

Florida Rural Water Association

Presents a non-diluted view of
inflow and infiltration

By
Allen Slater

- What is inflow and infiltration?
- Inflow is the rainwater taking a direct path into the collection system through some sort of opening in the collection system such as open or broken cleanouts, damaged manholes, etc.
- Infiltration is rainwater that has soaked into the soil and is now basically part of the water table and is finding its way into the collection system through bad seams on manholes, bad joints or broken pipes, unsealed lift holes, etc.

- To put in perspective one inch of rain on one surface acre is roughly 27,000 gallons.
 - So just one broken cleanout during an average thunderstorm can put you over your permitted capacity.

- How can we determine if we need to do an Inflow and Infiltration study?
 - Easy, compare flows from your drinking water facility with your wastewater facility. Are the drinking water flows a lot less?
 - Also chart your wastewater flows with the rainfall. Do we see immediate increase in flows during a rain event?

- My favorite is checking elapsed time meters on all lift stations, so you know which neighborhoods are a good place to start.
 - Also, it is a good practice to check lift stations in the early morning hours like 1:00 am seeing if there is flow and how heavy. Then checking each manhole following the flow upstream to where it originates.

Why care if we have direct inflow or infiltration into our collection system?

Bottom line the costs related to needlessly treating rainwater. Not to mention the regulatory aspect.

Costs such as:

1. Electricity
2. Wear and tear on pumps
3. Extra chemicals due to increased flow

Can anyone name some others?

- Other issues are reduced treatment capacity due to sand and grit filling up treatment basins, which can cause effluent violations as well.

- What are some of the things that can happen when we exceed permitted capacity due to rain?
 - Facility has solids washout due to hydraulic overload.
 - Chance for filamentous bacteria to be introduced to facility.
 - What else?

Everyone's favorite, fan mail
from your local Regulatory
Department.

The August, September, October, and November 2004 discharge

monitoring reports (DMRs) reported flows of
55%, 61%, 56%, and 51%

respectively. F.A.C. Rule 62-600.405(3) requires that
when the three-month
average daily flow for the most recent three consecutive
months exceeds 50
percent of the permitted capacity of the treatment plant
or reuse and disposal
systems, the permittee shall submit to the Department a
capacity analysis
report.

62-600.405 Planning for Wastewater Facilities Expansion

- (1) The permittee shall provide for the timely planning, design, and construction of wastewater facilities necessary to provide proper treatment and reuse or disposal of domestic wastewater and management of domestic wastewater residuals.
- (2) The permittee shall routinely compare flows being treated at the wastewater facilities with the permitted capacities of the treatment, residuals, reuse, and disposal facilities.

Excessive hydraulic loading at facility causes many problems, the worst being solids loss and permit violations.

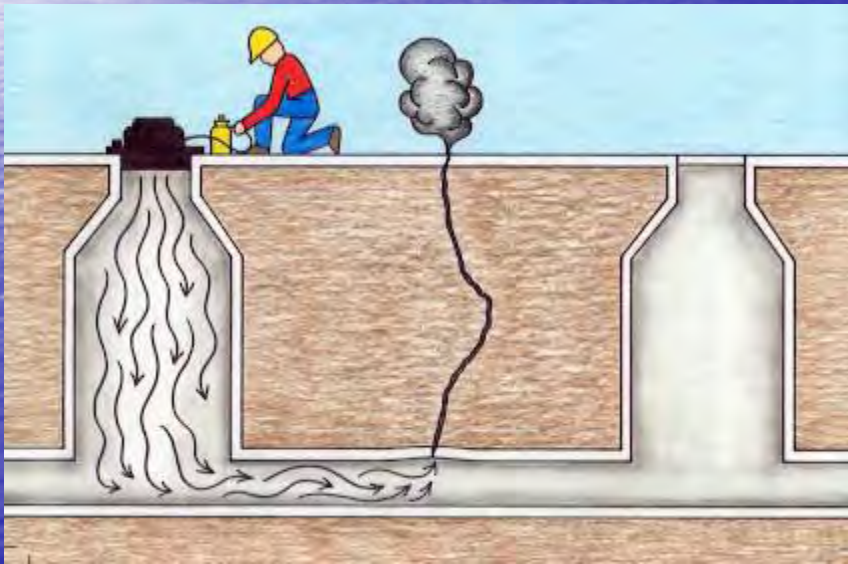
- Remember one inch of rain on one surface acre = roughly 27,000 gallons of water, which equals money down the drain.







