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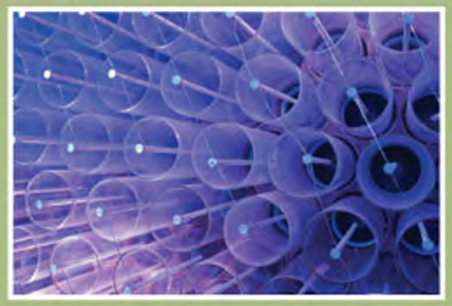

Module 3.1
Controlling Real Losses: Leakage Management

DRBC Rule Change & Water Audit Workshop
Rutgers EcoComplex
Bordentown, New Jersey
April 13, 2011

Russell G. Titus

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What are Real Losses?

- **Physical losses of treated water from a system**
- **Components, as defined in the water audit, are:**
  - Leakage on transmission and distribution mains
  - Leakage on service connections (to the meter)
  - Leakage and overflow at storage facilities
- **3 components are not distinguished in a top down audit**

Measure, then act

?

- **Calculate or measure then monitor your losses**
- **Recalculate your losses**
  - Make sure your apparent loss calculations or assumptions are valid

Figure 1: Understanding the problem of leakage (source: Water and Sanitation Program of the World Bank, in LIEMBERGER 2007)

General leakage management program

- Identify a cross-functional team that will have ownership of the program
- Compile an audit, assign a value to real losses
- Validate source meters
- Identify a preliminary target range, estimate savings

General leakage management program

- **Quantify components (reported, unreported leaks & background)**
  - Utilize MNF, pilot zones, DMAs
- **Assign values to leakage component volumes**
- **Compile short term plan, find the “low hanging fruit”**
- **Implement short term plan, attain short term economic level**
- **Recalculate component analysis considering new data**
- **Set medium and long term reduction goals, include methods**

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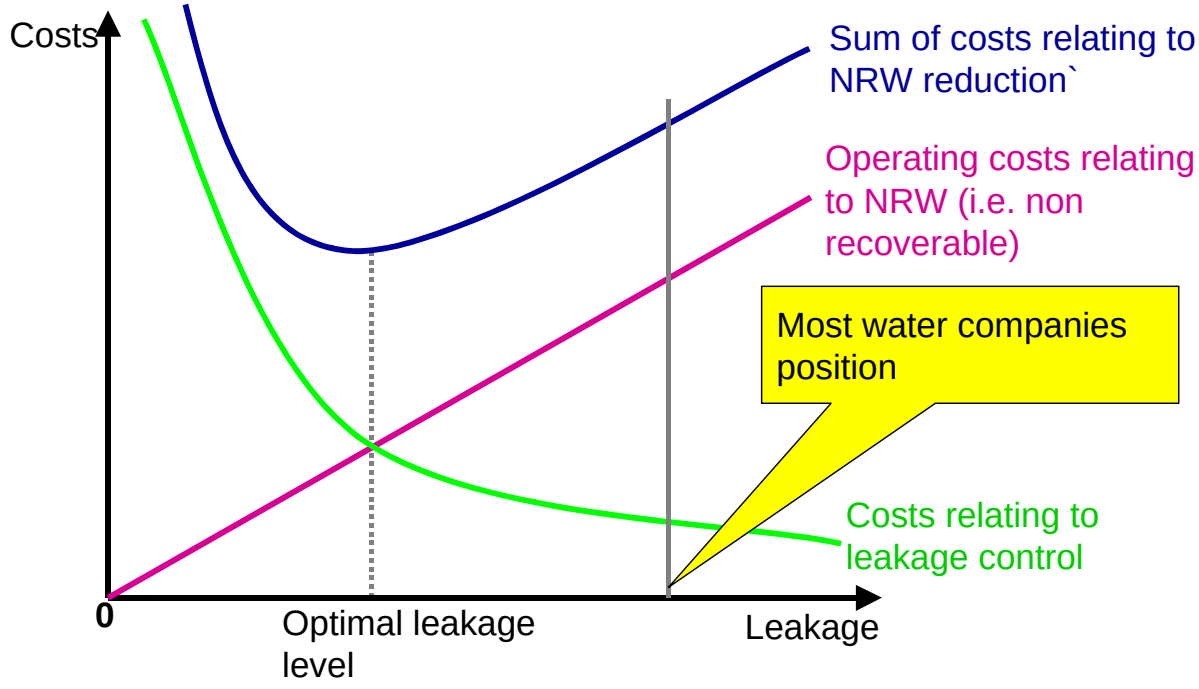
Target setting guidelines using ILI

General Guidelines for Setting a Target ILI (without doing a full economic analysis of leakage control options)			
Target ILI Range	Financial Considerations	Operational Considerations	Water Resources Considerations
1.0 - 3.0	Water resources are costly to develop or purchase; ability to increase revenues via water rates is greatly limited because of regulation or low ratepayer affordability.	Operating with system leakage above this level would require expansion of existing infrastructure and/or additional water resources to meet the demand.	Available resources are greatly limited and are very difficult and/or environmentally unsound to develop.
>3.0 -5.0	Water resources can be developed or purchased at reasonable expense; periodic water rate increases can be feasibly imposed and are tolerated by the customer population.	Existing water supply infrastructure capability is sufficient to meet long-term demand as long as reasonable leakage management controls are in place.	Water resources are believed to be sufficient to meet long-term needs, but demand management interventions (leakage management, water conservation) are included in the long-term planning.
>5.0 - 8.0	Cost to purchase or obtain/treat water is low, as are rates charged to customers.	Superior reliability, capacity and integrity of the water supply infrastructure make it relatively immune to supply shortages.	Water resources are plentiful, reliable, and easily extracted.

