Water Loss Control / Water Audit

- A Water Audit is made up of 5 major components
  1. Master Meter Testing
  2. Commercial/Industrial Meter Testing
  3. Residential Meter Testing
  4. Meter Reading & Billing Review
  5. Leak Detection

Need for optimized Distribution Systems

…To reduce water losses

Follow the New Water Audit format
***"Water Wiser"* Excel sheet available**
on line at AWWA… for free!

This will point you in the direction you need to look for losses.

Apparent losses and/or **Real** losses.

Water Losses

Apparent - Metering Inaccuracies

Unauthorized Consumption

($$ Non-Revenue Water $$)

Real Losses - Leakage

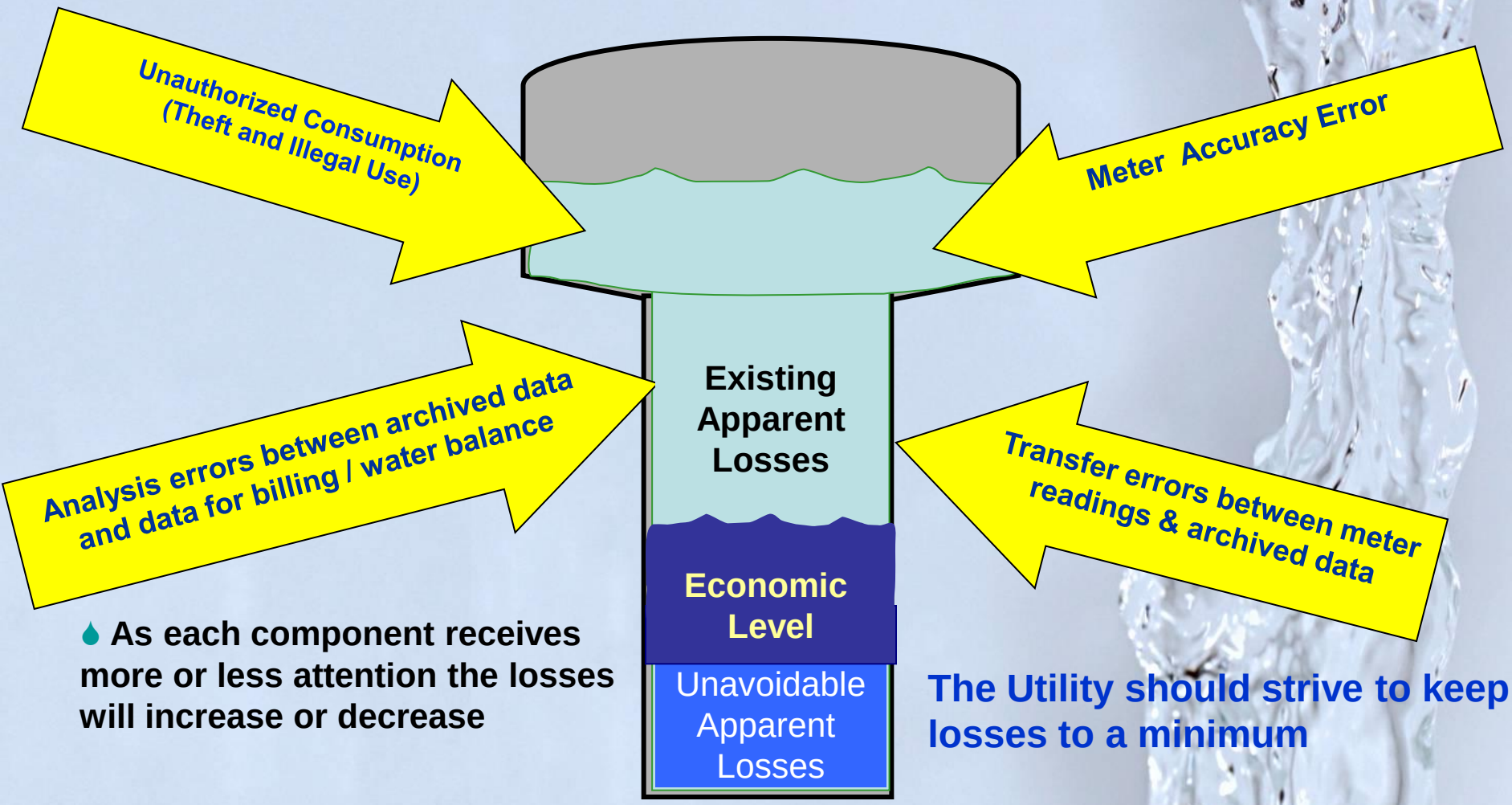
($$ Non-Revenue Water $$)

Apparent Losses

How do Apparent losses occur?

- ☒ Inaccurate meters
- ☒ Wrong meter application
- ☒ Inaccurate meter reading (data collection/management)
- ☒ Accounting errors
- ☒ Unauthorized consumption

Four Components of Managing Apparent Losses



- As each component receives more or less attention the losses will increase or decrease

The Utility should strive to keep losses to a minimum

Water Loss Control / Revenue Enhancement

- As a part of water loss control we also want to address the revenue produced by the water meter (another word for "***Cash Register***")

AWWA Policy Statement (M-36)

Metering

- Meter all water introduced into distribution system
- Meter all water distributed to users

** Metering provides basis of assessing users equitably, encourages responsible and efficient use of a precious resource

(remember: Julius Frontenus)

AWWA Policy Statement (M-36)

Conduct Audits

Evaluate overall effectiveness of:

- Metering
- Billing and accounting
- Water loss control

** Audits provide basis of assessing what needs to be improved

Master Meter Accuracy Testing

72” Venturi Meter, too big to be tested off sight

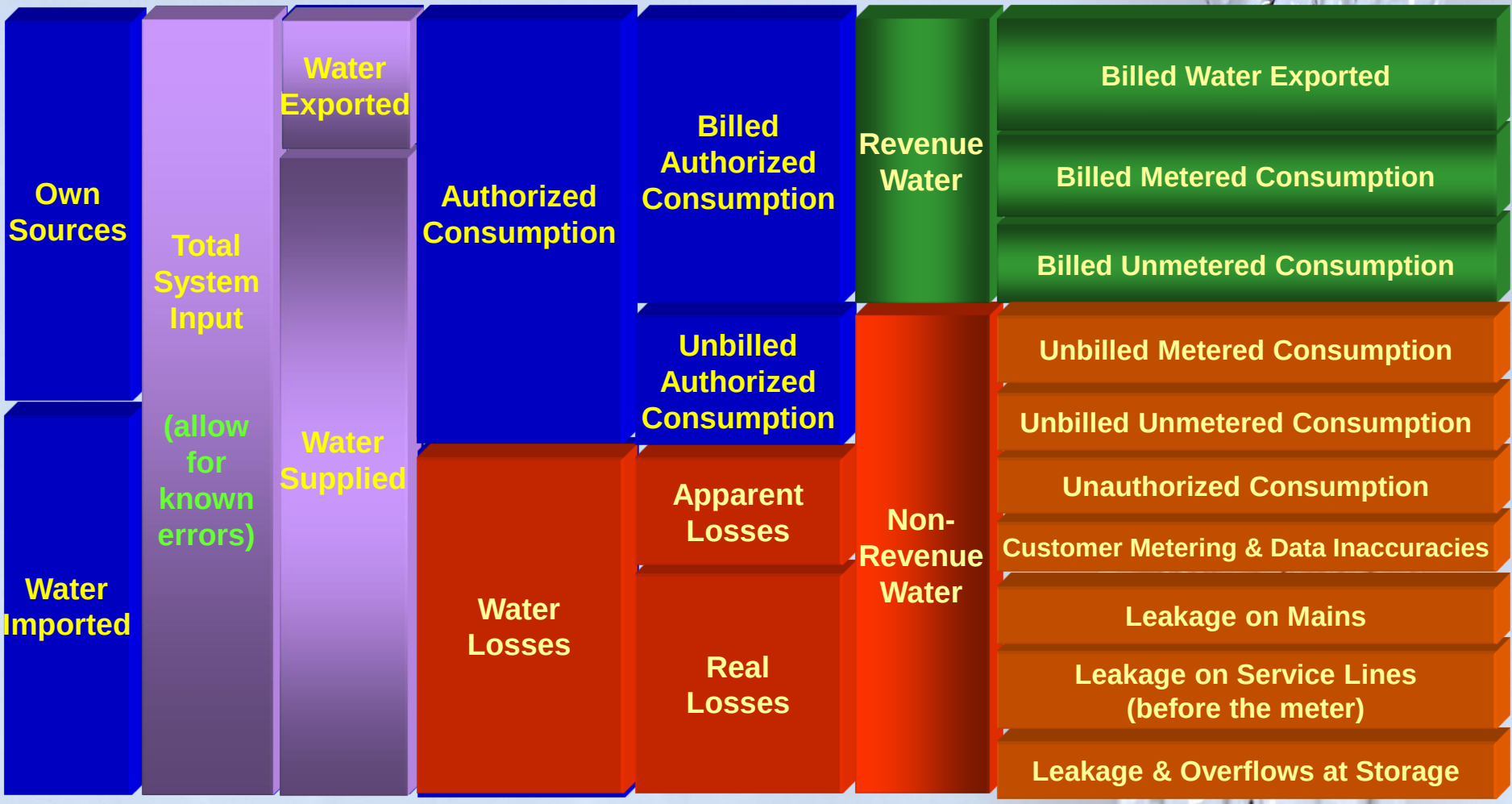
- Meters need to be tested in place
  - Too big to move
  - Testing in place allows for assessment of on site flow conditions

Master Meter Accuracy Testing

**** Flow testing Venturi Meters in place**

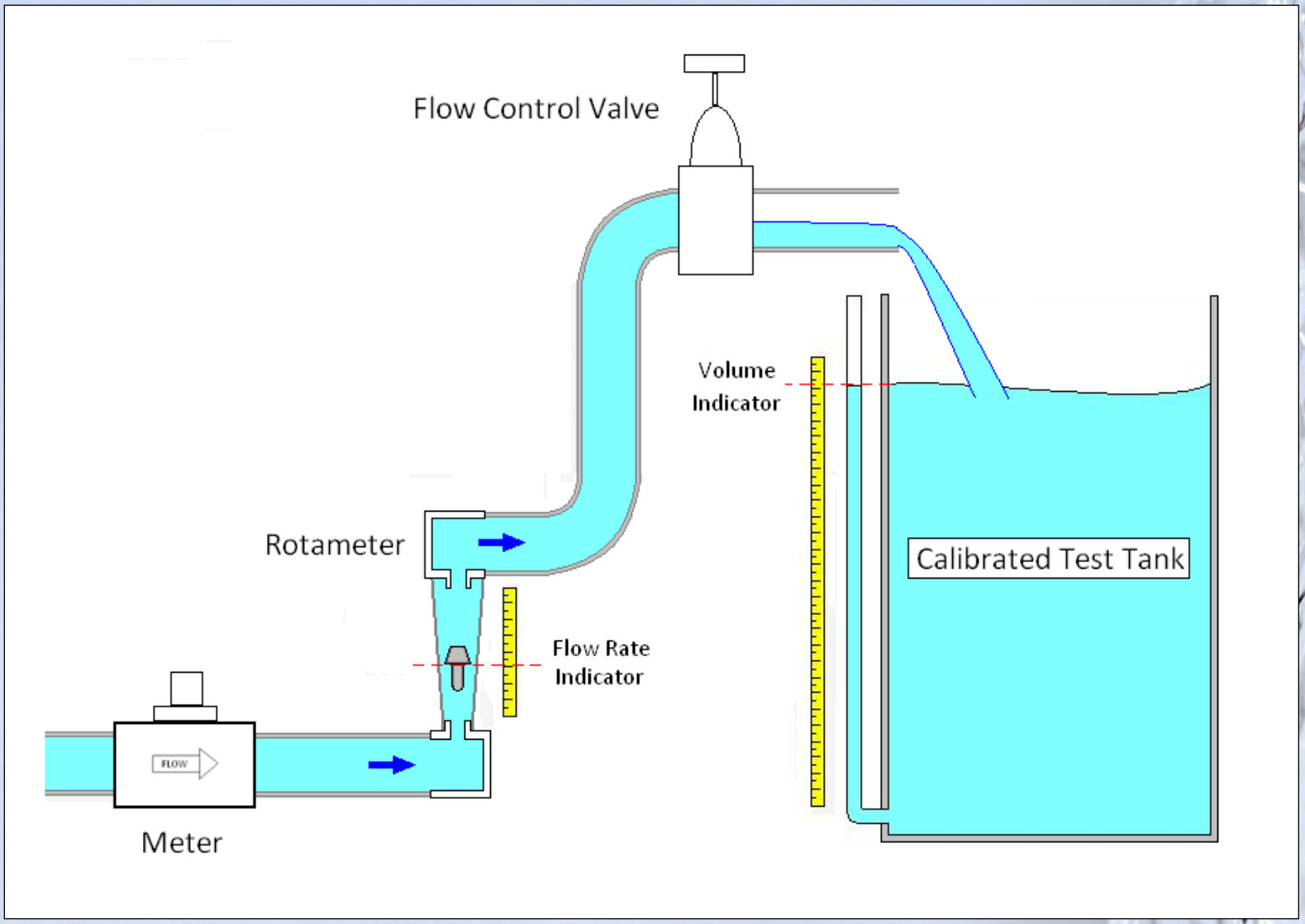
- **If the production meters are not right, all the data for the audit will be flawed!!!**