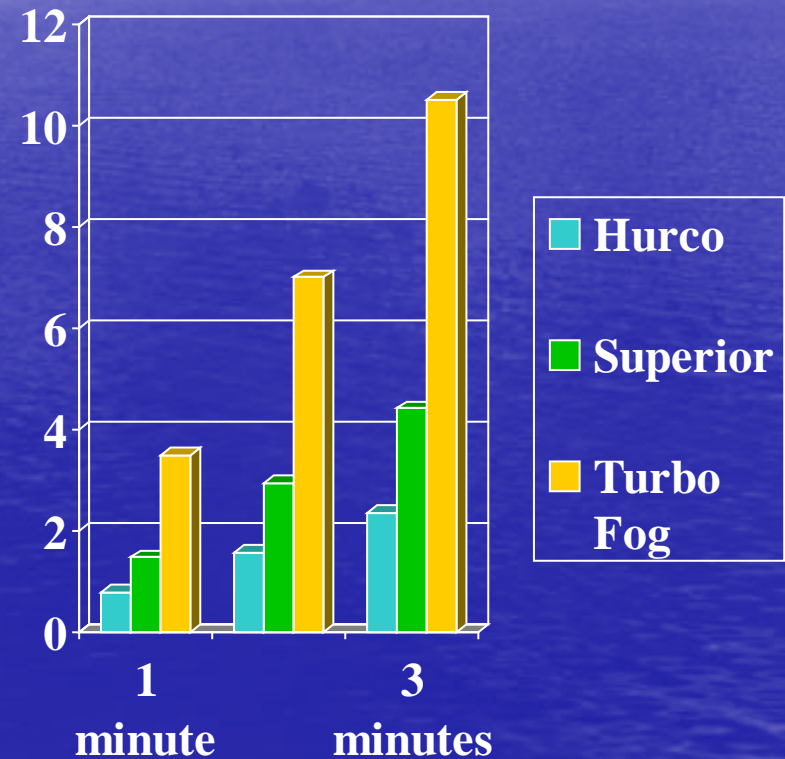
Why Smoke Testing?



- **Smoke testing is the most efficient and cost effective way to locate and identify these inflow and infiltration problems.** TV inspection can only identify these problems when water tables are high or there has been a recent rain.

Cost of Smoke In Minutes:

- Using LiquiSmoke, the cost of the smoke can run as low as \$2.34 per 3 minutes of use. This graph shows cost per minutes in dollars for each of the manufactures. The figures on the left are dollars.



•Hurco has MSDS sheets and Test Data for its LiquiSmoke. All test are conclusive, LiquiSmoke is 100% safe. It contains no harmful products.

•Hurco also has a NIOSH report on the dangers of Zinc Chloride.

LiquiSmoke - 100% Safe - Leaves No Residue

Some of the preparations needed to conduct a smoke test on your collection system.

1. Review the smoke test information packet, that I email out to those who request a smoke test.
2. Ensure that all the manhole locations are known and accessible, and that the machine will work on manhole.
3. Notify the residents.
4. Notify the fire department.
5. Gather needed items such as paint, stakes, etc.

Florida Rural Water Association
and
Member Wastewater System

Smoke Testing Agreement

In consideration of the mutual covenants contained herein; it is agreed between the Florida Rural Water Association (FRWA) and _____ (System), as follows:

The Florida Rural Water Association makes this service available to member wastewater systems in an effort to reduce inflow and infiltration into their wastewater collection systems.

For smoke testing, the Florida Rural Water Association (FRWA) will provide the following:

1. Smoke testing equipment for use in inflow and infiltration studies.
2. Sample letter of recommendations for wastewater systems to use in notification of customers of pending smoke testing project. FRWA accepts no responsibility for customer notification; customer notification is the responsibility of the wastewater system. If the FRWA field representative finds that customer notification has not been performed, the smoke test will be suspended until proof of customer notification has been performed. This proof must meet the satisfaction of FRWA. FRWA accepts no responsibility in the event that smoke enters a home or residence.
3.
 - A. FRWA field person to assist in manhole inspection program for systems with fewer than one thousand (1,000) connections.
 - B. FRWA field person for one (1) day of training of wastewater systems personnel in what to look for in a manhole inspection program for systems over one thousand (1,000) connections.
4.
 - A. FRWA field person to assist in smoke testing for wastewater systems under one thousand (1,000) connections.
 - B. FRWA field person to provide one (1) day of training of wastewater system personnel on proper smoke testing procedures for systems with over one thousand (1,000) connections.

