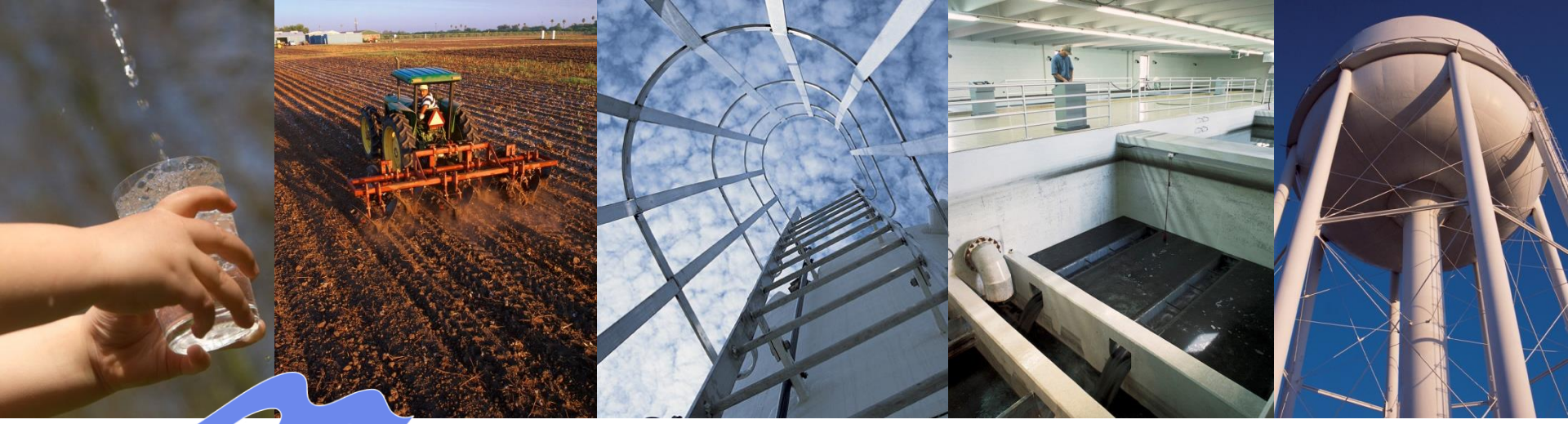

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Asset Management Webinar Series

Completing Condition Assessments

Wayne Cannon – Ohio RCAP Rural Development Specialist
Bud Mason – Ohio RCAP Rural Development Specialist

Why weren't we warned?

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Credit: Alan Cressler

But, we were!

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The real questions: “How did we miss them”.

- Performance typically declines slowly
- Changes in personal / Memories fade
- Poor maintenance records

Today's topic: Condition assessment and performance monitoring

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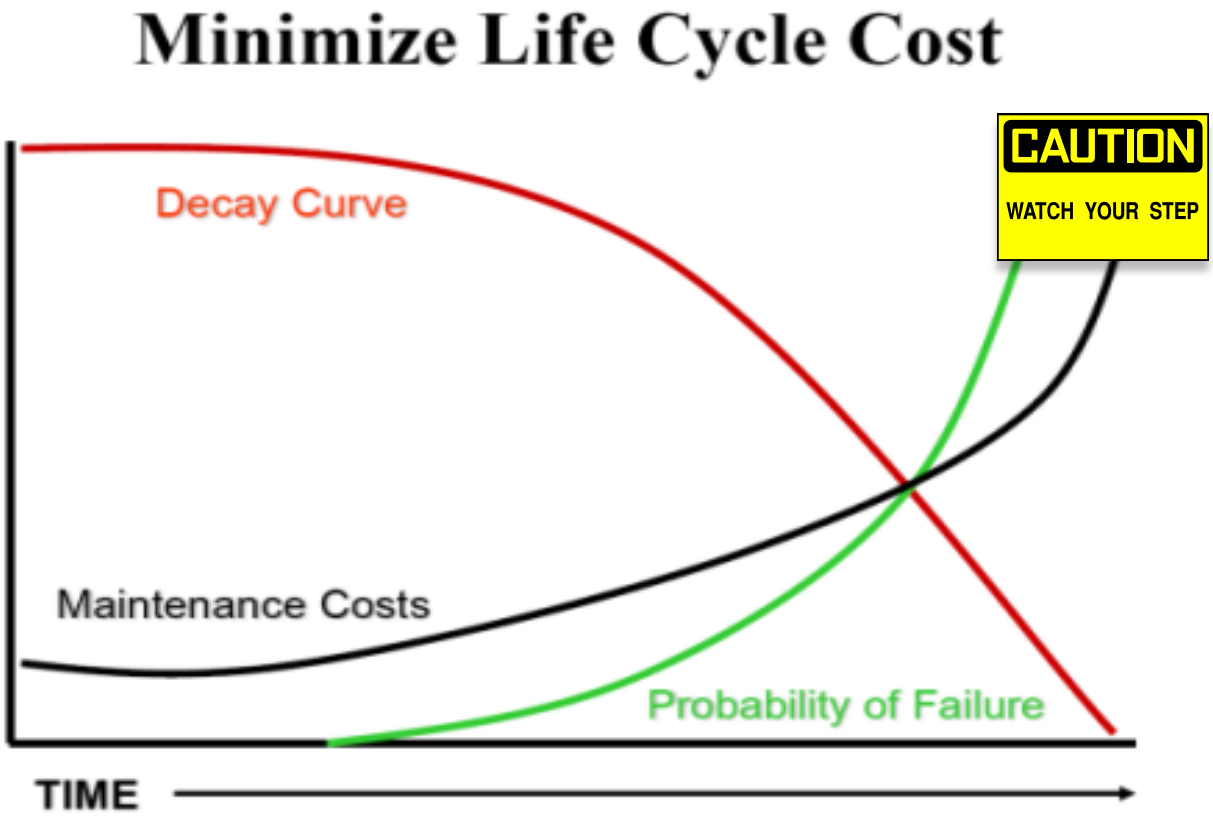