AWWA Water Audit Software v 4.2

Economics of Water Loss

- **Value Delivery Strategy: Water loss value plus leakage control costs need to be compared to avoided costs (recovery)**



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Four pillars for managing real losses

- Pressure management
- Active leakage control
- Infrastructure management
- Speed and quality of repairs

Four pillars for managing real losses: visual aide

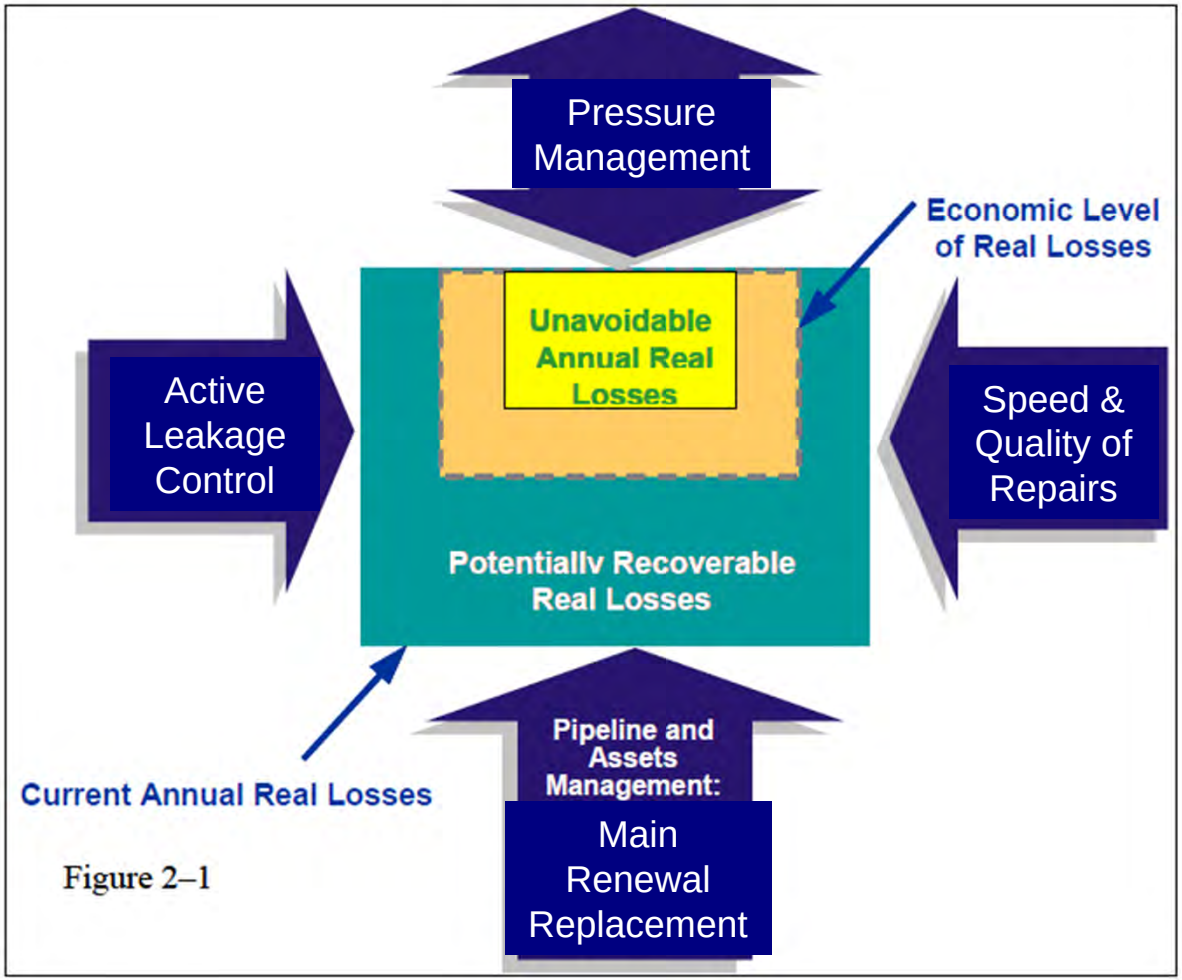

Figure 2–1

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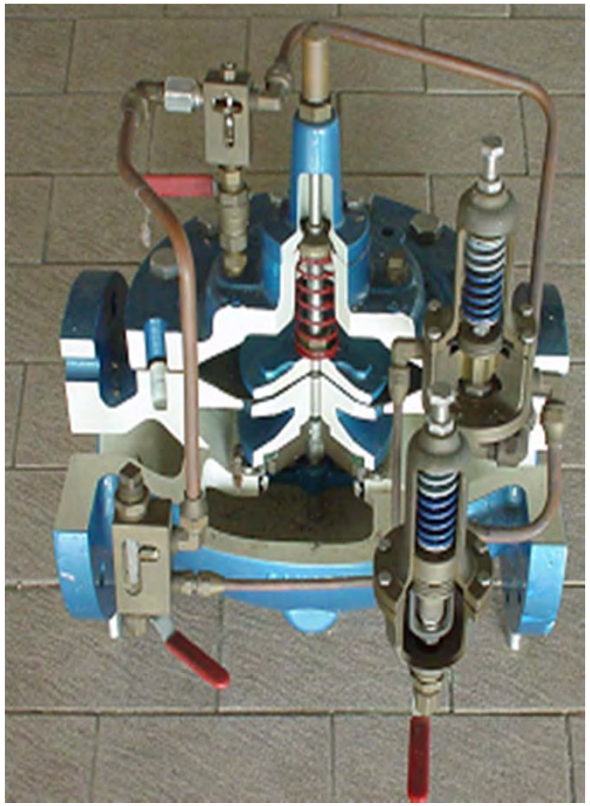
Pressure Management

- Provide optimum levels of service
- Ensure sufficient and efficient supply
- Reduce unnecessary or excessive pressure
- Eliminate transients
- Eliminate faulty level controls

Pressure Control Options

- Match input head to topography
- Boost critical areas rather than complete zone
- Match pump sizes and regimes to demand
- Use balancing tanks and reservoirs
- Use network analysis where available
- If other options are not available use pressure reducing valves



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Pressure Control Pros

- Immediate reduction in leakage
- Reduction in usage (e.g., car washing, sprinklers)
- Reduction in burst frequency in short term
- Stabilizing pressure reduces stress on the network
- Better service to customers

