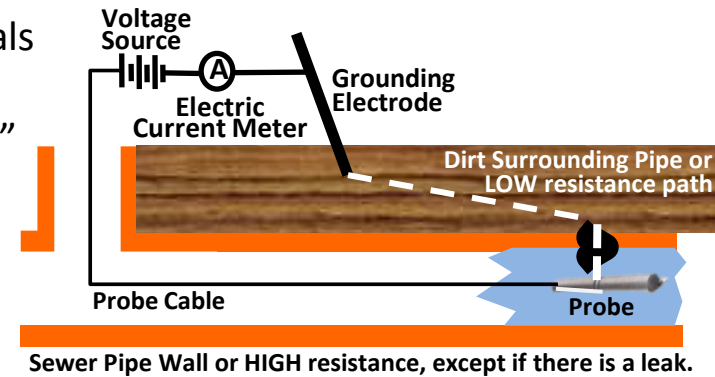
**DIAGNOSTIC RESOURCES
& SOLUTIONS, LLC**

What is Electro Scan?

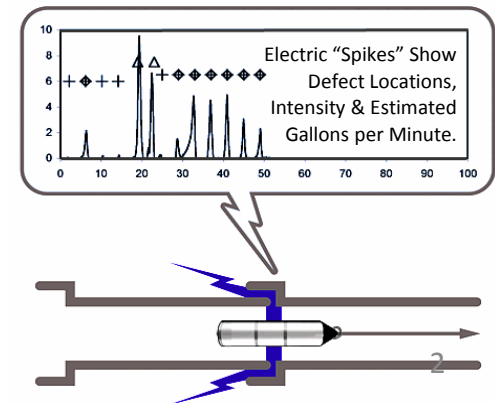
1. What Does Electro Scan Do, That CCTV Cannot? Answer: Find infiltration. Infiltration is a key factor causing Sanitary Sewer Overflows (SSOs) and Combined Sewer Overflows (CSO) caused by cracks & defects found in manholes, sewer mains, service connections, and laterals. Given the limitation of CCTV – i.e. not able to visually find leaks -- Electro Scan automatically finds, locates and estimates the amount of infiltration caused by defects. Electro Scan can also certify newly installed, recently repaired and rehabilitated pipe lining projects as “leak free” and can work year around, in dry or wet weather.



2. How Does It Work? Sewers are made of non-conductive materials (e.g. asbestos concrete, brick, clay, cement, plastic, reinforced concrete, etc.), so no electrical current should ever be able to “leak” or escape into the ground from inside the pipe – unless, of course, there is a crack or break in a pipe. Electro Scan’s patent-pending technology releases a focused array of low-voltage high-frequency electrical current that locates and quantifies all defects.



3. Who Has Endorsed or Used Electro Scan? Electro Scan has been tested in numerous U.S. EPA studies and found superior to CCTV in finding the location and quantification of defects that cause leaks. Electro Scan is the only company with products in compliance with ASTM Standard F2550-06. Winning international acceptance, Electro Scan has recorded nearly 1 million feet of scans in the U.S., England, Australia, and New Zealand, and represents the next generation in leak detection and certification of pipeline repairs & rehabilitation.



About the Miami Dade Water and Sewer Department...



The Miami-Dade Water and Sewer Department (WASD) is one of the largest public utilities in the United States – employing nearly 2,500 workers and providing direct service to more than 440,000 customers with annual operating revenues of more than \$528 million. In addition, the department provides water and wastewater service to the unincorporated areas of Miami-Dade