Standard Water Balance Format



Small Residential Meters

Tank & Rotameter Test



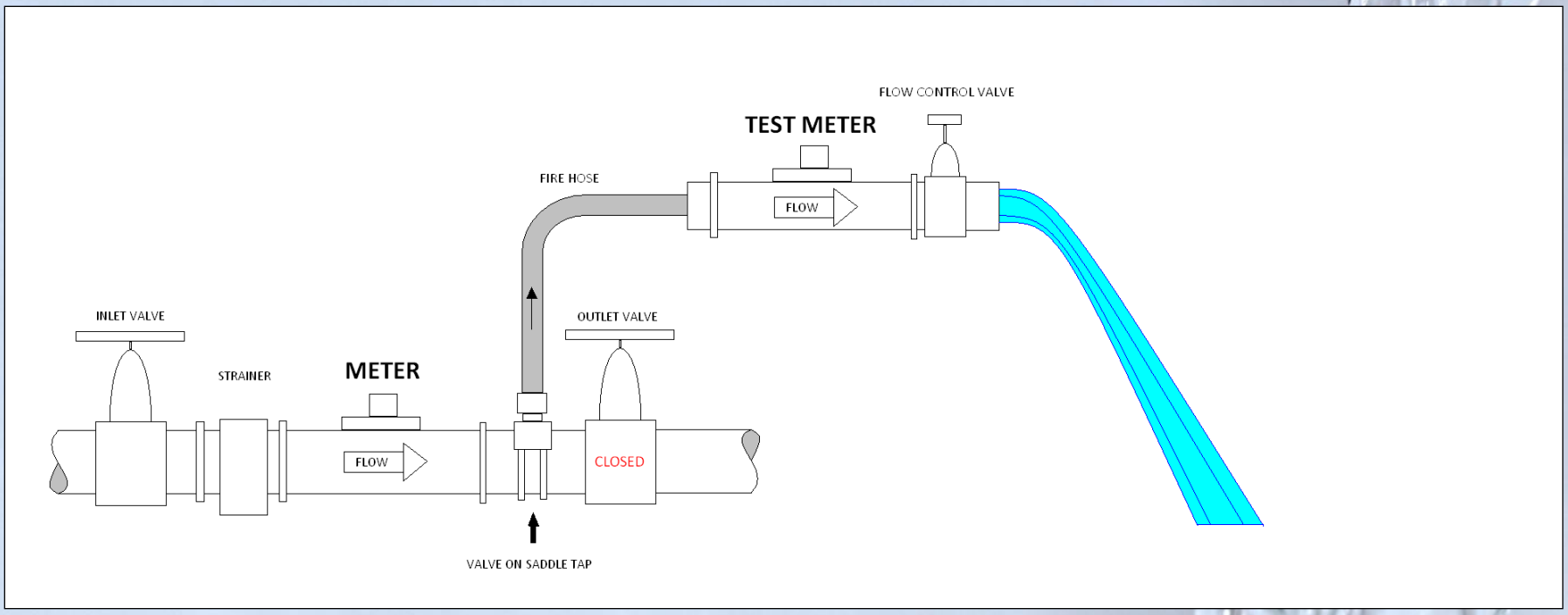
A Random Sample are Tested

Commercial and Industrial Meters

High Revenue Meters

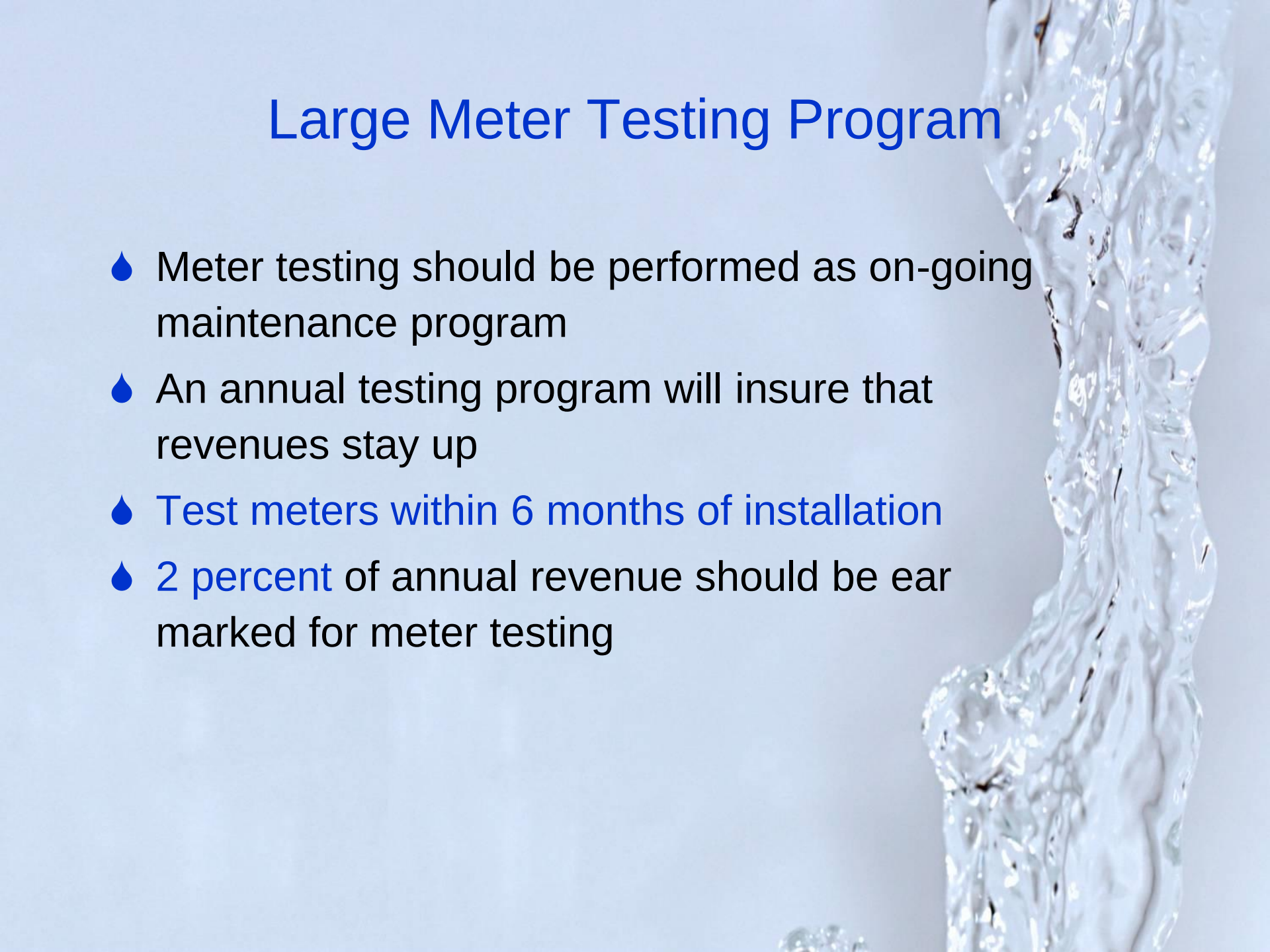
- Usually 10%-12% of the customers use 50% - 60% of the water.
- Test and repair industrial and commercial meters
- Replace obsolete meters

Comparative Test



Large Meter Testing Program

- Meter testing should be performed as on-going maintenance program
- An annual testing program will insure that revenues stay up
- Test meters within 6 months of installation
- 2 percent of annual revenue should be ear marked for meter testing



Testing Methodology

- Refer to the AWWA M-6 Manual
  - ✓ Test specs are for meter test bench situations
  - ✓ Field testing (testing meters “on site”) requires following a strict methodology.

    ****M-6 does not spell out field testing requirements.**
- Refer to the meter manufacturer specs
- Newer style meters require different testing approach

Testing Methodology

- Calibrated test meter needs to be used
- AWWA requires tests at 3 flows
  Low , Intermediate, High flows
- In some cases testing may be limited by flow situation
- It makes sense to conduct several tests at different flows to get full assessment of meter's performance aside from the three tests.
- Look at how water is being used by water customer.
  - That will help in determining proper meter size and type.
  - Refer to the M-22 Manual on Service line and Meter sizing.