The member wastewater system will provide the following:

1. No less than two (2) people familiar with the wastewater collection system to assist FRWA personnel in inspection of system.
2. System will be responsible for purchase of smoke product, gas for smoke blower and other necessary supplies (see cover letter).
3. System will provide all necessary employees' insurance coverage and safety equipment for use by wastewater system personnel (not FRWA employees).

DATE

FRWA

SYSTEM

SPECIAL NOTICE

Dear Customer:

To better serve you, your utility will be smoke testing its sewers. This is done periodically to locate sources of sewer odors, leaks and breaks in sewer lines. The type of smoke used is harmless, white to yellowish-white in color, and may have a slight odor.

The smoke testing will occur sometime during the following dates:

between the hours of

_____ **until** _____

You may notice smoke coming from building sewer vents, gutters and downspouts or out of the ground along sewer lines.

On the inside of your house, smoke or its odor may come out of the plumbing or fixtures. This should not happen if your plumbing is in good shape. This is also an indication gases and odors from the sewer may enter your house or building. These can be both unpleasant and dangerous as well as a health hazard to the occupants.

Location, identification and correction of the source of smoke entering your house or building is urgently advised. While the utility will render all possible cooperation, the correction of any defects in the pipes and sewer on private property is the responsibility of the house or building owner.

The smoke is harmless to plants and animals and leaves no residuals or stains. If smoke gets into your house, please ventilate your house.

If you have any questions or desire additional information, please contact your utility at ---



MAPS AND PRINTS

- **A sanitary sewer location map with measurements and locations.** This map will show where the manholes are and which direction the lines flow. It will also show you whether there are other lines such as force mains or cleanouts, etc. Usually, this map also helps with street names, addresses and the overall area sanitary picture. This is an excellent map to include your notes on. **Remember! Good notes will prevent delays on the job.**

Nothing takes longer than having to hunt manholes when your ready to smoke test, that are either buried or under units, also when you have non-standard manholes you have to make adjustments such as making your own frame or gasket.