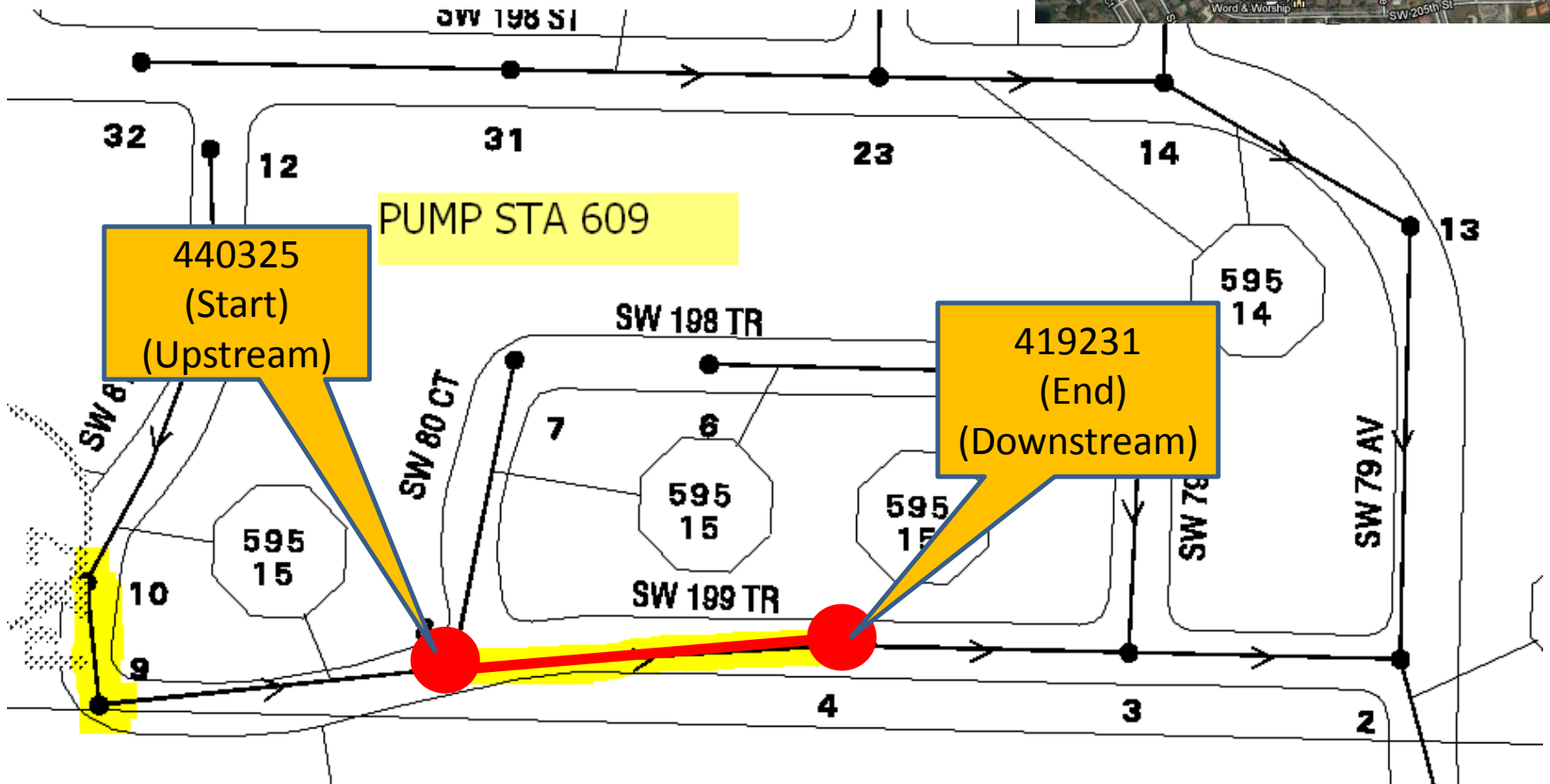
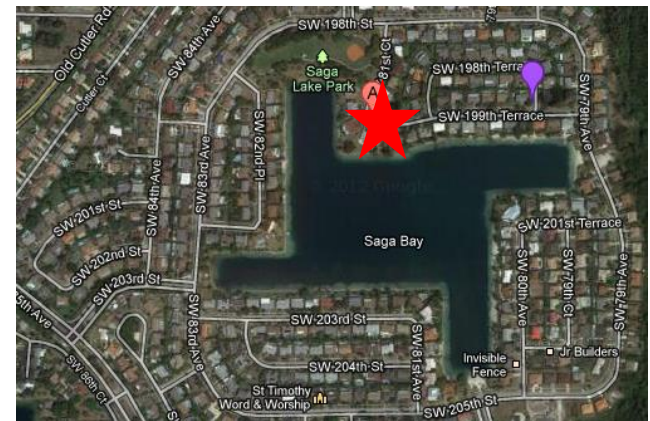
Miami-Dade WASD By The Numbers...

Regional WWTPs	3
Pump Stations	1,035
Force Main (Miles)	910
Gravity Sewers* (Miles)	3,071
Public Laterals (Miles)	2,241
Total Collection and Transmission (Miles)	6,000
Population Served	2,000,000
Sewer Retail Accounts	336,000
Volume Sewer Customers	15