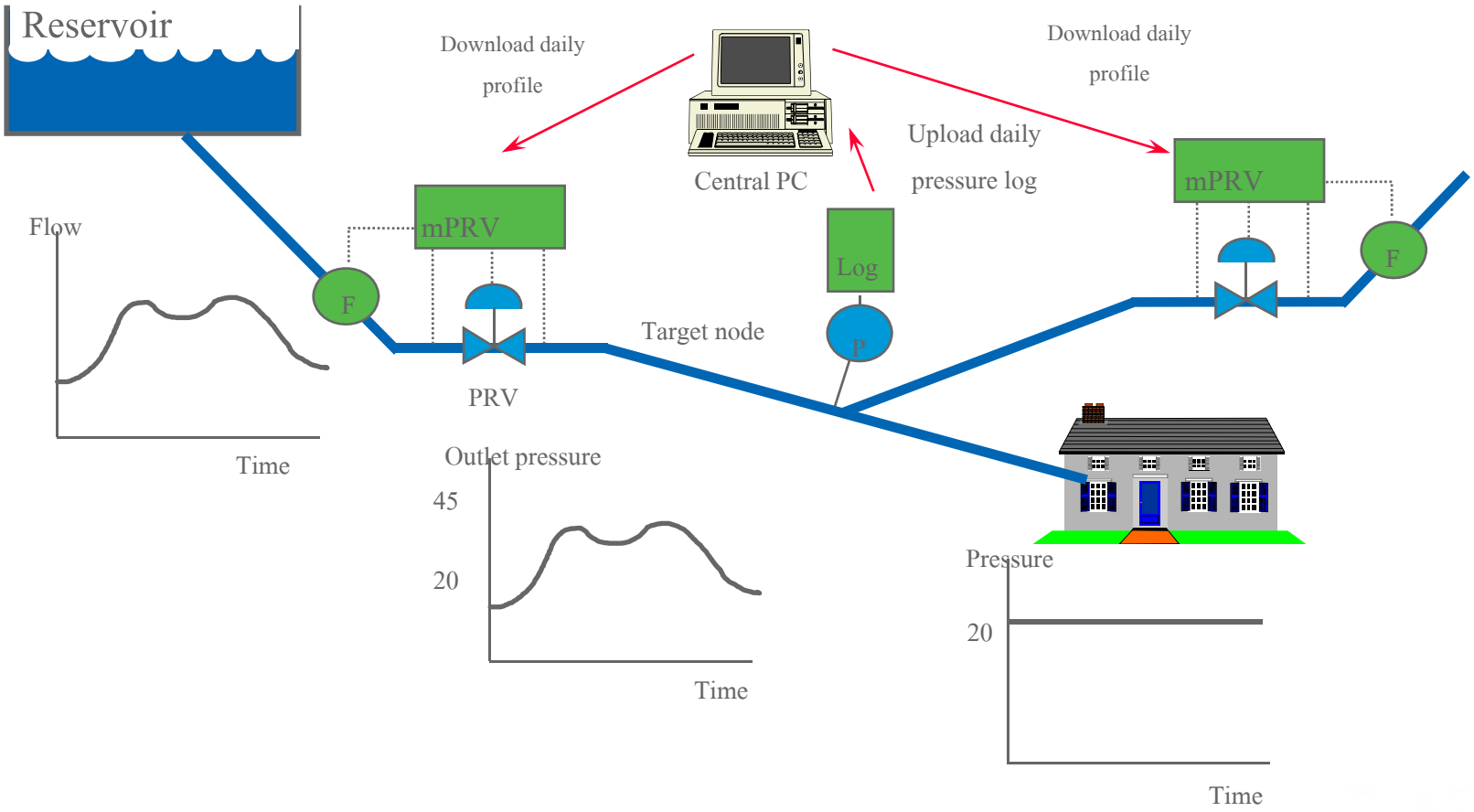
Pressure Control Cons

- Unacceptably low pressure due to undersized pipes or partly shut valves; fire flows may be reduced
- Noise on the system
- Valve operations affecting PRV performance
- Supply difficulties with high rise buildings
- Special consumers (industry, dialysis)

Pressure Management: Types of PRVs

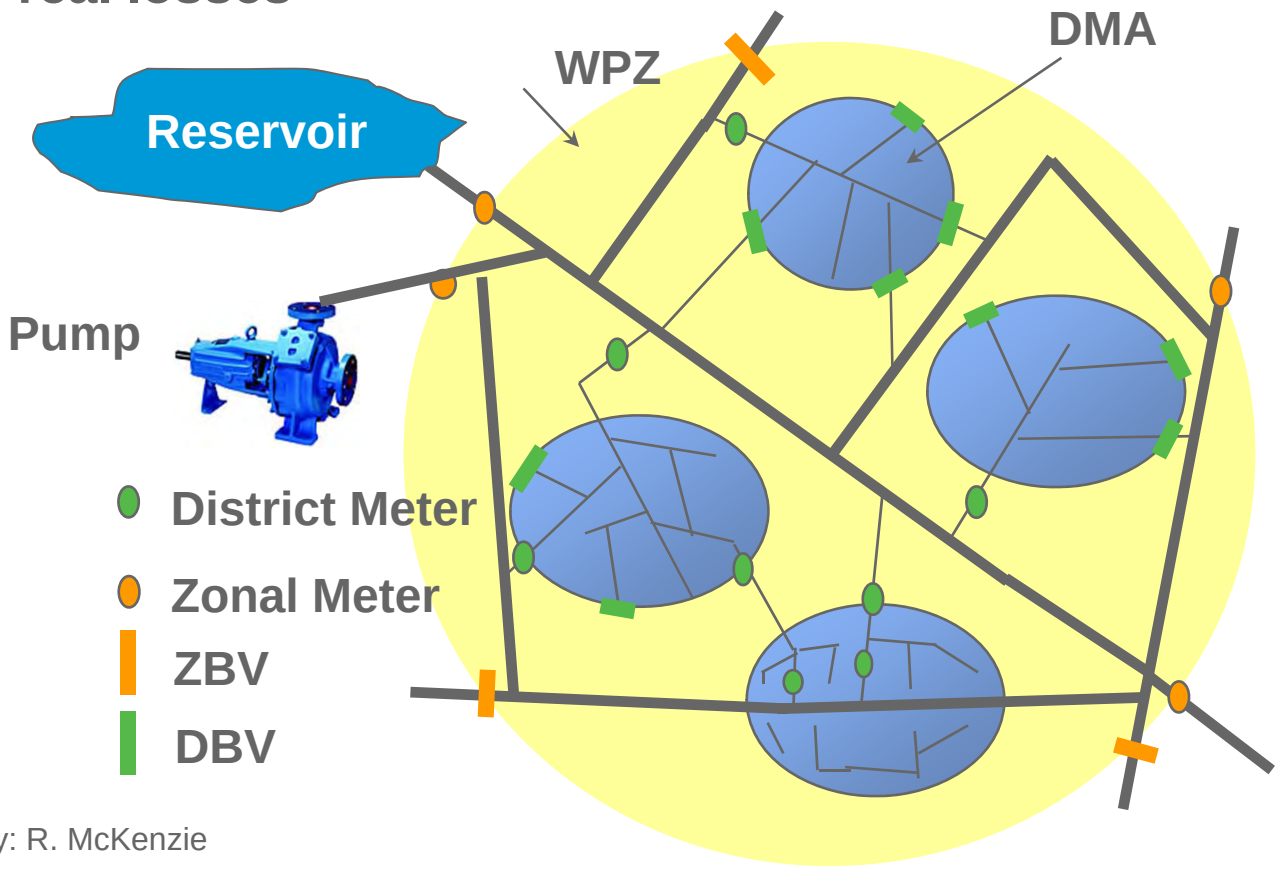
- **Fixed outlet**
  - some benefits but cannot respond to changing conditions
- **Time controlled**
  - can be set to respond to known 24 hour profile
- **Flow modulated**
  - sophisticated response to changing conditions