How do manage what you don't understand!

Individual components must work together to achieve greatness!

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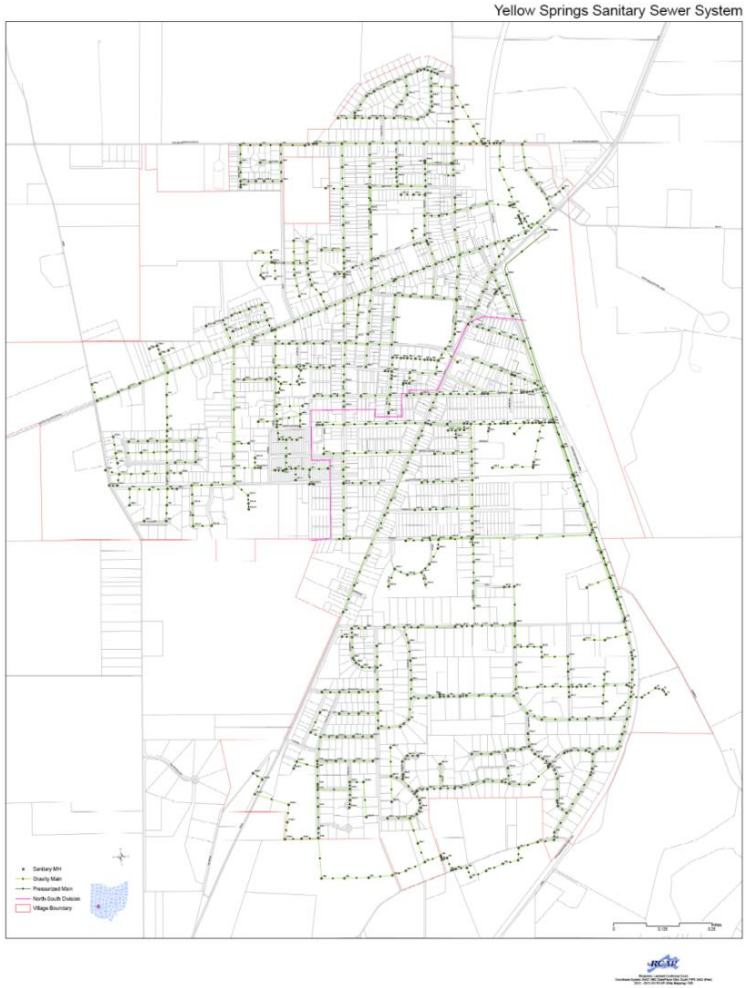
- Source
- Treatment
- Pumping and Storage
- Distribution
  - Pipes
  - Valves
  - Hydrants
  - Meters

Historically we focused on the big stuff. Little attention was paid to distribution and collections systems.



Age is but one RISK factor in determining asset condition.