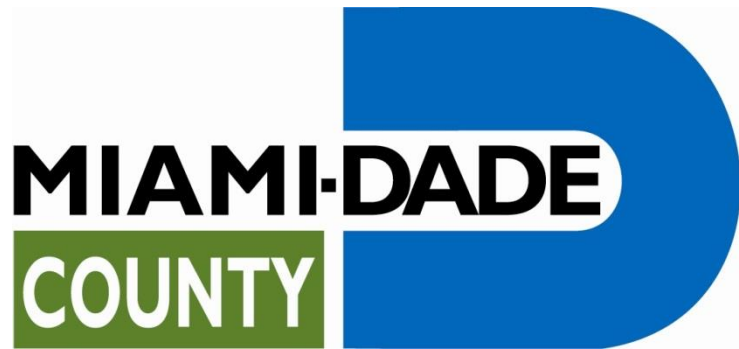




SW 199th Terrace Scan 1



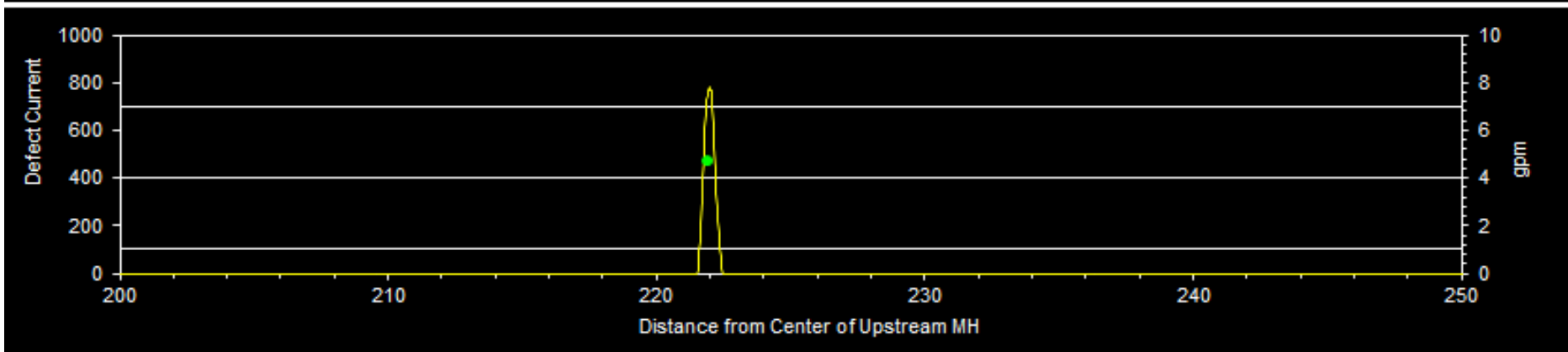
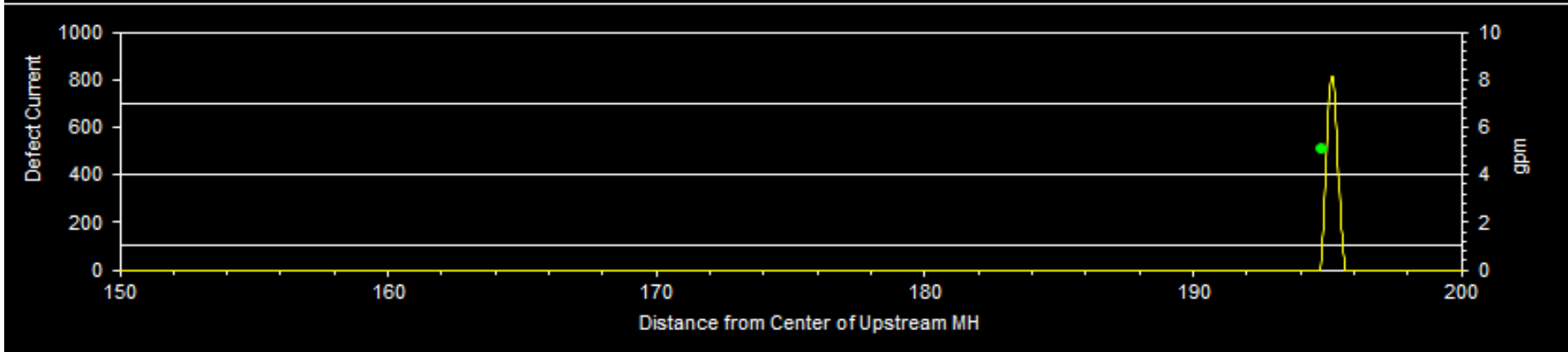
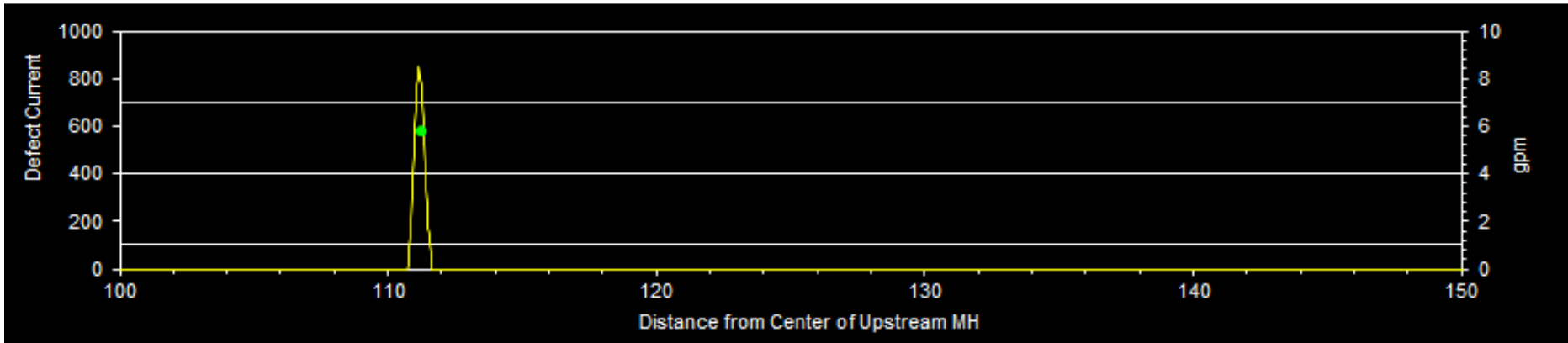
SW 199th Terrace Electro Scan Demo – Scan 1



- 8” VCP sanitary sewer line, laid at minor grade, with a minimal flow and 3 lateral connections. Pipe segment had been lined within the last few years using a CIP lining process. MH to MH distance is about 310 feet. Electro Scan was stopped short at about 301 feet
- Objective: Determine if Electro Scan can identify any defects within the lining and compare those results to CCTV results

SW 199th Terrace (Scan 1) Defect Graph

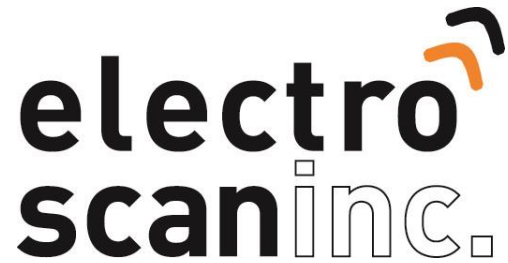
Note: In the interest of saving space, only the section of the graph from 100' to 250' where the defects are located is shown below



SW 199th Terrace Scan 1 Defect Chart

Start of Anomaly	End of Anomaly	Length of Anomaly	Maximum Current Level of Anomaly		Max. Current Anomaly Grading	Defect Flow	Defect Flow Grading
111.24	112.57	1.33	850.00		L	5.80	L
194.83	195.58	0.75	816.00		L	5.10	L
221.90	223.50	0.60	780.00		L	4.70	L

SW 199th Terrace (Scan 1) **CCTV Data Compared to**



The following pages show the locations within the pipe where Electro Scan identified defects that displayed the potential to infiltrate any amount at all, along with the corresponding CCTV callouts.