Pressure Management: Modulation



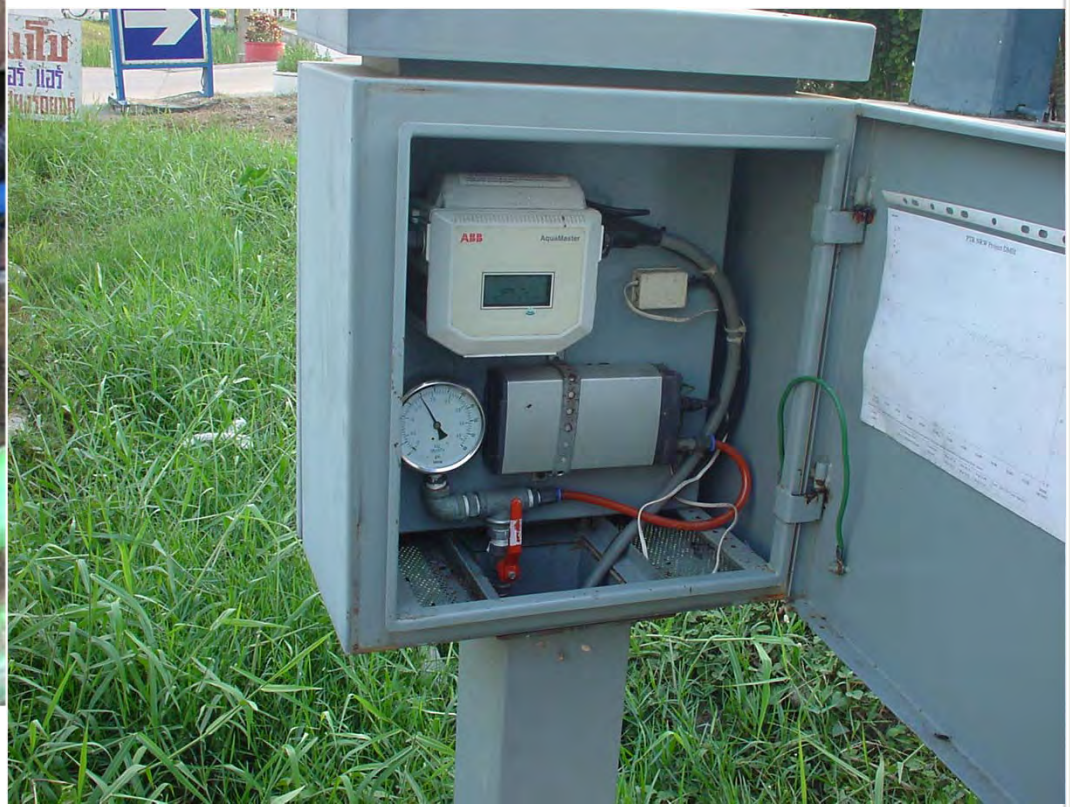
Leakage Control: the DMA

- District metered areas (DMA) are effective in localizing and reducing real losses



BenchLeak, courtesy: R. McKenzie

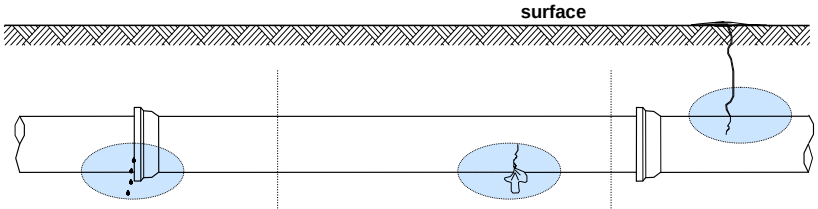
Leakage Control: DMA appurtenances



Active Leakage Control

- **Leak Detection**
  - Step Testing
  - Noise Logging
    - Correlating
    - Non-correlating
    - Permanent
    - Lift and Shift
  - Correlation
    - Accelerometers
    - Hydrophones
  - In situ
  - Sounding Survey
  - Gas injection
  - Other