Testing Frequency

- Is influenced by the cost of water
  - as water costs increase more accounts require annual testing
- The water quality
  - harsh water requires meters be tested more frequently

Testing Frequency

- Table 5-2 in the M-6 manual lists for every State, PSC regulations for Meter testing by size
- 16 states have no regulations!
- (My Opinion) - The rest do not appear to be adequate to meet sound economic business practices…

… for example, Arizona has no statement for meter testing frequency per M-6 manual (pp. 53, table 5-2)

How often should you be testing meters?

Using Revenue as a basis for testing frequency

- Using the rule of investing about 2% of a meter's annual revenue in the "maintenance" (testing) of that meter, the following averages apply.
  - $14,400.00 or greater = annual testing
  - $7,200.00 to $14,400.00 = every 2 years
  - $3,600.00 to $7,200.00 = every 3 years
  - Less than $3,600.00 = every 4 years

Using Revenue as a basis for testing frequency

$14,400.00 annual revenue divided by $2.00 billing units (1000 gals.)

= 7200 units or 7.2 mg/yr.

7.2 mg/yr. = 13.69 gpm

average for the year

Consequences of not maintaining meters

- These are your cash registers!

  (** Do you think it is ok to loose 10% - 20% of your money?)

- All your **operating money** comes from collecting the revenue generated by the meters!

- Make sure everyone pays for their fair share

- Sewer revenues often based on meter readings!

  (** Maybe you can get the sewer department to help fund the meter testing program!)

Case study

Gwinnett County Department of Water Resources, Gwinnett County, Georgia

- 225,000 metered accounts, suburban area NE of Atlanta
- (2007) Pilot study with 36 - 3” and larger meters
- 26 testable, 23 failed, 10 untestable (no test ports, no isolation valves)
- 1 failed meter after replacement yielded a monthly revenue return of $ 38,000 ($**456,000** annually!!!)
- This provided incentive to test and repair all 3” and larger meters

Case study

Gwinnett County Department of Water Resources, Gwinnett County, Georgia

- 732 – 3” and larger meters inventoried and tested
- Initial program costs were estimated at approx. $850,000
- Initial testing failure rate was 52% failure rate (Failed to meet suggested AWWA accuracy limits)
- 68 fireline meters were over 20 years old (past useful meter life) and had failed.
- Many meters in wrong applications.

Case study

Gwinnett County Department of Water Resources, Gwinnett County, Georgia

- Initial program costs were estimated at $850,000
- 68 fireline meters slated for replacement at estimated cost of $1 million (average of $14,000 each)
- Assumed average large meter annual revenue of at least $14,400, the 68 meters replaced will pay for themselves in 1 year
- Estimated annualize revenue return for entire program projected to be slightly over $5 million.
- Net annual revenue return after testing, repairs and replacements projected to be $3.2 million.

Case study

City of Muskegon Heights, Michigan

- The City needed to develop a meter testing program for its 2” and larger commercial/industrial water meters.

- A budget of $15,000.00 was approved to test, evaluate and repair meters as needed.

Case study

City of Muskegon Heights, Michigan

- 68 - 2” and larger water meters were tested as a part of the program
- 9 of these water meters failed to meet AWWA (M6 Manual) Standards
- 7 were repaired on site and then re-tested
- 2 were determined to be obsolete and were recommended for replacement