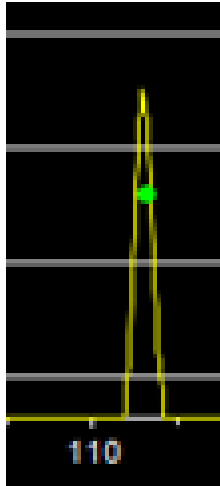
All defects are at lateral connections. Of the three (3) defects that have the potential to infiltrate, only one of them had any CCTV callout that would have identified that location as defective. Comparing the same pipe length that was Electro Scanned with that same length that was CCTV'd, Electro Scan located three (3) total defects that could cause infiltration, while CCTV only identified one (1) of those lateral connections as infiltrating, and listing the other two just as “active taps” (not defective).

When viewing the following data overlay, please also note that a difference in footage references exists and continues to increase distance, possible due to an imprecise footage calibration on the CCTV system (CCTV finished with a MH to MH distance of 327 feet).

CCTV Snapshots (01/13) Overlaid with Electro Scan Readings (03/13)

116.0'
(CCTV)

111.2'
(ES)



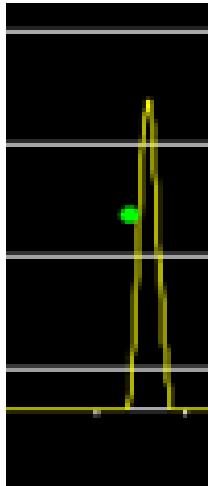
Estimated
Infiltration
Flow:
5.8 GPM

CCTV Callout: <None>



202.3'
(CCTV)

194.8'
(ES)



Estimated
Infiltration
Flow:
5.0 GPM

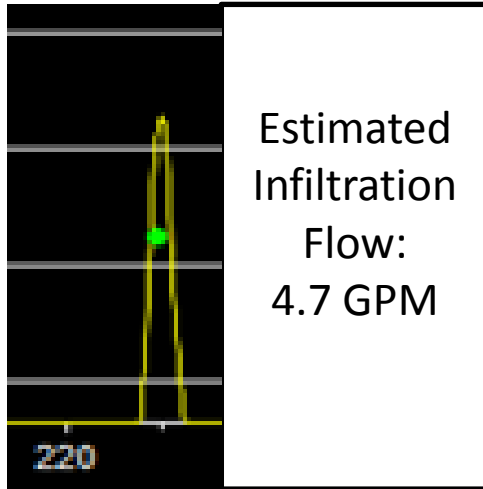
CCTV Callout: <None>



CCTV Snapshots (01/13) Overlaid with Electro Scan Readings (03/13)

230.7'
(CCTV)

221.9'
(ES)