Leakage & break components and reduction tools



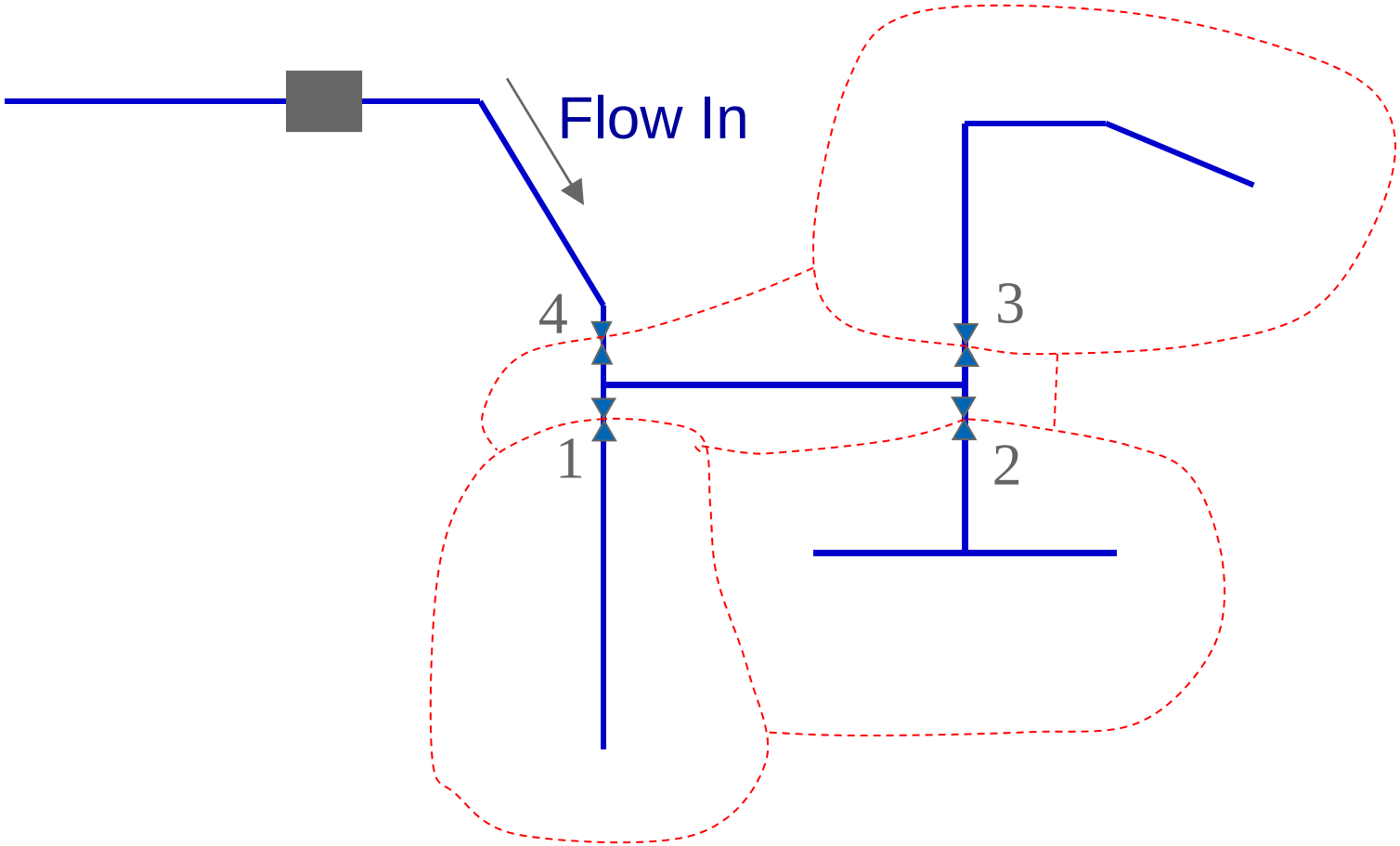
Background leakage	Unreported leaks	Reported breaks
Un-reported and un-detectable using traditional accoustic equipment.	Often does not surface but is detectable using traditional accoustic equipment.	Often surfaces and is reported by the public or utility workers
Tools	**Tools**	**Tools**
• Pressure stabilization • Pressure reduction • Main and service replacement • Reduction in the number of joints and fittings	• Pressure stabilization • Pressure reduction • Main and service replacement • Reduction in the number of joints and fittings • Proactive leak detection and repair	• Pressure stabilization • Pressure reduction • Main and service replacement • Optimized repair time

(from J. FilhoTardelli , SABESP, Sao Paulo, Brazil, Internal reports 2004)

ALC: Step Testing

- A step test is a method of narrowing down the search for suspected leakage by successively shutting parts of a discrete area, and noting the effect on the incoming flow.
- The integrity of the area must be established, all boundary valves shut, and the status of all other valves known.
- Supply should preferably be from a single source and must be metered.

ALC: Step Testing



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ALC: Step Testing

Advantages

- Easy interpretation of results
- Non-acoustic method
- Finds large leaks quickly

Disadvantages

- Relatively crude method – works best with large leaks
- Potential water quality problems
- Interrupts customers supply
- Usually requires night work
- Labor intensive

ALC: Noise Logging

ALC: Noise Logging

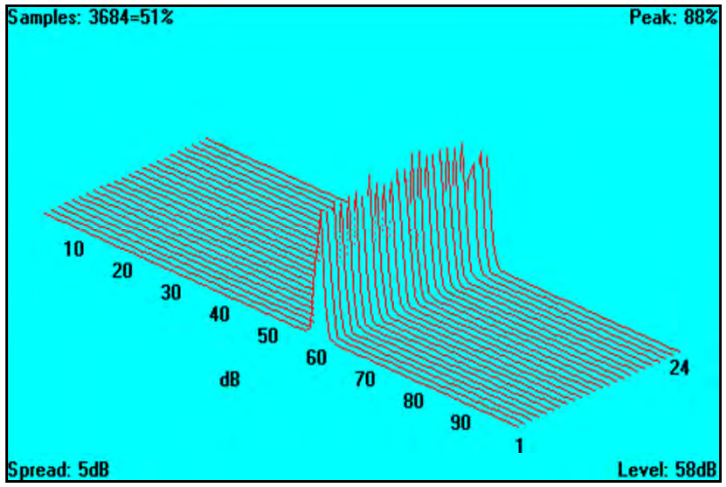

Image showing clear, consistent leak noise

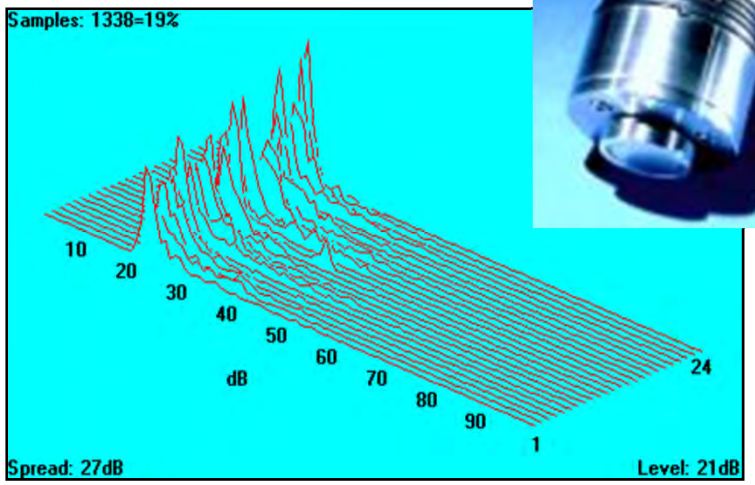

Image showing variable levels of noise = No Leak Status

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ALC: Noise Logging, Permanent

Itron mlogonline™
Network Leak Monitoring System

Water System Settings Help Log Off — California American Water - Monterey — User: Russ — © 2008 Itron, Inc. All Rights Reserved