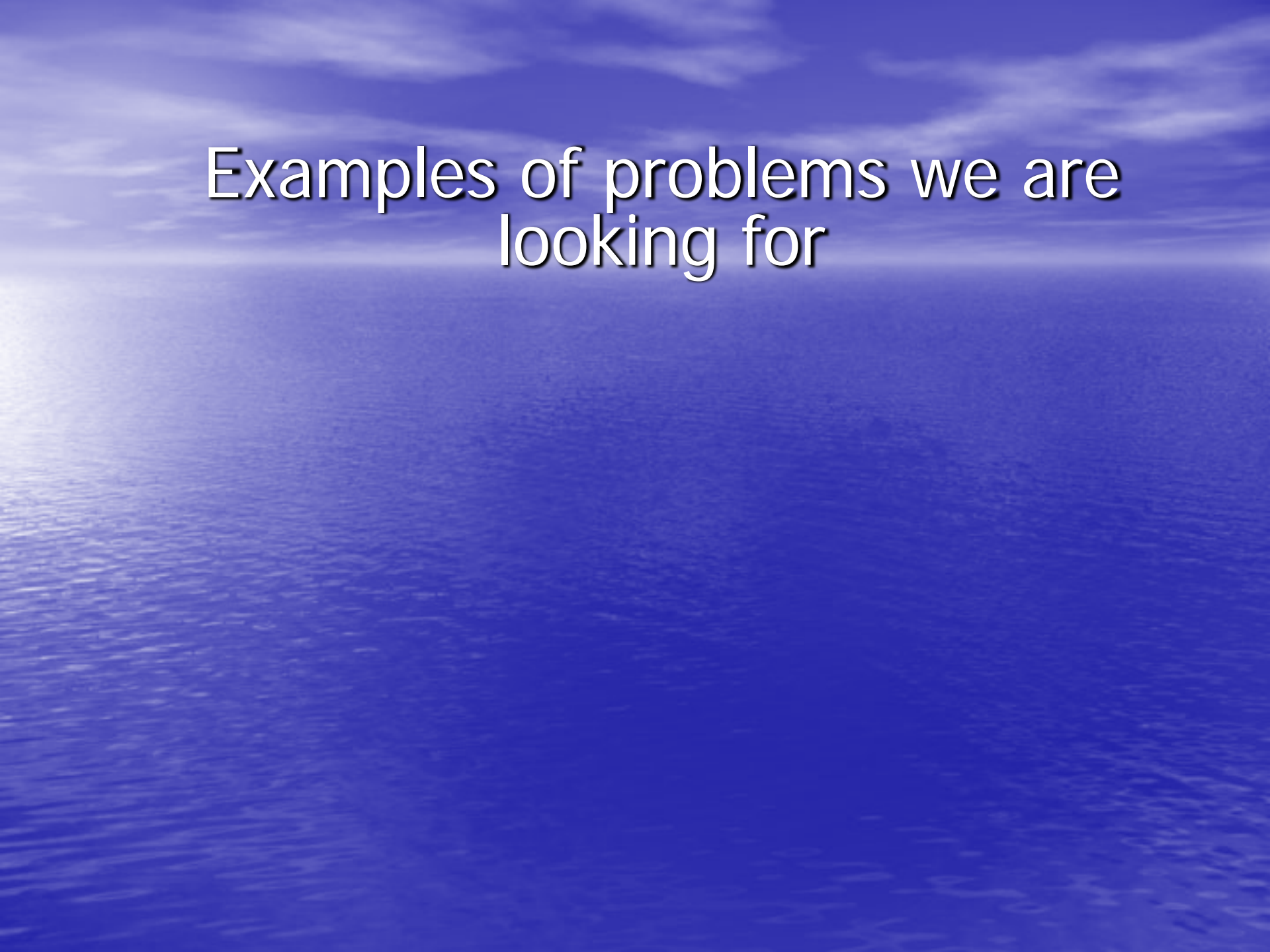












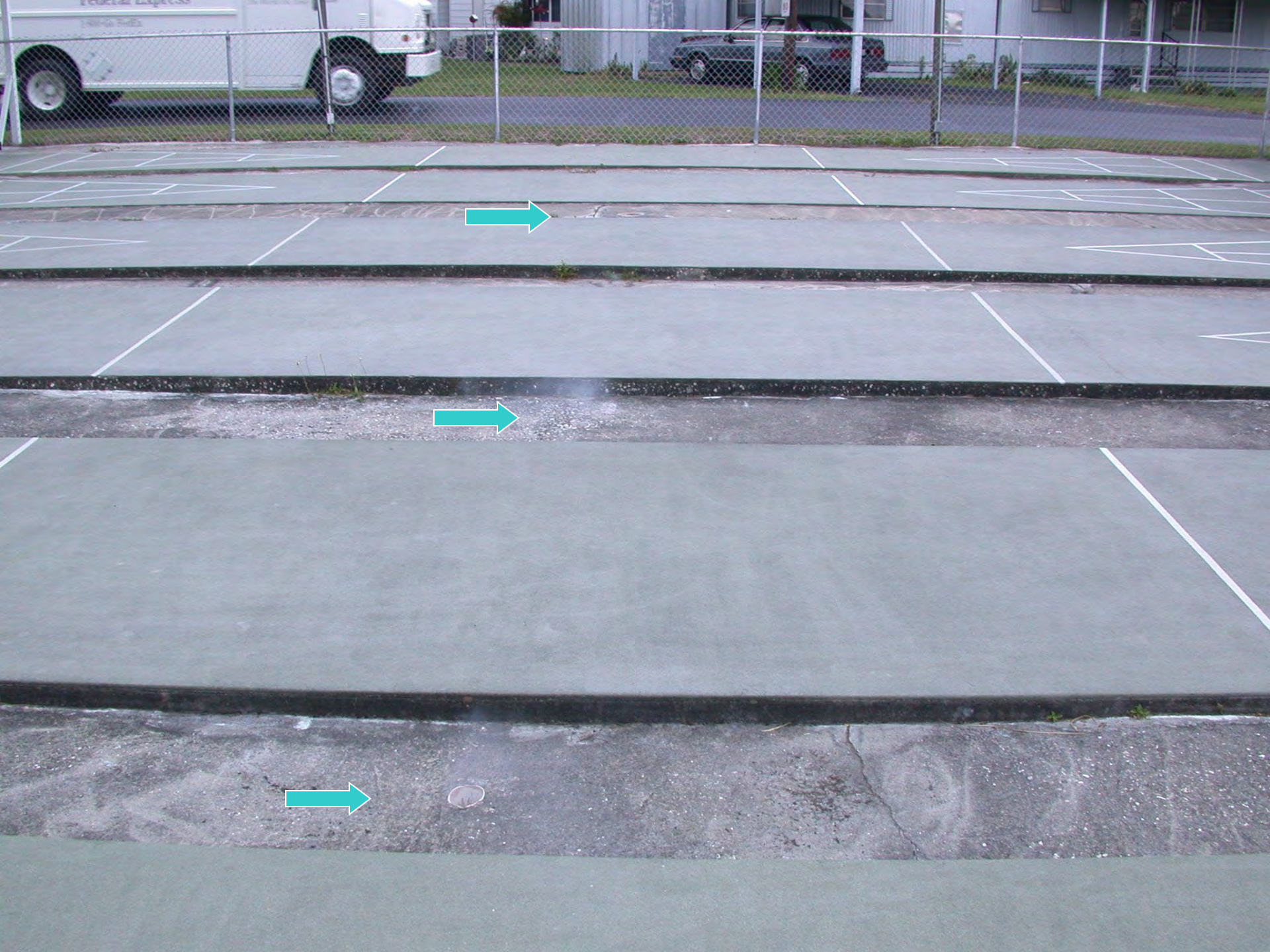
Examples of problems we are
looking for

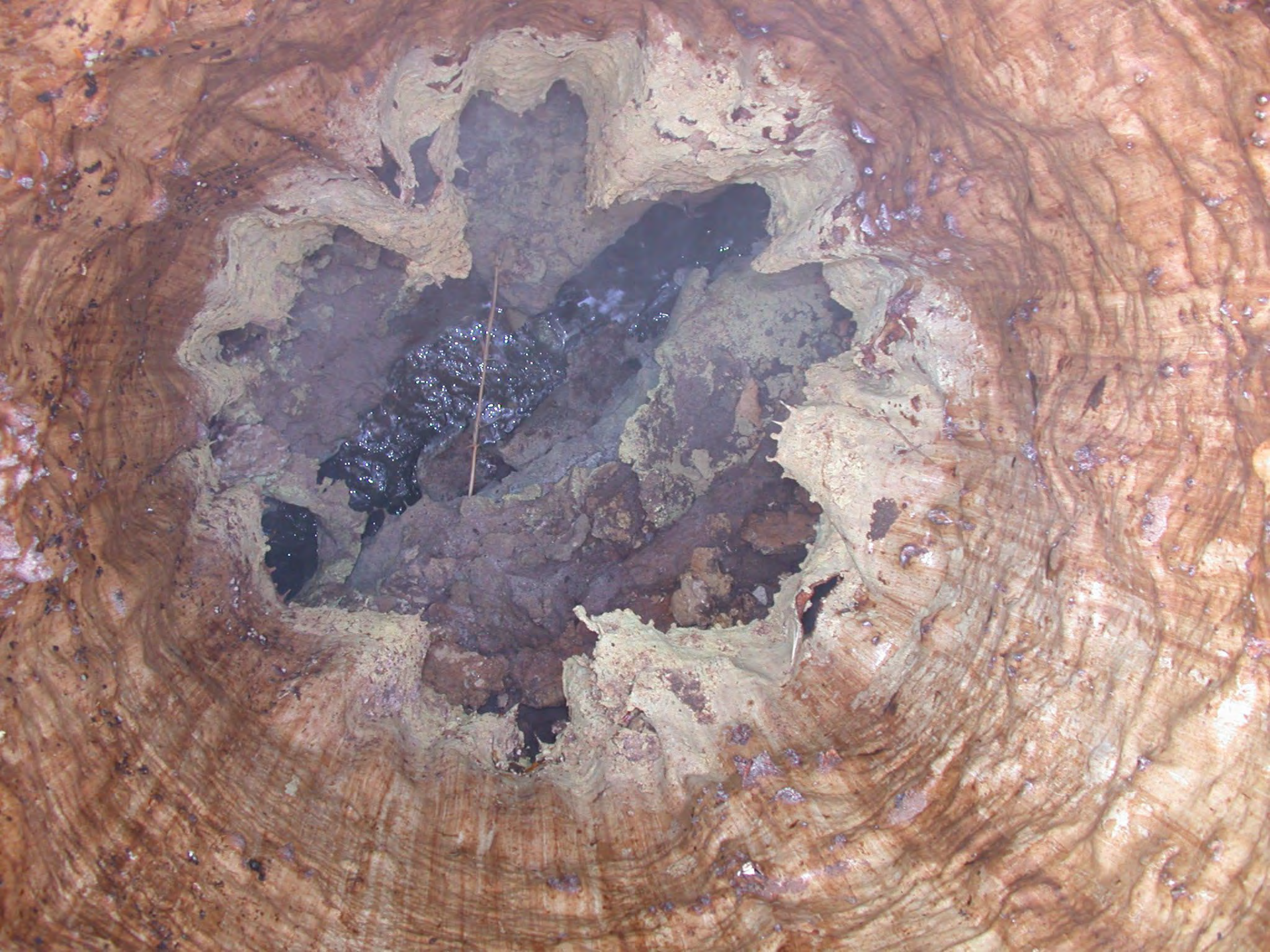






Picture of a broken 6-inch cleanout







In one year, the inflow from one illegally connected house roof is the same volume as the wastewater from 50 houses.





Defect: Manhole is in a bowl with a rain gutter directing water to it, needs raised to bring it above grade

Location: Unit 120



Defect: Manhole is in a bowl with a rain gutter directing water to it, needs raised to bring it above grade

Location: Unit 120























The background of the slide is a photograph of a bright blue sky with wispy white clouds at the top. Below the sky is a vast expanse of blue water, likely the ocean, with a bright sun on the left side creating a shimmering reflection on the water's surface. The overall color palette is dominated by various shades of blue.