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Other factors include:

- Construction Problems
- Maintenance History
- Type of Materials
- Manufacturing Problems
- Water Quality
- Usage (Wear and Tear)
- High Operating Pressure
- Wide Pressure Swings
- **Can you think of more?**

What is the most important RISK factor?

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Cause of failure is the most important risk factor.

- What was the cause of failure?
- Location of failure? (Site Condition)
- Isolated incident / Systematic problem (Frequency)
- Could failure have been prevented or delayed?

History repeats itself! By maintaining a record of asset failures that is sortable by location and cause we will eventually be able to predict approximately when and where future failures will occur.

Will past problems impact future performance?

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ABSOLUTELY!

Spontaneous repairs require divine intervention.

- Defective valves never heal.
- Leaking hydrants will continue to leak.
- Dirty pipes never clean themselves.
- Water loss only increases with age.

Were there warning signs?

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YES! Almost always.

The real questions: "**How did we miss them**".

- Performance typically declines very slowly
- Increasing maintenance needs become routine
- Poor maintenance records - Memories fade
- Institutional memory lost - Changes in personal

"Those who fail to learn from the mistakes of their predecessors are destined to repeat them."
George Santayana

What is the condition of your assets?

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- Are they operational?
- No time for testing during emergencies!
- When was the last time your used them?
- If not operational, what will it take to make them work?
- What happens if we don't get things fixed?
- Impacts on public health / reliability / longevity?
- **What can we do to improve asset performance??**
- **Your opinion estimate of remaining useful life???**

Can you control flow well enough to avoid depressurization?
"EPA recently issued findings and orders for inoperative valves."

Assessment Methods

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1. Age Based - Lowest level (We can do better.)
   - When was it installed?
   - Estimated Useful Life
2. Valued Opinion – Consensus of Management Team
   - Problem ID Exercise (**Recommended starting point**)
   - Testing to Confirm Assumptions (Worst asset first!)
3. Systematic Inspection and Testing (**GOAL**)
   - Annual Water Audits
   - Exercise Valves
   - Test Hydrants
   - Active Leak Control

The webinar on Wed. Sept 27th is devoted to Improved Preventive and Predictive Maintenance

Step 1: Problem ID Exercise

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- Organize a discussion group to review and document the utilities condition.
- The groups should include administrators, operators, engineers and political officials.
- Be sure to include individuals with historical perspective on construction and maintenance of the infrastructure.

Completion of this exercise may require several meeting with interim homework assignments. The more time you put into the process the more you will gain from it.

Problem ID Exercise

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- Obtain at least 2 large format maps of the utility system to document your findings. One for construction history and another for maintenance history.
- Organize supporting documentation such as plans, specifications, as-built drawings, purchase invoices, written maintenance records, etc.

What can we learn from construction history?

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Construction problems linger forever.

- Inappropriate design
- Poor material selection
- No inspection / Inadequate inspection
- Poor bedding materials
- Manufacturing problems (Bad Luck)

Discuss age, construction methods and materials for the various phases of construction.

Problem ID Exercise - Continued

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Pipe material has changed over the decades with different life expectancies and maintenance needs

- Sand Cast Pipe
- Old Ductile Iron Pipe
- Galvanized Pipe
- Modern Era Ductile Iron Pipe
- Concrete Asbestos Pipe
- PVC Pipe
- Lead, Galvanized, Cooper, Plastic Service Lines

Develop management groups for similar asset types.
Establish color codes for each asset group.

Problem ID Exercise - Continued

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Document difficult construction:

- Floodplains
- Hydric Soils
- Corrosive Soils
- Soils with poor Load Strength
- Soils with high Shrink / Swell
- Rock
- Difficult topography (Slope, Etc.)
- Poor Resident Inspection

Maintenance problems are more prevalent in these areas.
Reference soils, floodplain and topo maps.

What can we learn from maintenance history?

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Maintenance history tells the story

- Pipeline repairs (Location / Suspected Cause)
- Have valves been exercised? Operational? Why don't they work?
- Are hydrants flushed? Are you cleaning the pipe or just displacing water?
- Customer complaints (Quality / quantity)

Do you track the location and cause of failure for each repair?

Problem ID Exercise - Continued

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Document maintenance history

- Pipeline Breaks (**Cause of Failure**)
- Pressure problems (Both high and low)
- Inoperative hydrants / valves
- Corrosion issues
- Dead ends

Do you ever take time to review maintenance records to identify trends?