Water System Summary

Last Updated: 11/24/2009 — 4108 mlogs installed

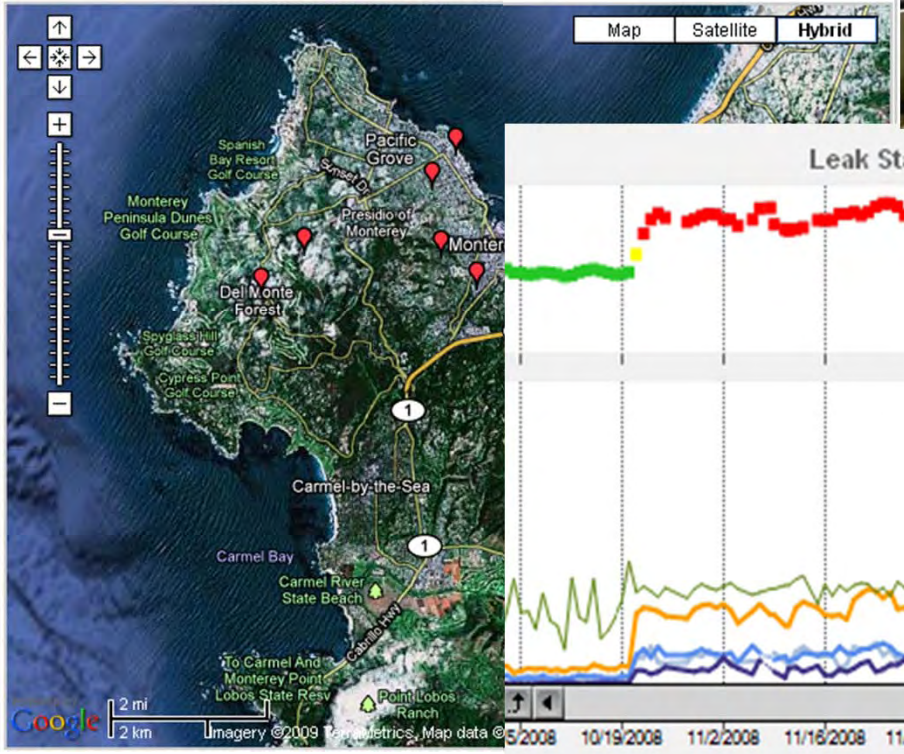
11 Probable Leak | 3776 No Leak Likely | 19 Leaks
46 Possible Leak | 275 Out Of Status | 21 Noises

Enter an mlogid or address to find — Search — more... clear

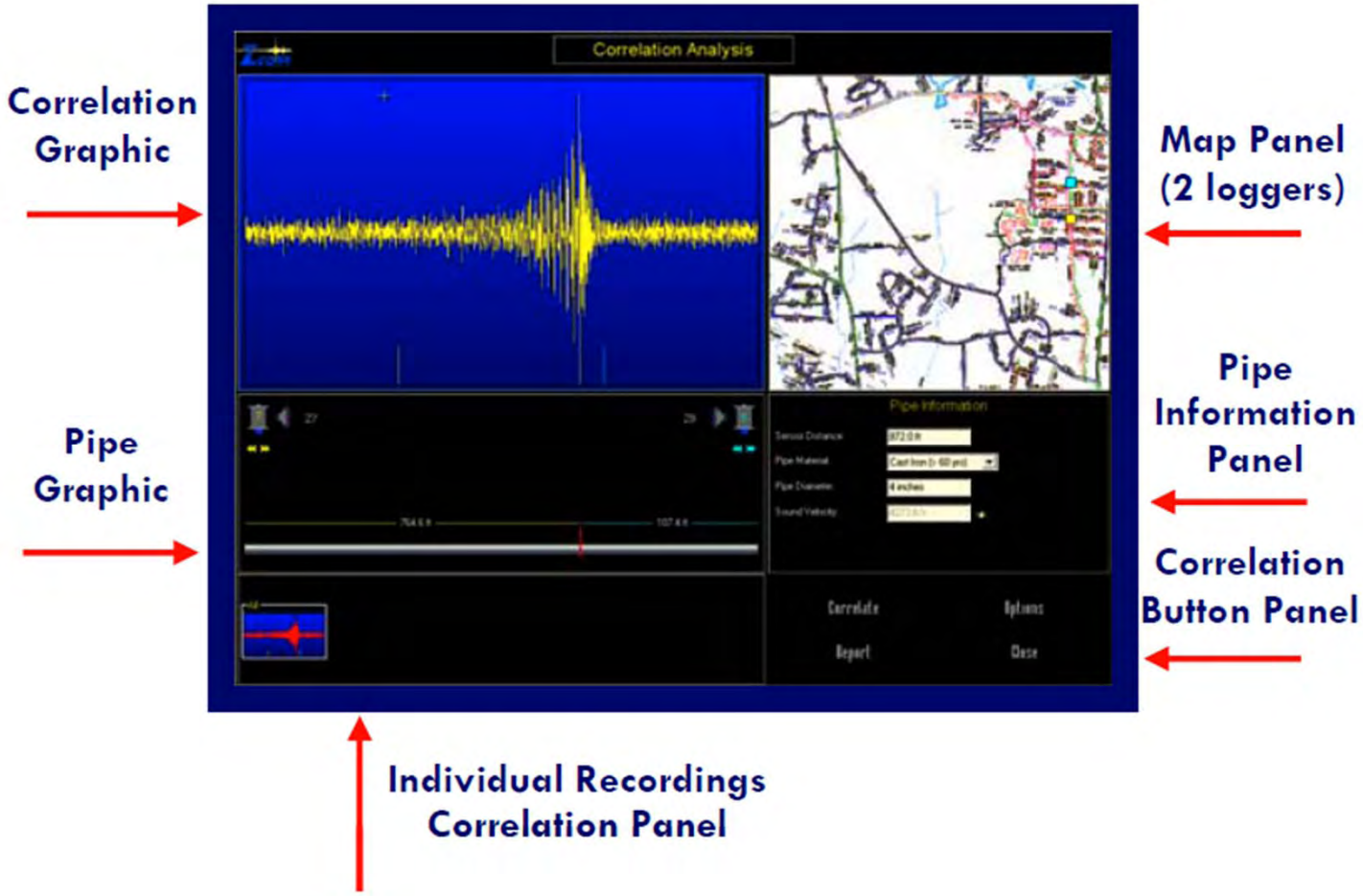
Right click on the map to install a new mlog, leak or noise source

mlog Devices Export...