Hazards to be aware of when smoke testing







Turner
CONSTRUCTION

TAMPA
813-68419



The background of the slide is a photograph of a vast blue ocean under a blue sky with wispy white clouds. A bright sun is visible on the left side, creating a shimmering reflection on the water's surface. The text is overlaid on the upper portion of the image.

After all, who says a facility can't be a work of art?





Closed Circuit TV Inspection

Closed Circuit TV Inspection

- Locates problems in pipes
- Locates damage to sewers
- Reveals unrecorded connections

Closed Circuit TV Inspection

- Locates sources of inflow and infiltration
- Inspect lateral connections
- Locate lost or buried manholes



**TV Inspection
located this
large water
leak**

9/16/21
12.7 FT.

Closed Circuit TV Inspection

- Prior to TV inspection, the sewer lines must be cleaned.



Sewer line cleaning nozzle

12/13/00 15:01
180.4 FT.



TV inspection can help locate

- Joint separations
- Offset joints
- Leaks
- Service connections

TV inspection can help locate

- Broken pipes
- Obstructions / blockages
- Manholes
- Bellies

TV Inspection Equipment



TV Inspection Equipment





Severe separated joint

07/19/99 17:05
35.1 FT.

0029

Infiltration at service connection



A close-up photograph of a metal pipe with a prominent longitudinal crack. The crack runs vertically through the center of the pipe, showing a jagged, uneven surface. The pipe has a mottled, greyish-blue appearance, possibly due to rust or weathering. At the bottom of the image, there is embossed text that reads "THE CITY OF NORTH YORK".

Cracked pipe (longitudinal crack)