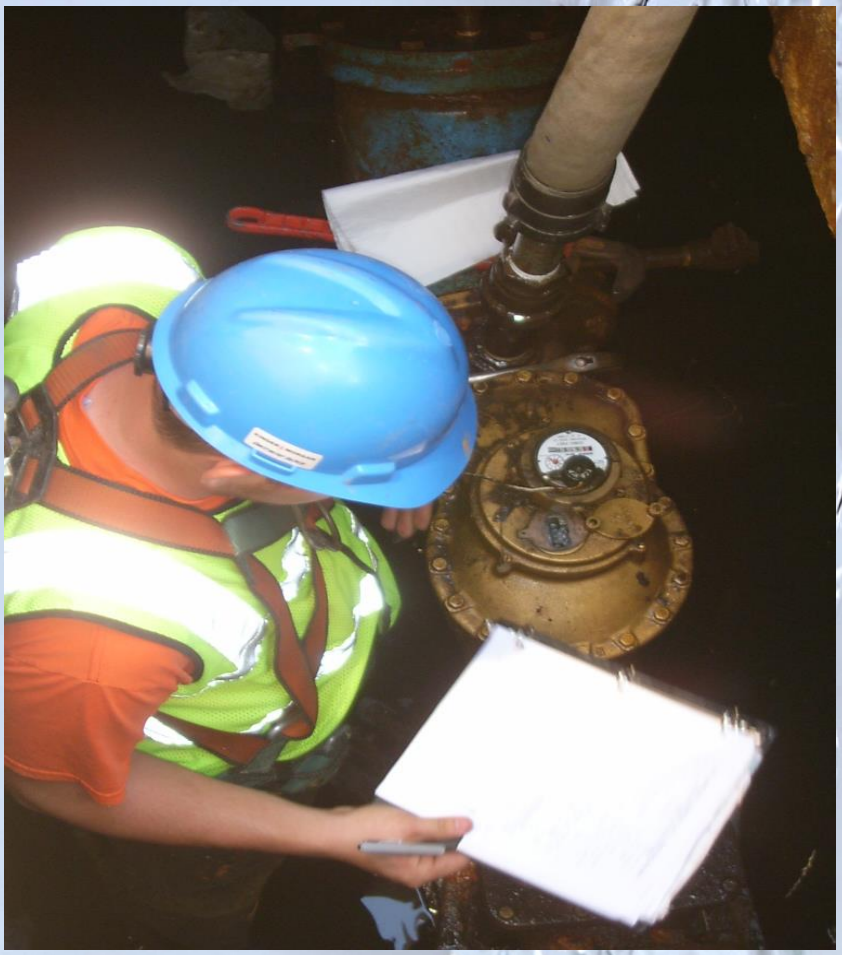
Case study

City of Muskegon Heights, Michigan

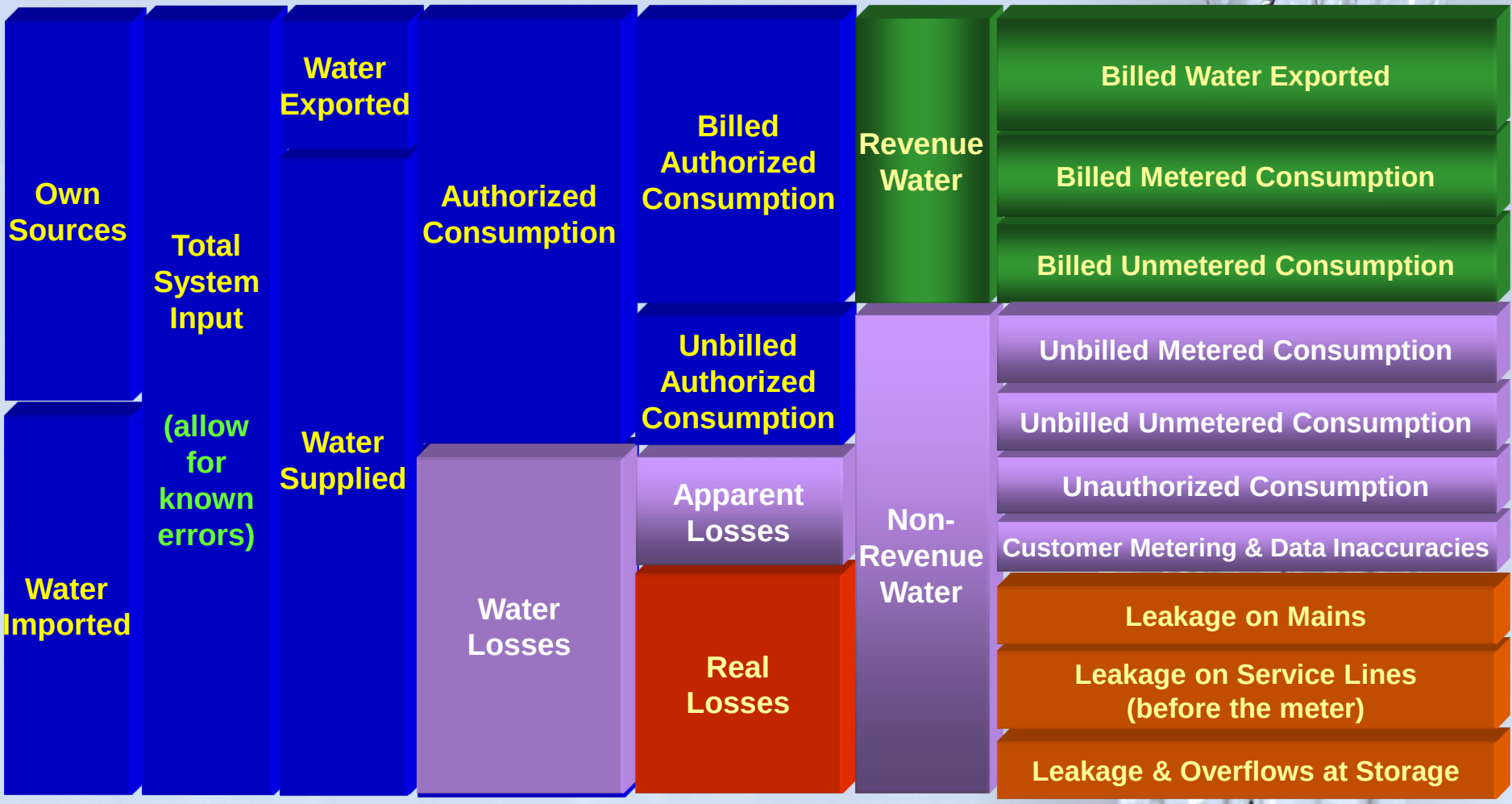
- Of the 7 repaired water meters, revenues increased
- An additional $4,089.00 was now being collected each quarter (=$16,356 for 1 yr.)
- The program paid for itself in 11 months
- The 2 replaced meters were revenue neutral (they were on non-billed city owned facilities)

Why develop a meter testing program?

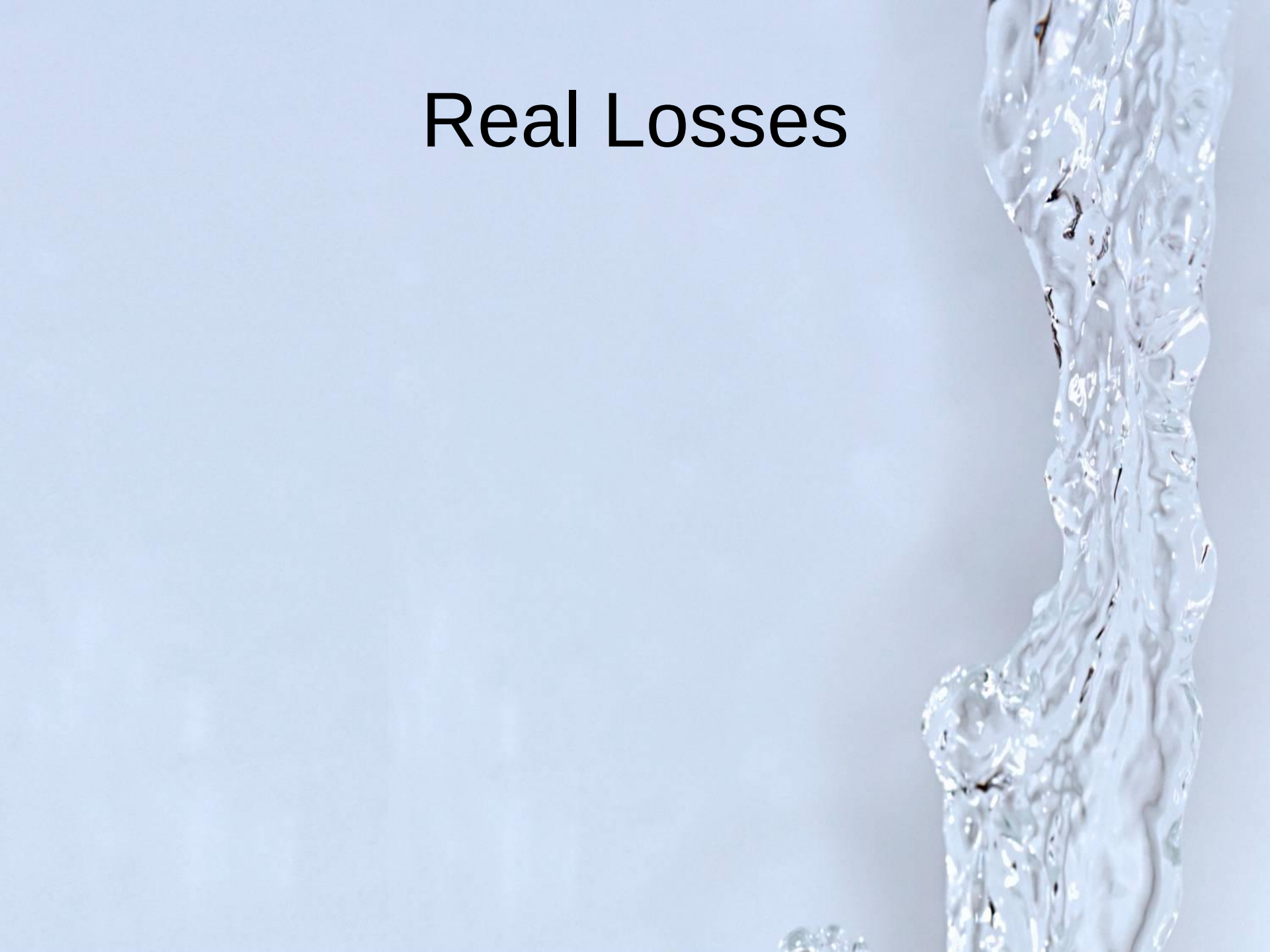
- To insure that the utility is receiving all the revenue it should
- To promote conservation, **reduce water loss** and use **best management practices**
- To make sure that the cost of operating the utility is spread fair and equitably among all customers



Standard Water Balance Format



Real Losses



“Let’s begin today with a look at

Holy #@**%$ … When did this happen”?