CCTV Callout: <None>



Findings and Conclusions

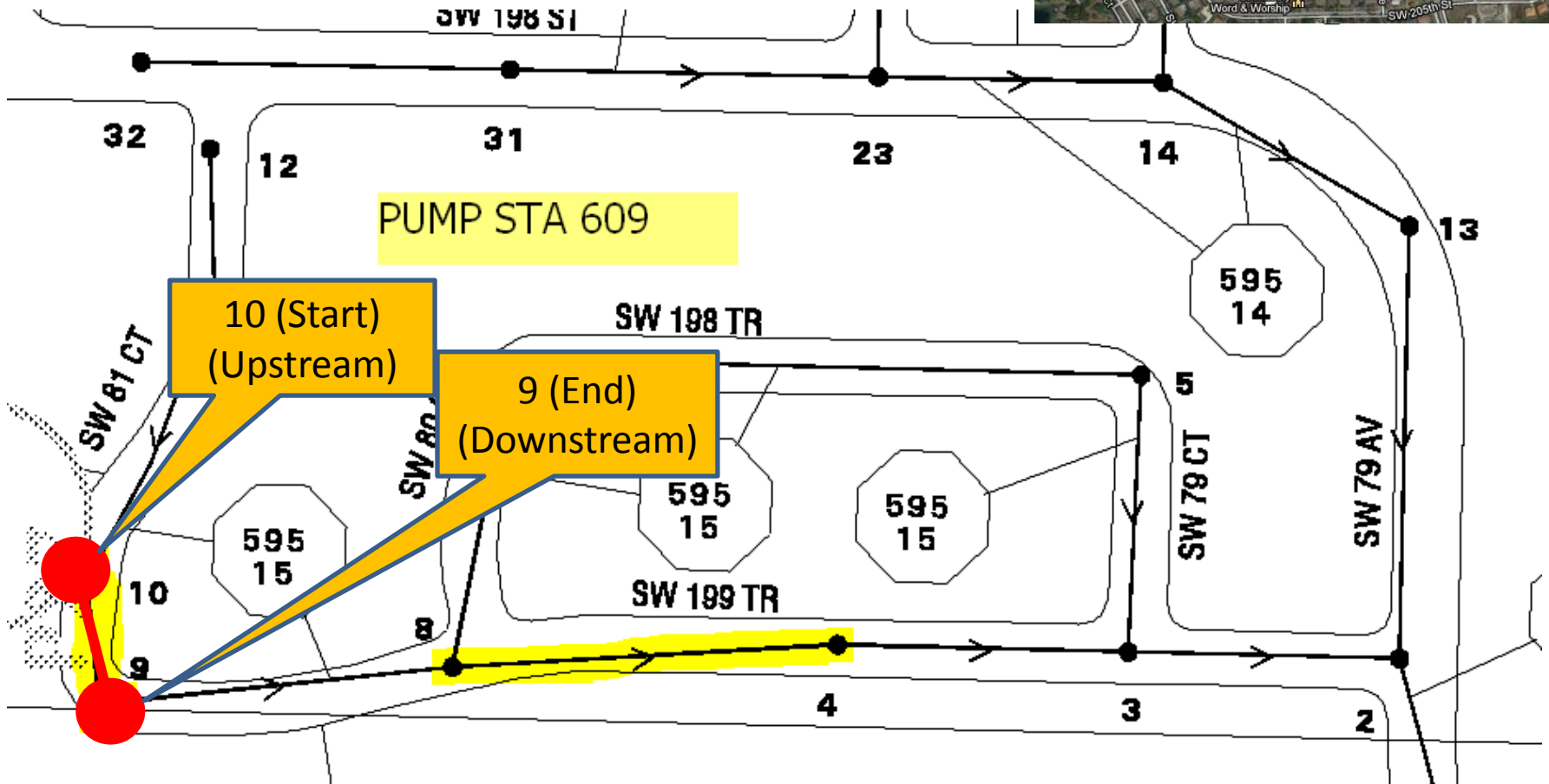
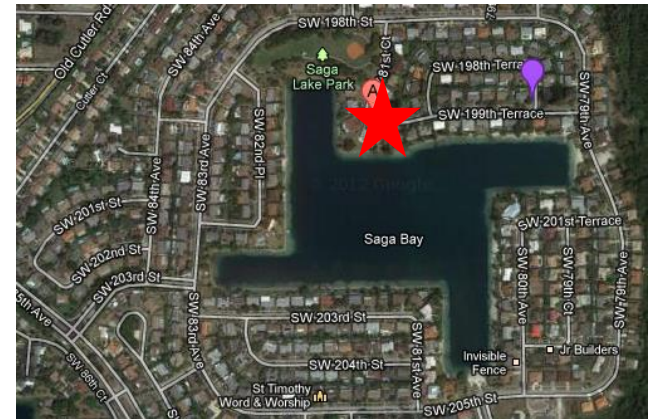
SW 199th Terrace Scan 1

Anomaly Picking Threshold	100.00	Grade Current Levels	Number	Length	% Length of Pipe Tested	% of Total Anomaly Length	Grade Flow Levels	Number	Flow gpm	Flow per 100ft of pipe	% of Total Flow
Grade	Large	>700	3	2.7	1%	100%	>4	3	15.6	5.2	100%
	Medium	700 to 400	0	0.0	0%	0%	4 to 1	0	0.0	0.0	0%
	Small	<400	0	0.0	0%	0%	<1	0	0.0	0.0	0%
Total			3	2.7	1%	100%	<1	3	15.6	5.2	100%

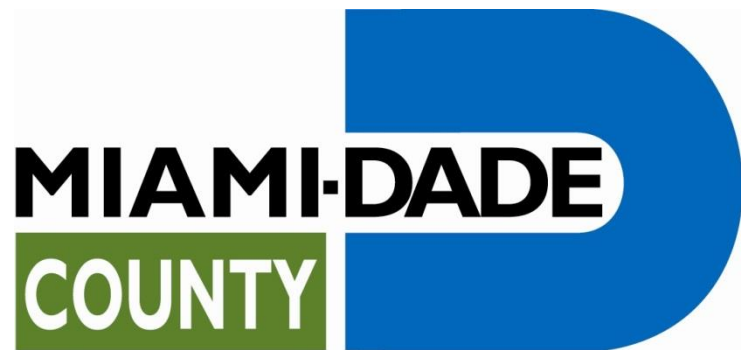
Electro Scan located **3** total defects – all of them large. Based on the size and quantity of those defects, it is estimated that this pipe length could infiltrate **15.6 gallons per minute**.

The defects appear to correspond to lateral connections. In reviewing the CCTV video, no lateral or connection lining or sealing method had been used. The Electro Scan results reveal that all three service connections are faulty and are a source for infiltration into the newly lined pipe. Because of these unaddressed connections, this pipe has the possibility of infiltrating about 22,464 gallons per day.