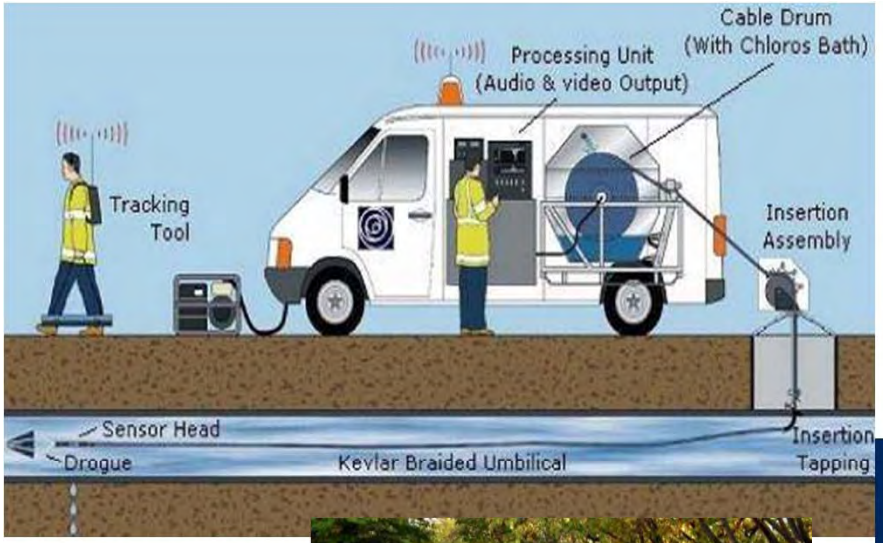
ID	Address	Status	Rank	*
56420	2928 Congress Rd		2	
58042	23 El Caminito Del Sur		3	
54240	27365 Schulte Rd		4	
57520	1137 Wildcat Canyon Rd		5	
58121	565 Oak St		6	
56487	37 Laurel Dr		7	
59707	1035 Cass St		8	*
54763	298 Sloat Ave		15	
57789	751 Wave St		16	*
54354	570 Trinity Ave		17	
59970	1148 San Pablo Ave		18	

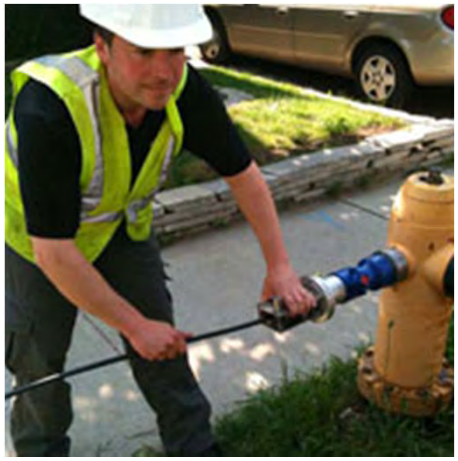


ALC: Correlating Loggers

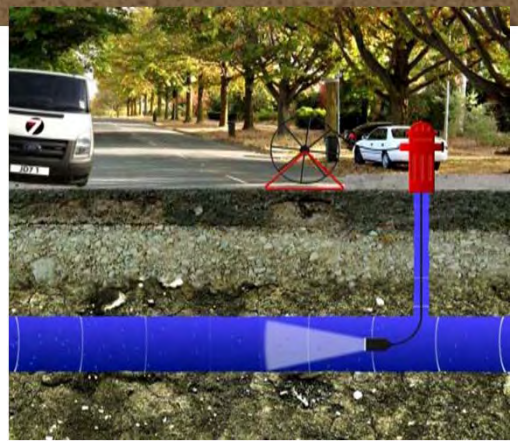


ALC: Other Technologies

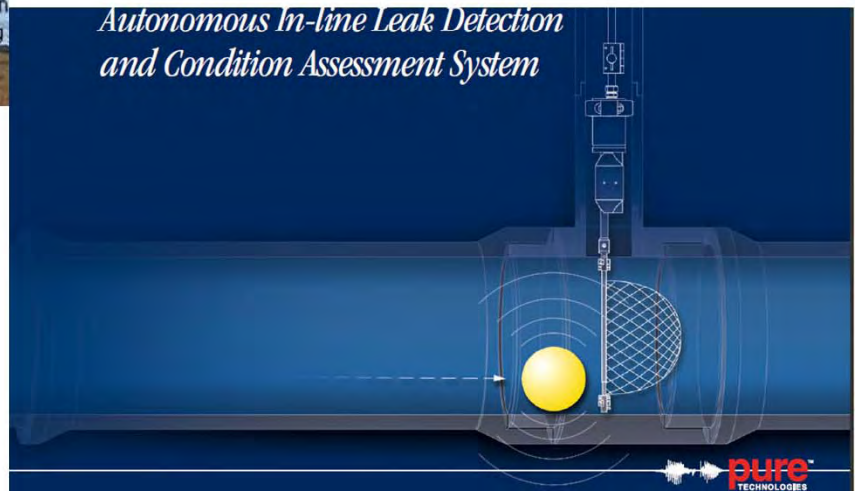




Cable driven



Tethered



Free Swimming

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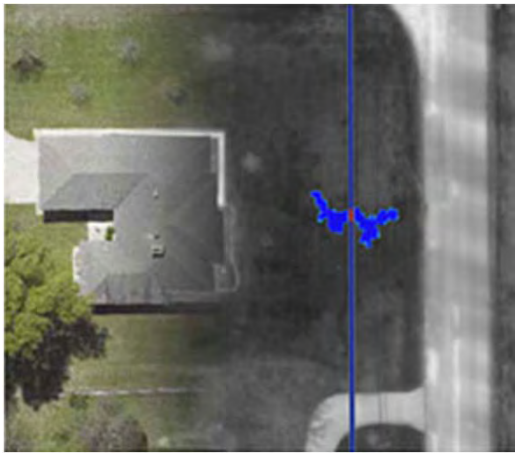
ALC: Other Technologies