72” main break

Too late…

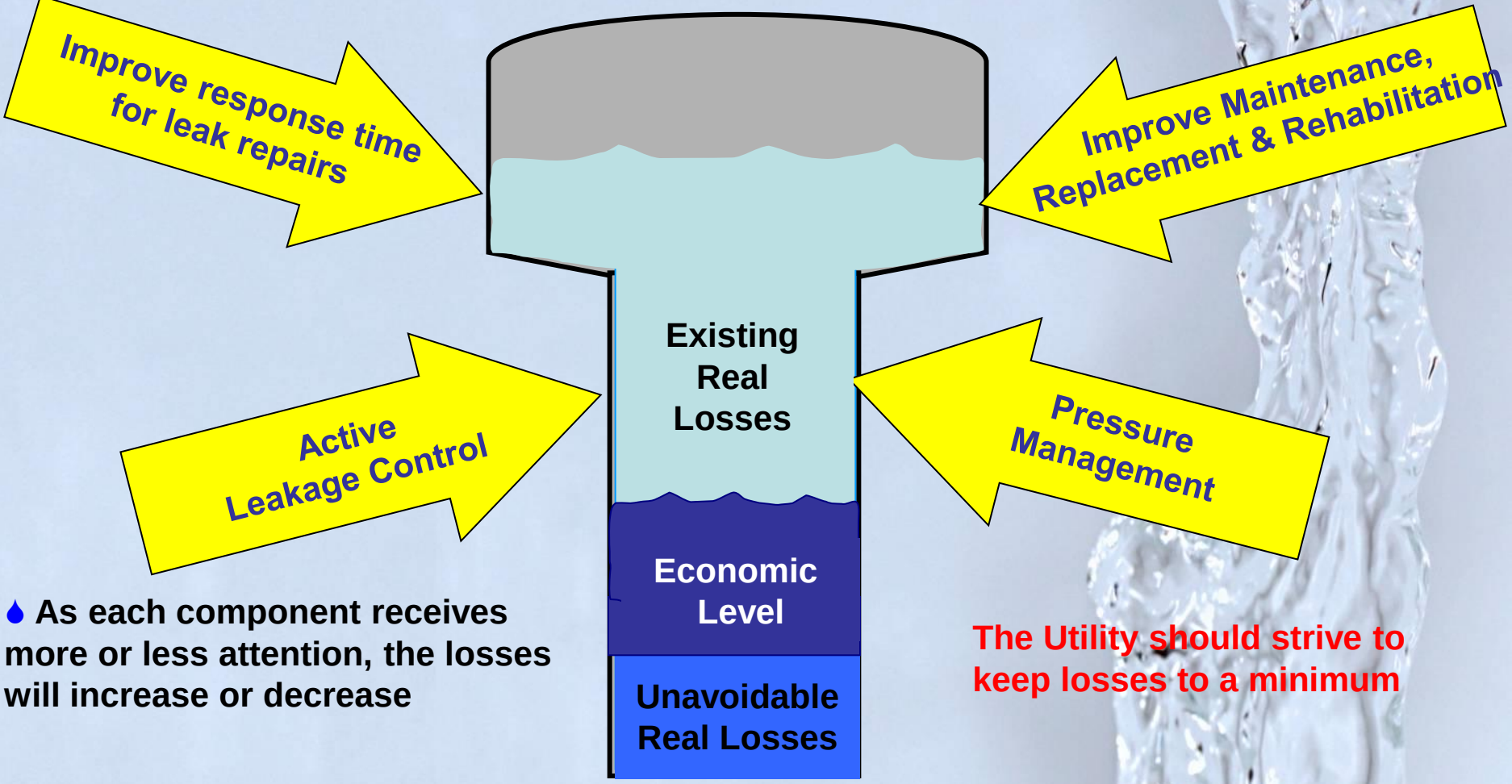

LIVE
BREAKING NEWS
13
WJZ
Dunhaven Road
DUNDALK, BALTIMORE COUNTY

Well, so much for watering the lawn and washing the car today…

**Main breaks happen… some are unavoidable.

Are you ready for this??

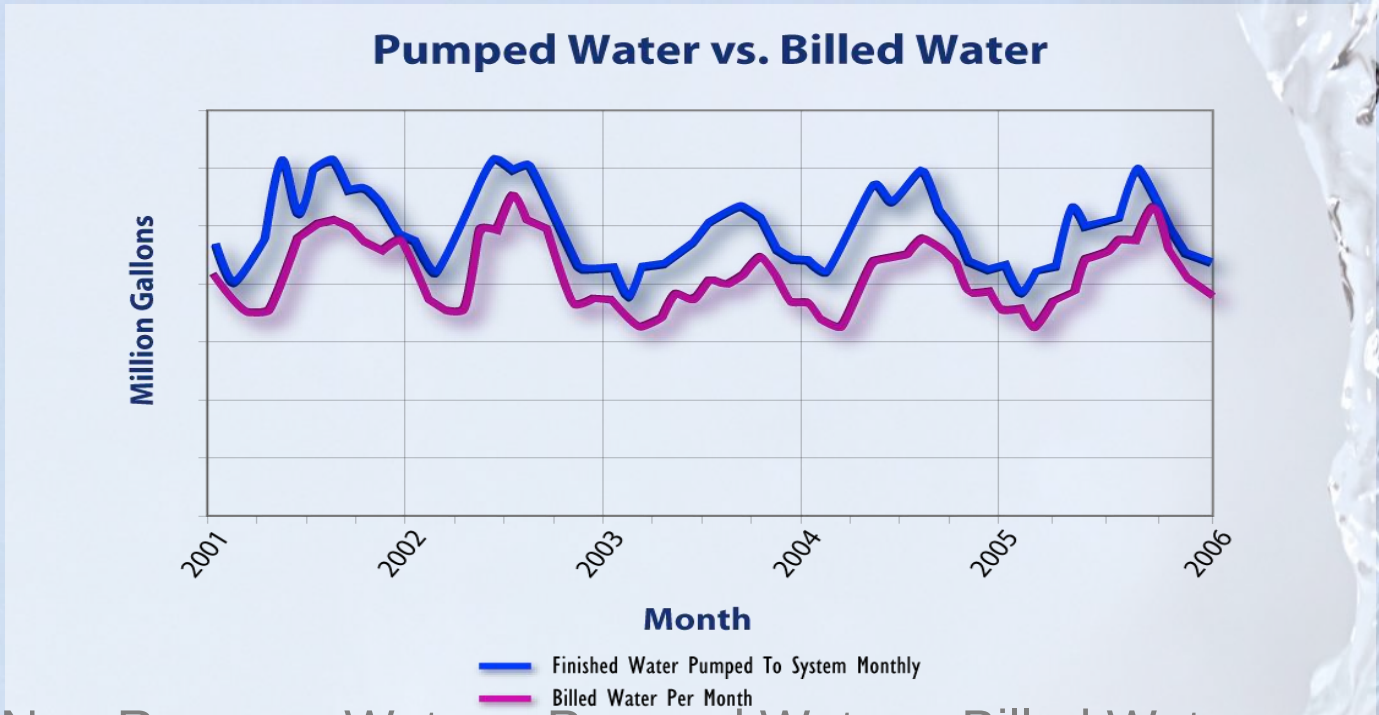
Four Components of Managing Real Losses



- As each component receives more or less attention, the losses will increase or decrease

The Utility should strive to keep losses to a minimum

Non-Revenue Water



- Non-Revenue Water = Pumped Water – Billed Water

Real Losses- Leakage
($$ Non-Revenue Water $$)
(You are not making $$'s on leaks!!)