SW 81th Ct. Scan 2

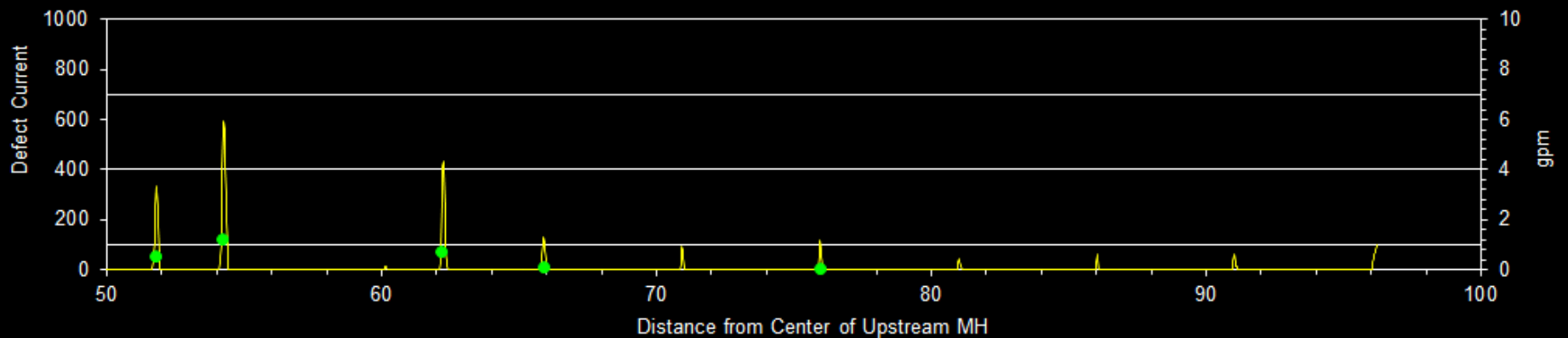
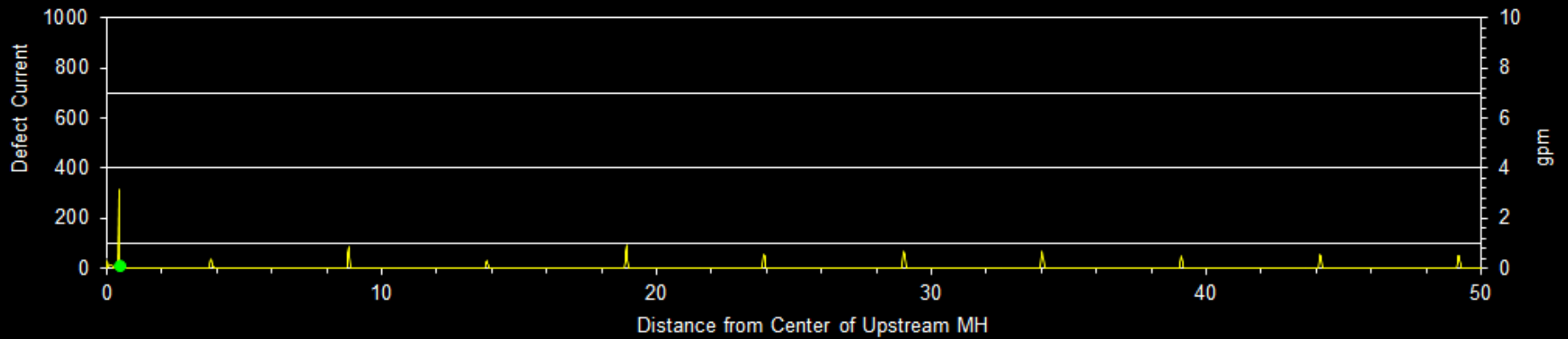


SW 81st Ct. Electro Scan Demo – Scan 2



- 8” VCP sanitary sewer line, laid at minor grade, with a minimal flow and 1 lateral connection. Pipe segment had known infiltration problem. MH to MH distance is about 103 feet. Electro Scan was stopped short at about 96 feet
- Objective: Determine if Electro Scan can identify any defects and compare those results to CCTV results

SW 81st Ct. (Scan 2) Defect Graph

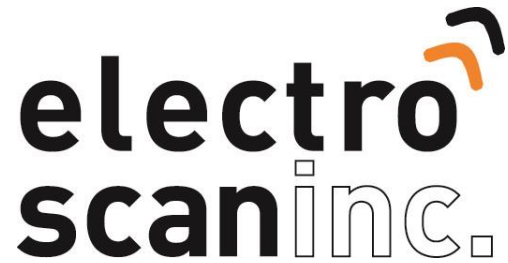


SW 81st Ct. Scan 2 Defect Chart

Start of Anomaly	End of Anomaly	Length of Anomaly	Maximum Current Level of Anomaly		Max. Current Anomaly Grading	Defect Flow	Defect Flow Grading
0.43	0.43	0.00	315.00		S	0.12	S
51.73	51.87	0.15	332.00		S	0.59	S
54.18	54.38	0.20	594.00		M	1.25	M
62.17	62.32	0.15	432.00		M	0.75	S
65.87	65.92	0.05	129.00		S	0.13	S
75.94	75.96	0.02	118.00		S	0.08	S

SW 88th Ct. (Scan 2)

CCTV Data Compared to



The following pages show the locations within the pipe where Electro Scan identified defects that displayed a potential to infiltrate ***an estimated one-half (1/2) Gallons Per Minute or higher.***

Of the three (3) defects that have the potential to infiltrate an estimated one-half (1/2)-plus gallons per minute, only one (1) of them had a CCTV call out that referenced infiltration. The other two call outs were structural (“sag” and “change in material”)

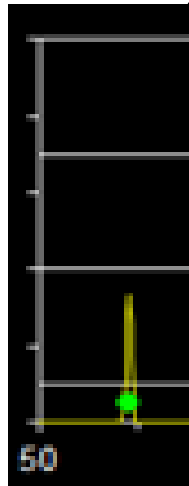
Due to the noticeable visible defects on this pipe, Electro Scan and CCTV had just about the same amount of locations where defects existed. However only Electro Scan was able to quantify the infiltration from those defects. Also, Electro Scan was able to identify infiltration from the Fernco-type fittings, which was not visible on the CCTV investigation.