What is the impact of deferred maintenance?

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- How does it impact reliability?
- Will it increased future O&M cost?
- Will it reduce remaining useful life?
- What is the value of extending useful life by 20 years?

Common Maintenance Tasks

- Not changing oil in the generator – Generator fails during emergency
- Not painting the storage tank – Reduced tank life (rust and corrosion)
- Not exercising valves – Unable to control flow in an emergency
- Not cleaning pipe – Material buildup reducing flow capacity
- Not testing hydrants – Failure during emergency / Possible loss of life!
- Not testing / replacing meters – **NO revenues to perform maintenance**

Existing O&M Problems

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- Facilitate a lengthily discussion on operational and maintenance problems.
- The discussion should include water loss, metering issues, bad pipe, valves, hydrants, pump stations, tanks, water treatment, raw water sources, illegal connections, availability of easements, private property issues, etc.
- In some communities water meters are located inside the dwelling making the utility responsible for service line leaks. Is this how you want to operate going forward?

Design and Capacity Problems

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- High operating pressures and wide pressure variances can create stress points. Infrastructure problems can sometimes be located by documenting these stress points.
- Ask about low pressure areas and hydrants with inadequate capacity to support fire flow. This information will be useful in documenting capital improvement plans.

Final Product
Problem ID Exercise

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- Pink - 1920 to 1935 era cast and ductile iron
- Orange - 1935 to 1950 era ductile iron
- Yellow - 1950 to 1980 era ductile iron
- Green – Concrete pipe
- Blue – 1980 & newer PVC
- Line breaks are indicated by X.
- Rocky area circled in red

Pipeline failures are age related on Pink pipelines and corrosion on the Green pipelines (Bolt failure on service connections).

Value of Problem ID Information

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- Begin to assemble asset attribute information
- Infrastructure problems defined by cause-of-failure
- Document the impact of deferred maintenance.
- Facilitates a discussion of management solutions.
- Platform for improved maintenance budget. Management solutions are normally less expensive than capital upgrades.
- Capital improvement upgrades which address the REAL cause of operational problems instead of increasing capacity to overpower them.

Step 2: Condition Assessment and Performance Monitoring

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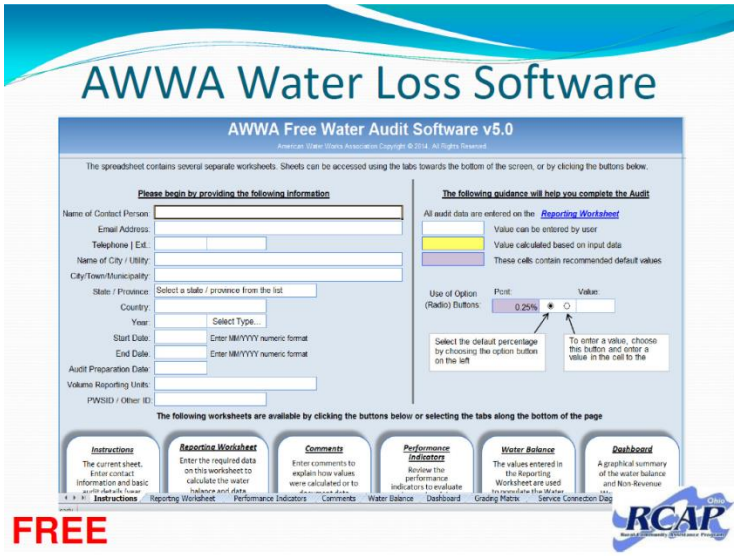

Static Pressure
Flow Rate - GPM
Residual Pressure

Condition assessments and performance monitoring are critical maintenance tasks. **How can you manage what you don't understand?**

Initial Condition Assessments

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Initial Asset Condition Assessment for:

- Hydrants
- Valves
- Water Mains
- Wells
- Pumps and Motors
- Storage Tanks
- Treatment Plants

Condition assessments are performed by utility department staff with the assistance of coop students and volunteers. **(SWEAT EQUITY)**

Condition assessments are very time consuming. Estimate 30 minutes per asset for a Level I assessment.

Most communities will need several years to inspect **ALL** of their assets. Condition inspection and performance monitoring will therefore need to become an ongoing maintenance activity. The resulting asset management plan should be revised as the quality of information improves.