Try to find them before they cause major losses

Acoustic Leak Detection 101

- Fluid escaping a pipe under pressure produces “Leak Noise”
- Leaks are detectable based on:
  - Size of leak
  - Pressure of pipe
  - Pipe size
  - Pipe material
  - Length of pipe between listening points
  - Good physical contact with pipe or valve

How to perform a Leak Survey…

The old way…

Leak Noise

- **Leak noise is Energy.**
- **Energy gets “used up” as noise travels along pipe. Larger the pipe, the more noise gets absorbed. (pipe material plays a factor …Amount of water in the pipe)**
- **Rectilinear Propagation** – defined as energy waves traveling in straight lines.
- Sound Waves do not want to make turns.
- Tees and elbows cause noise (energy) to split up (resulting in wave distortion… echoes)

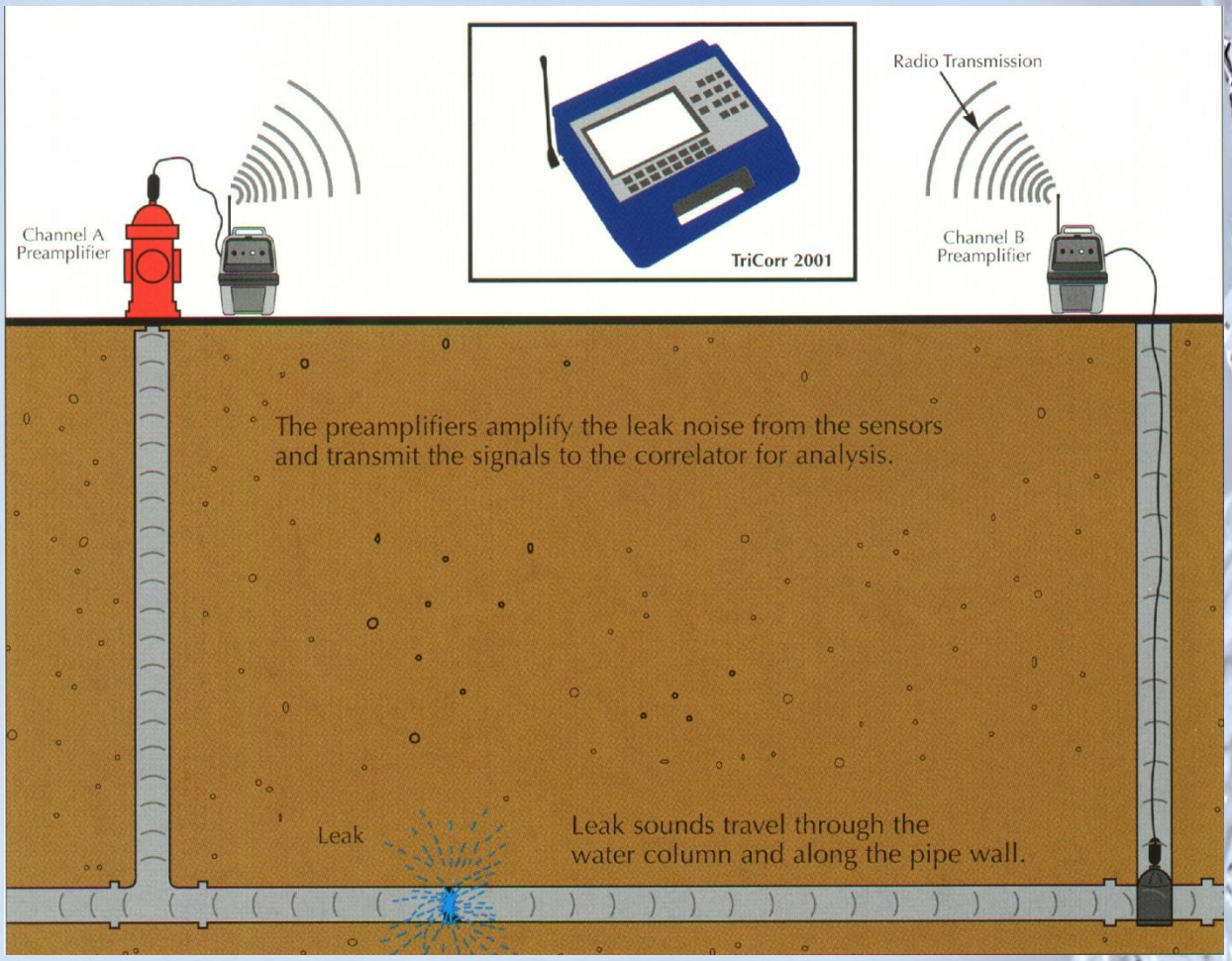
Order of preference for Listening

- Pipe
- Mainline Valve
- Hydrant Valve
- Hydrant
- Service (b-box)

Acoustic Leak Detection 101 (continued)

- Leak noise is picked up by a set of transducers
- Signal is amplified and transmitted to Correlator to pinpoint leak location.
- Leak Correlation is based on time delay difference of arrival of leak sound received by each sensor.
- Generally,
  - Smaller, high pressure leaks - mid to higher frequency ranges
  - Larger, low pressure leaks - low to mid range
  - PVC - lowest range

The pipe material, pipe size, and length of pipe segments are entered into the Correlator and the leak noise is analyzed and the leak pinpointed!