Please note that an estimated 2.5’ difference exists between the CCTV data and the Electro Scan data.

CCTV Snapshots (04/12) Overlaid with Electro Scan Readings (03/13)

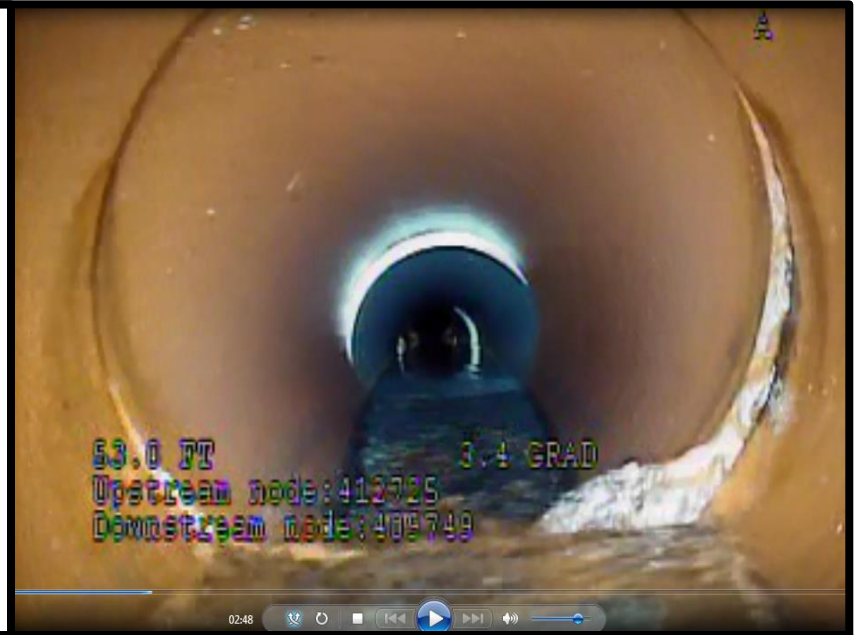
54.0'
(CCTV)

51.7'
(ES)



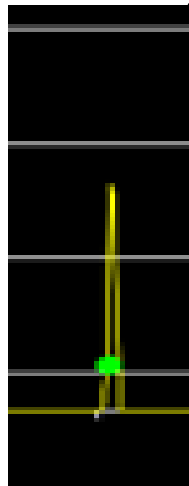
Estimated
Infiltration
Flow:
0.59 GPM

CCTV Callout: <Crack, Infiltration>



56.6'
(CCTV)

54.2'
(ES)



Estimated
Infiltration
Flow:
1.25 GPM

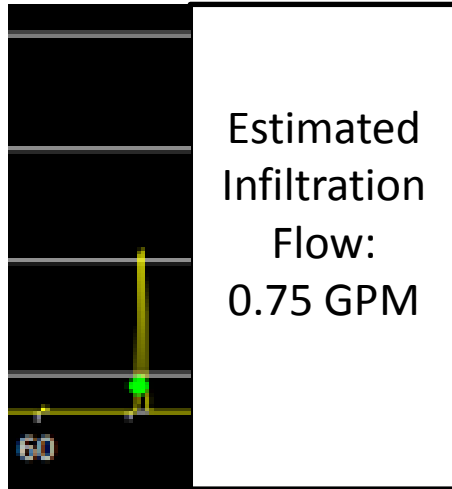
CCTV Callout: <Sag, Material Change>



CCTV Snapshots (04/12) Overlaid with Electro Scan Readings (03/13)

64.6'
(CCTV)

62.2'
(ES)



CCTV Callout: <Material Change>



Findings and Conclusions

SW 81st Ct. Scan 2

Anomaly Picking Threshold	100.00	Grade Current Levels	Number	Length	% Length of Pipe Tested	% of Total Anomaly Length	Grade Flow Levels	Number	Flow gpm	Flow per 100ft of pipe	% of Total Flow
Grade	Large	>700	0	0.0	0%	0%	>4	0	0.0	0.0	0%
	Medium	700 to 400	2	0.4	0%	62%	4 to 1	1	1.3	1.3	43%
	Small	<400	4	0.2	0%	38%	<1	5	1.7	1.7	57%
Total			6	0.6	1%	100%	<1	6	2.9	3.0	100%

Electro Scan located **6** total defects – 4 small and 2 medium. Based on the size and quantity of those defects, it is estimated that this pipe length could infiltrate **2.9 gallons per minute**.

The majority of this pipe (including most joints) are in good shape. From the graph and chart, almost all the infiltration is occurring in a 15' section between the 51 foot and 66 foot marks – where the spot repair and new lateral tie-in occurred. Correcting that area could prevent almost 4200 extra gallons per day.

GPM estimates $\pm 40\%$, assume a 1 ft of water head over pipe.