Data Collection for Condition Assessments

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Asset Management – Condition Assessment
Hydrants

Asset Name/ID	
Asset Location	
Asset Category	
Asset Type	

Field Notes: _____

Age:		Manufacturer:	
Design Flow (GPM):		Actual Flow (GPM):	
Paint Condition:		Accessibility:	
Existing Grade:		Function (flushing):	
Main Pressure:		Main Diameter Size:	
Original Cost:		Replacement Cost:	$2,500

Fire Hydrant #1

Current Year =	2014	
Installation Year =	1980	
Age-Based Asset Estimated Useful Life* =	50	Years
Estimated Remaining Useful Life (RUL) =	16	Years

Cells highlighted in Yellow are input cells, those highlighted in gray are calculations.

Maintenance Condition?

Condition	RUL
Excellent	35 years
Good	20 years
Fair	10 years
Poor	5 years
Very Poor	< 5 years

Condition	Maintained	Not Maintained
Excellent	120%	110%
Good	110%	105%
Fair	100%	100%
Poor	95%	90%
Very Poor	90%	80%

Use the RUL, then move across to Maintenance to find the multiplier

The Condition Multiplier =	100%	
Calculated Remaining Useful Life (RUL) =	16.00	Years
Replacement/Repair/Rehab Year =	2030.0	or 2030

** From the USEPA Publication 816-R-03-016 Sept 2003, Fire Hydrants 40-60 years*

Adjustments for the RUL may be made based on: Maintenance Records, Harsh or Caustic Conditions, Excessive Wear, Corrosive Soils, Installation Quality, and other Relative Factors if documented by professional, reliable, historical, and accurate data sets. It is important to be conservative and realistic.

The strategy for O&M varies by the asset, criticality, condition and operating history. Operating and maintenance strategies can be broadly classified as:

- **Preventive Maintenance** is scheduled according to equipment manufacturer recommendation and industry accepted best practices. Maintenance schedules can be augmented by knowledge and experience of the operator to reflect site-specific conditions.
- **Predictive Maintenance** activities are scheduled based upon monitoring and inspection report findings. Equipment is inspected and monitored for early warning signs of impending failure, such as vibration, leakage or reductions in performance.
- **Reactive (emergency based) Maintenance** activities are scheduled immediately upon equipment failure or after inspection activities reveal an imminent problem that must be corrected to avoid an emergency situation. This maintenance strategy is commonly referred to as run-until-failure (RUF).

Recommended Preventive Maintenance for Hydrants includes:

Yearly Flushing	Inspect Paint	Verify Caps in Place (w/ chains)
Leak Checking	Verify Barrel Drains	

The hydrants must be flushed properly and in accordance with municipality standards to avoid over-tightening, breakage, water hammer, and improper system function.

Recommended Predictive Maintenance for Hydrants includes:

Lubricate Threads	Grease/Oil Bonnet	Pump Barrel
Re-Paint	Replace Lid/Box, etc	

Reactive (emergency-based) Maintenance for Hydrants includes:

Replace Hydrant		

Excel worksheets have been developed to help utilities organize information on asset condition and performance.

March 2014

Valves

- Needed to control flow and address emergencies
  - Main breaks must be isolated
  - Speed of shut-off important in limiting damage
- Will deteriorate over time if not used.
  - Corrosion
  - Sediment deposits
- Valves can be lost!

Valves – Poll Question

- What do you call a valve that does not work?
  - A piece of pipe.
  - Unacceptable
  - A surprise
  - Depends who is asking

Valves – Condition Assessment

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Age:		Manufacturer:	
Water Line Depth:		Valve Size (Diameter):	
Turn Direction:		Number of Turns:	
Accessibility:		Function (Exercising):	
Original Cost:		Replacement Cost:	

Water Valve #1		
Current Year =	2014	
Installation Year =	1980	
Age-Based Asset Estimated Useful Life* =	40	Years
Estimated Remaining Useful Life (RUL) =	6	Years

Hydrants

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- Improve Water Quality (Flushing)
  - Reduce water age
  - Expelling sediment and contaminants
  - **Scouring and cleaning of pipes – Unidirectional Flushing**
- Condition Monitoring Site
  - Static Pressure
  - Flow – GPM
  - Residual Pressure
- Fire Protection
  - Impact on hazard insurance ratings
  - Reduce liability from non-operating hydrants

Hydrants – Poll Question

- The main purpose of a fire hydrant in a water distribution system is
  - To fight fires
  - Give community groups something to decorate
  - Give snow plow drivers something to aim for
  - Maintain water quality