Fiber Optic Cable

Remote Field Eddy Current

Using Hydrogen Gas

Ground Penetrating Radar

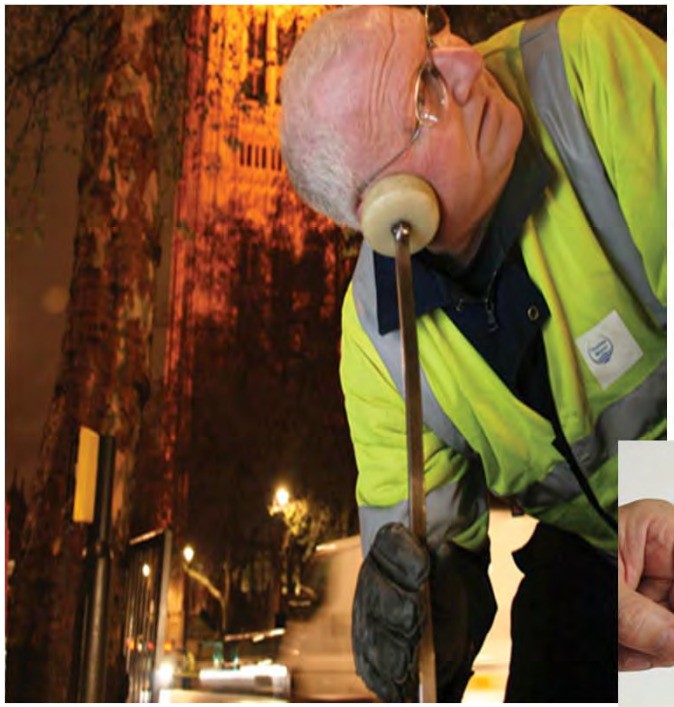


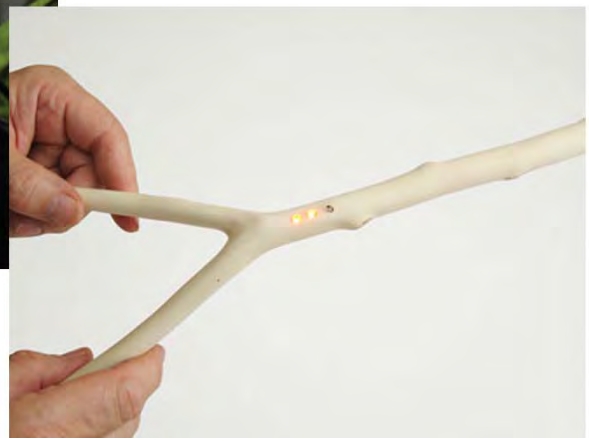
Aerial thermography

Leak Detection Pinpointing

Once an acoustic leak signature has been identified, a ground microphone is used to pinpoint the leak from the surface

Active Leakage Control: The Future ?





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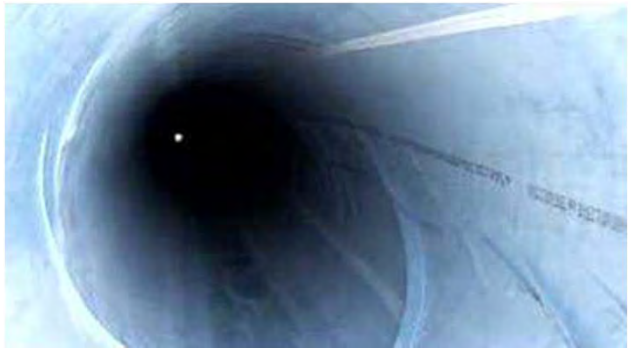
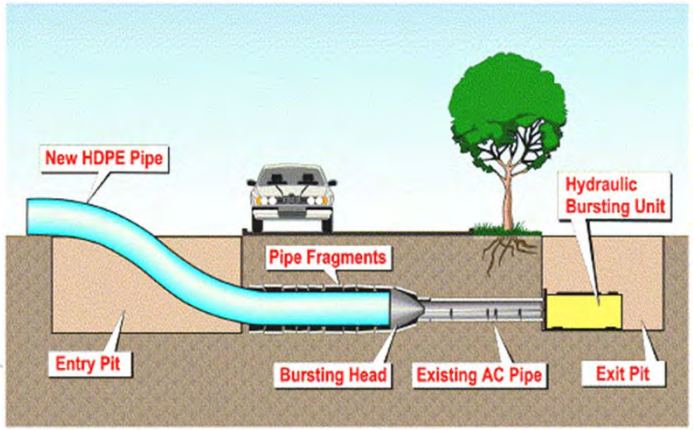
Infrastructure Management

- Rehabilitation and replacement
  - Structural Lining
  - Spot Repair

- Replacement
  - Choice of material
  - Pipe bursting
  - Pipe pulling





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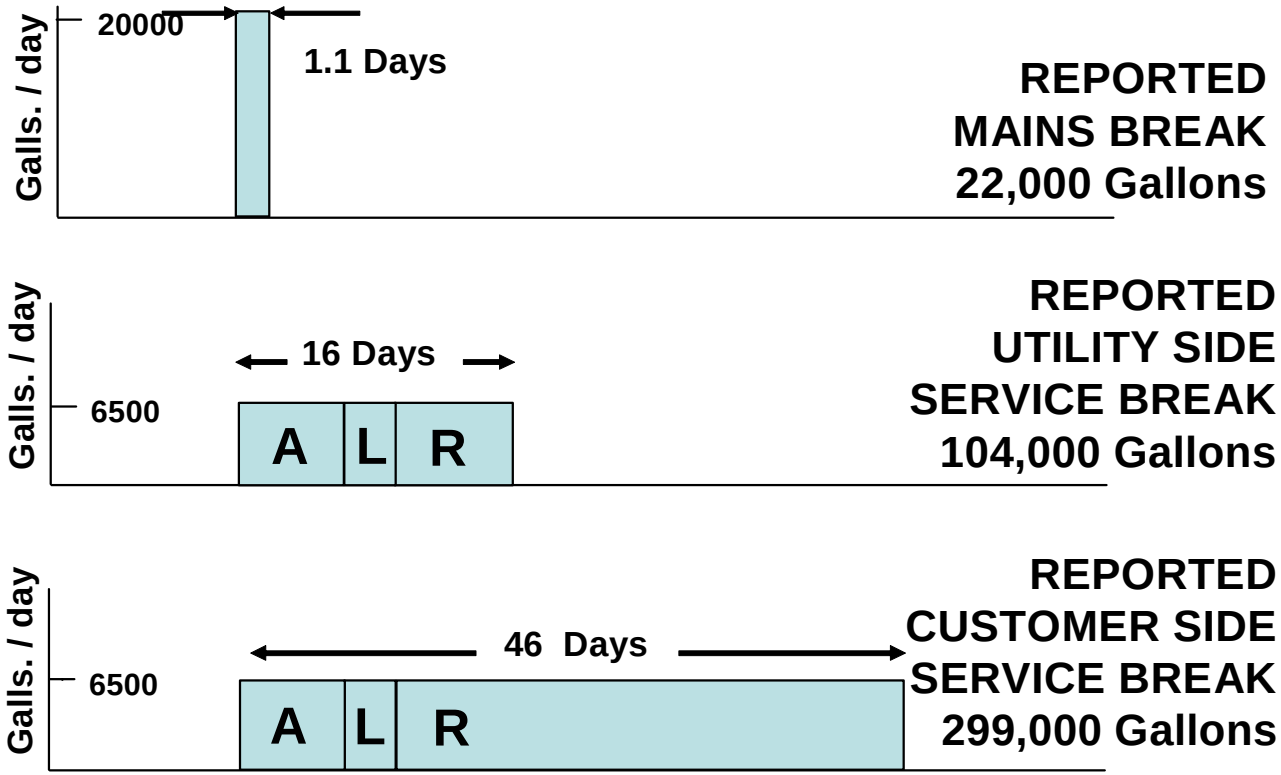
Speed and Quality of Repairs

- Why find and repair leaks quickly?



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Questions ?