Leak Correlation Equipment

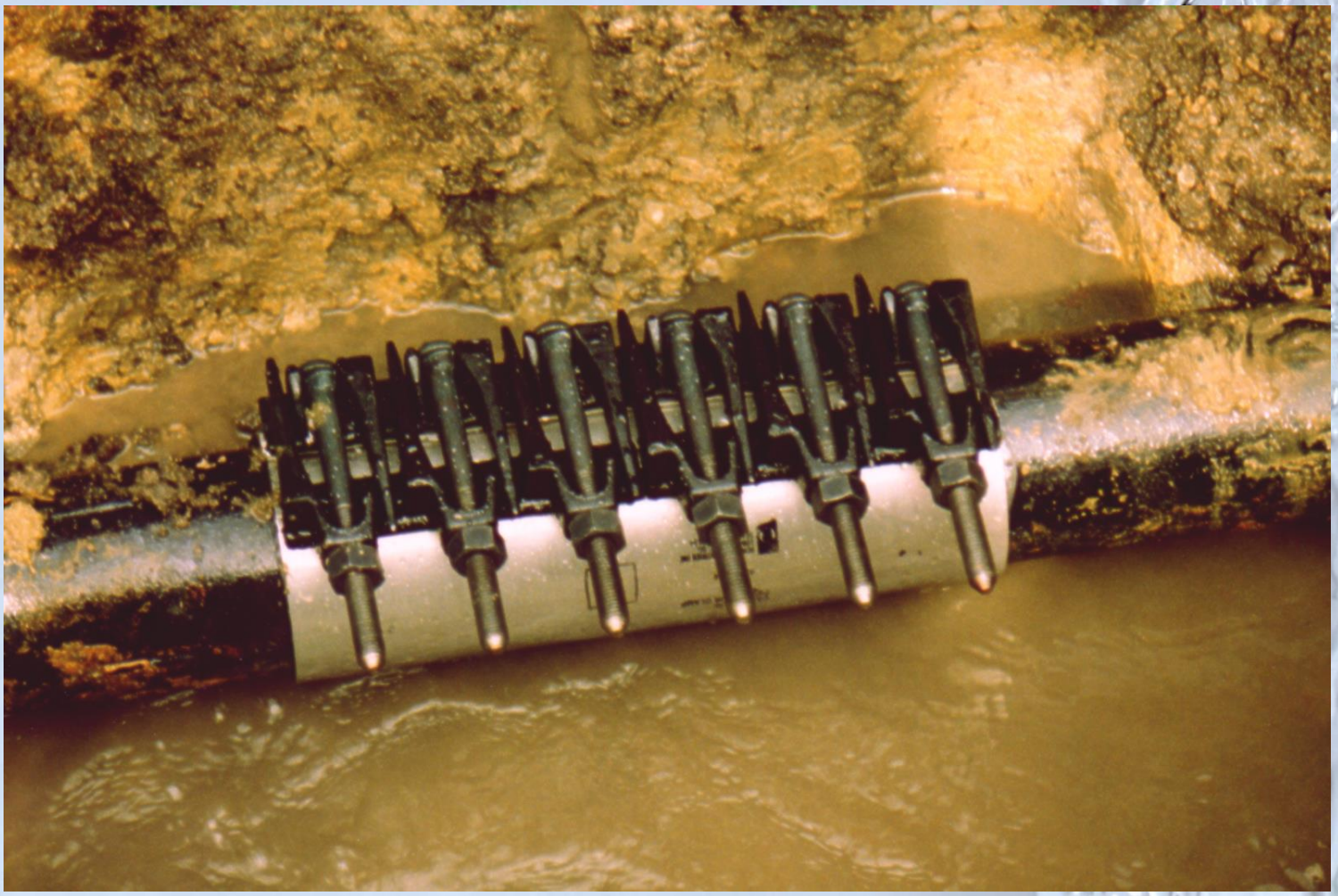
Leak Located - X marks the Spot

Leaks are pinpointed using one of our FCS Computer Correlators.

Pavement Cut

Hole Dug

Leak Repaired - One Hole, One Restoration

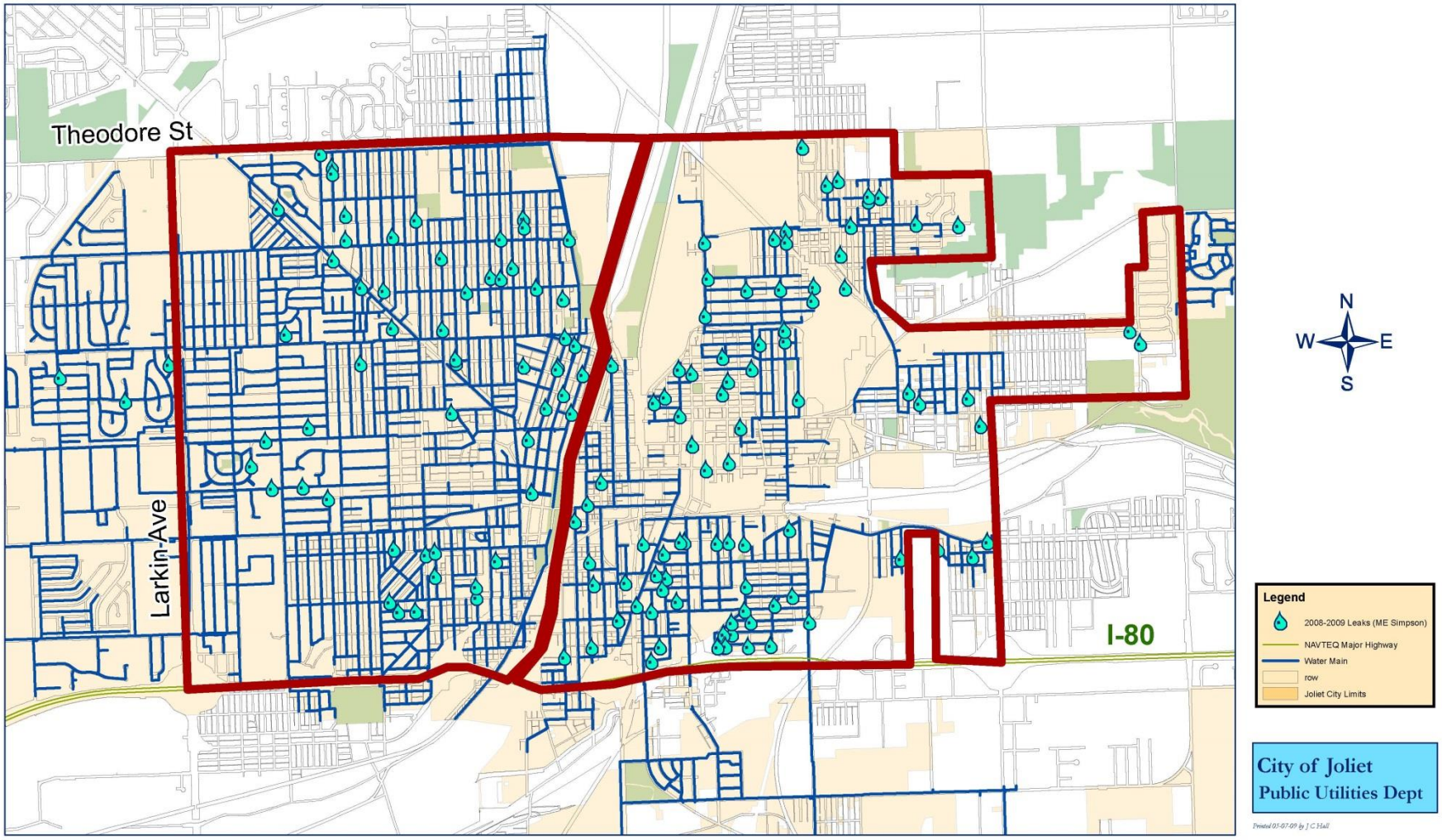


Case study

City of Joliet, IL (2008-2009)

- ✓ **180 miles out of 375 miles of water main in the City of Joliet's distribution system.**
- ✓ **149 leaks. 33 main breaks, 59 service line leaks (7 on the customer side of the shut off valve), 46 hydrant leaks, and 11 valve leaks (packing and bonnet bolts).**
- ✓ **The majority of these leaks did not surface because the local geology of Joliet is limestone. Annualized water losses in dollars was $918,354 (wholesale costs). Payoff for cost of survey: 8 days**
- ✓ **The City has since extended the contract for the remainder of the system.**

Leak Locations (water drops) in 180 miles of main



This Leak, located during a survey would never have surfaced, was running into an old tile.

Lessons Learned from a Leak program

- Fire Hydrant issues…
- Customer Meter issues…
- Customer Lateral issues
- GIS Mapping Updates
- Not all leaks surface!
- Program complements Utility's "proactive stance" on water loss prevention
- Prioritize CIP programs

THANK YOU!!

A special thank you to the following people/entities who provided information:

AWWA Water Loss Control Committee

John Van Arsdel/Dan Hood – M.E. Simpson Co., Inc.

QUESTIONS?

M.E. SIMPSON Co., Inc.