How Electro Scan Estimates GPM Infiltration

While Electro Scan's standard graphs display the Max Defect Current, Electro Scan's estimated Gallon per Minute (Defect Flow) is based on the Defect Area and the Electric Current sustained over that Area.

Start of Anomaly	End of Anomaly	Length of Anomaly	Maximum Current Level of Anomaly	Max. Current Anomaly Grading	Est. GPM Flow	Est. GPM Grading
1.23	1.30	0.08	146.00	S	0.19	S
1.43	1.43	0.00	115.00	S	0.05	S
3.33	3.33	0.00	104.00	S	0.04	S
8.26	8.44	0.18	291.00	S	0.60	S
13.12	13.20	0.08	216.00	S	0.28	S
18.15	18.20	0.05	137.00	S	0.15	S
18.95	19.10	0.15	328.00	S	0.61	S
20.95	21.11	0.15	544.00	M	0.95	S
23.84	24.26	0.42	698.00	M	1.93	M
24.51	24.56	0.05	245.00	S	0.22	S
28.02	28.14	0.12	330.00	S	0.56	S
31.87	32.05	0.18	536.00	M	1.02	M
35.52	35.75	0.23	559.00	M	1.26	M

'Large Current Readings over a Large Area' often result in a large GPM or Defect Flow, frequently found in defects at a service connection. In other cases **'Large Current Readings over a Small Area'** result in small and medium GPMs, frequently showing defects at joints.

References

1. US EPA Sewer Electro Scan Field Demonstration Revisited, Special Reprint from 2012 WEFTEC Conference Proceedings

http://www.electroscan.com/wp-content/uploads/2012/11/WEFTEC_US-EPA-Electro-Scan-Demonstration-Project.pdf

2. ASTM Standard F2550-06

http://www.electroscan.com/wp-content/uploads/2012/01/2006-02-01-Electro-Scan_ASTM-Standard-F2550-06.pdf

3. Electro Scanning Technology Adds Another Layer of Inspection, *Trenchless Technology Magazine*, Published February 2013

http://www.electroscan.com/wp-content/uploads/2013/03/Trenchless-Technology-Mag_ES-Tech-Adds-Another-Layer-of-Inspection.pdf


4. Electro Scan Technology Test Drive, *Municipal Sewer & Water Magazine*, December 2012

http://www.electroscan.com/wp-content/uploads/2012/11/Electro-Scan_Technology-Test-Drive.pdf


5. Electro Scan Newsletter, September 2012

http://www.electroscan.com/wp-content/uploads/2012/09/Electro_Scan-Inc._The_Sewer_and_Storm_Chronicles_First-Edition.pdf


2013 Product Innovation of the Year*



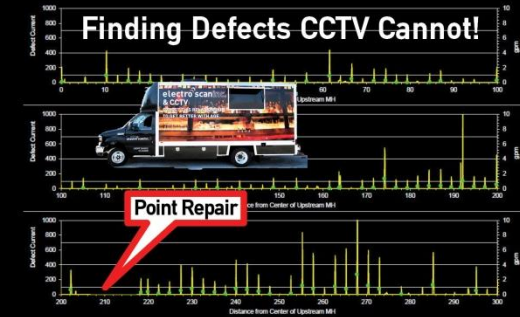
* NASTT No-Dig Joseph L. Abbott, Jr. Award Recipient.



**If You Use
CCTV to Find
Infiltration,
You Might Be
Fixing The
Wrong Pipe.**



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(Above) Sewer agency used CCTV to locate a defect that was determined to require a Point Repair at 210 feet. A Point Repair was completed and the Contractor used CCTV to certify the repair. Then, the pipe was **Electro Scanned**.

Good News: The Point Repair was successful -- no electrical readings!
Bad News: The Sewer Pipe had numerous other defects not seen by CCTV.

INFILTRATION SCORECARD

How Do They Compare?		CCTV	Electro Scan
1	Automatically Finds Potential Sources of Infiltration	N	Y
2	Automatically Finds Leaks Inside Joints	N	Y
3	Automatically Finds Leaks at Service Connections	N	Y
4	Automatically Finds Sources of Infiltration at Cracks	N	Y
5	Automatically Finds Leak Locations (within 0.4 in or 1 cm)	N	Y
6	Automatically Measures Size of Leaks (Est. GPM or LPM)	N	Y
7	Automatically Finds Defects That Leak from Bad Couplings	N	Y
8	Automatically Finds Defects That May Still Leak After Repairs	N	Y
9	Automatically Finds Defects That Leak in Re-Lining Projects	N	Y
10	Automatically Finds Defects After Service Re-Connections	N	Y
11	Automatically Finds Leaks, If Silt or Debris on Bottom of Pipe	N	Y
12	Able to Conduct Inspections, If Sewer Pipe Is Full of Water	N	Y
13	Able to Determine Size of Potential Leak, If Roots Are Present	N	Y
14	Automatically Finds Leaks at Joints, If Grease Is Present	N	Y
15	Able to Determine Size of Leaks, If Pipe Has Encrustation	N	Y
16	Requires Active Infiltration to Identify Defect at Source	Y	N
17	Contains Moving Parts That Could Clog from Debris or Silt	Y	N
18	Requires Bypass During Inspection, If Pipe Full	Y	N
19	Requires Special Training and Certification to Identify Defects	Y	N
20	Relies on Visual Observations to Record Defects	Y	N
21	Ave. Speed of Inspection (6-20" Sewer Main)	3ft / min	50ft / min