THE CITY OF NORTH YORK

Heavy roots obstructing sewer

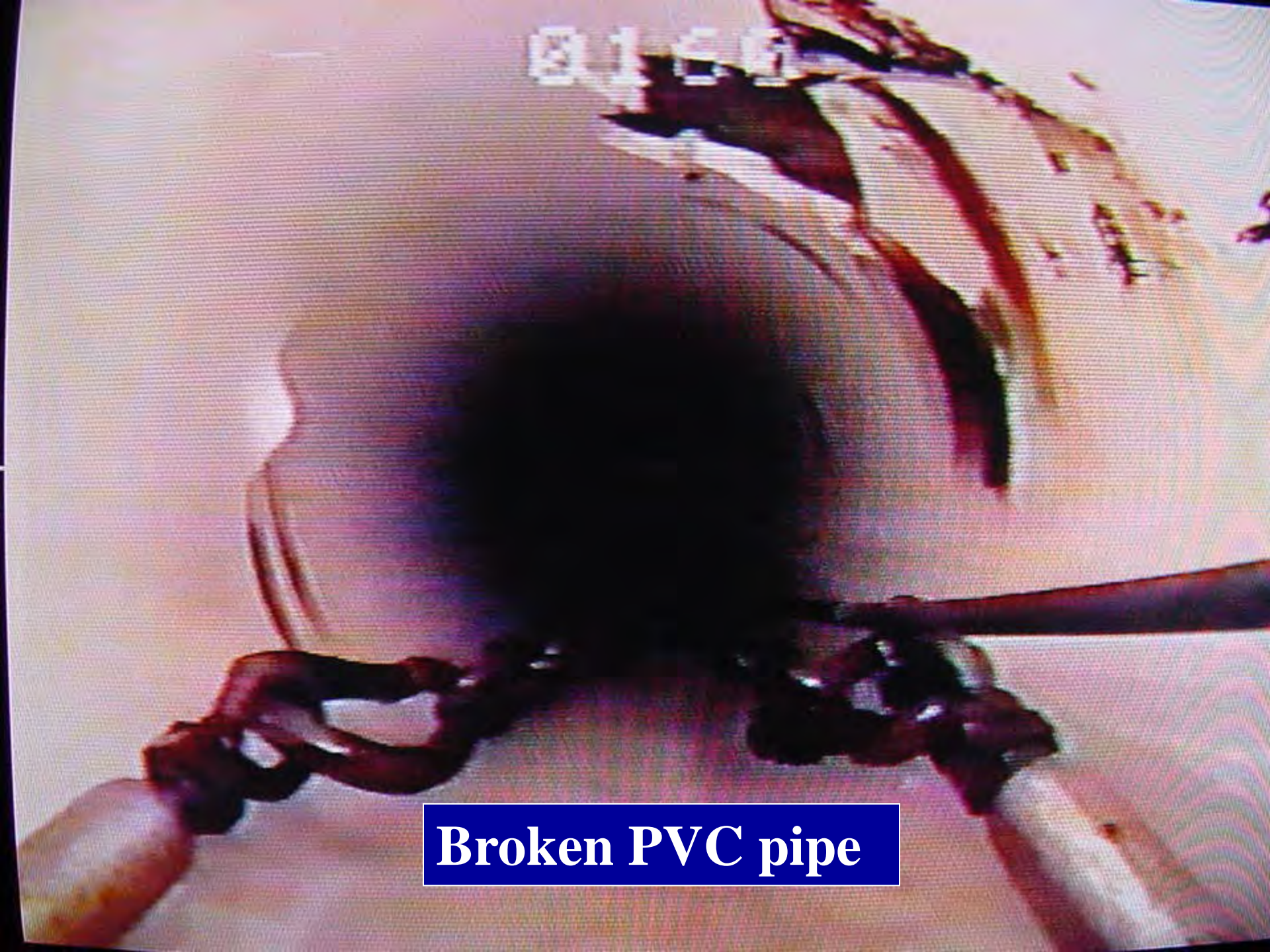
07/19/99 13:21
79.9 FT.





Severe offset joint

12/11/00 11:57
7-0 FT.



Broken PVC pipe

Service connection break-in

U. T. E. ... CITY OF NORTH YORK
1081 ...

A close-up photograph of a broken pipe. The pipe is dark, possibly black or dark grey, and has a jagged, broken edge. The interior of the pipe is visible, showing a rough, reddish-brown surface. The pipe is set against a dark, textured background. A blue rectangular box with white text is overlaid on the lower part of the image.

Broken pipe (crown missing)



Crushed pipe

51524
1100
DISTANCE
BAH
CRUSH
15
1000

A close-up view from a sewer line inspection camera. The camera lens is visible in the upper left, showing a bright, circular opening. The surrounding area is dark and appears to be the interior of a pipe or tunnel. The text "Sewer line inspector" is overlaid in a white box with a blue border.

Sewer line inspector

Dangers of Sewer Inspection

- There is always a risk of the camera equipment becoming stuck in the sewer line
- Before digging up the sewer line, proper locates must be performed

Dangers of Sewer Inspection

- All lines must be located:
 - Gas mains
 - Fiber optic cables
 - Water mains
 - Cable TV
 - Electrical services