Hydrants – Condition Assessment

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Age:		Manufacturer:	
Design Flow (GPM):		Actual Flow (GPM):	
Paint Condition:		Accessibility:	
Existing Grade:		Function (flushing):	
Main Pressure:		Main Diameter Size:	
Original Cost:		Replacement Cost:	$2,500

Fire Hydrant #1		
Current Year =	2014	
Installation Year =	1980	
Age-Based Asset Estimated Useful Life* =	50	Years
Estimated Remaining Useful Life (RUL) =	16	Years

Storage

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Storage – Condition Assessment

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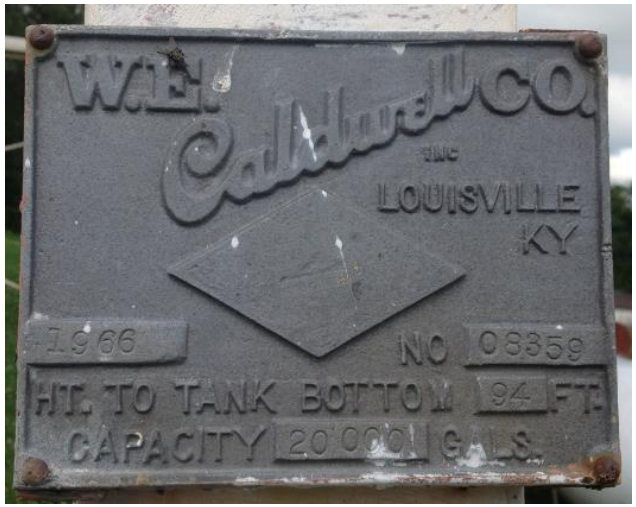
Age:		Size (Gallons):	
Water Depth:		Height of Tank/Tower:	
Hydraulic Grade (Max):		Hydraulic Grade (Min):	
Original Cost:		Replacement Cost:	

Tower #1		
Current Year =	2014	
Installation Year =	1980	
Age-Based Asset Estimated Useful Life* =	60	Years
Estimated Remaining Useful Life (RUL) =	26	Years



Pipes

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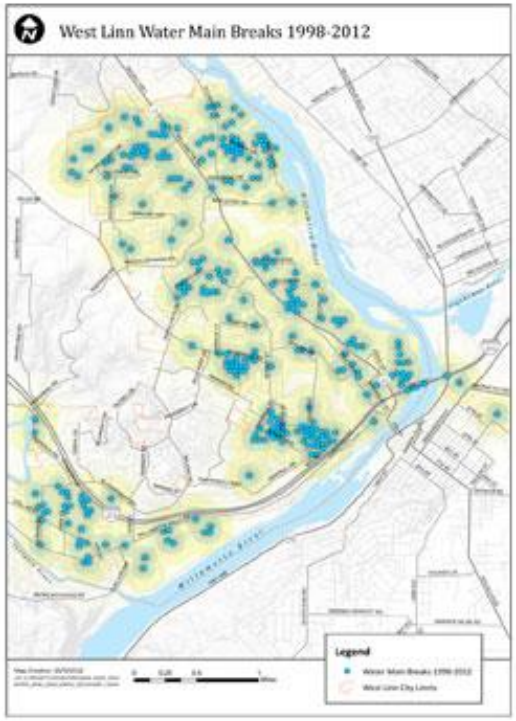
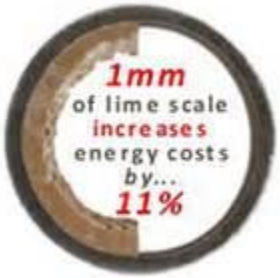
- Track Repairs
  - Location
  - Cause of Failure
  - Condition of Pipe (Scale)
- Monitor Pressure and Flow
- Real Water Loss





Pipes – Poll Question

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- Does anyone currently have sections of water mains that are stainless steel?
  - Yes
  - No

Pipes – Condition Assessment

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Age:		Pipe Diameter:	
Main Depth:		System Pressure:	
Pipe Length:		Pipe Material:	
Original Cost / LF:		Replacement Cost / LF:	

Water Main Section #1		
Current Year =	2014	
Installation Year =	1980	
Age-Based Asset Estimated Useful Life* =	40	Years
Estimated Remaining Useful Life (RUL) =	6	Years

Pipes – Condition Assessment
Annual Water Audit

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- Most important **"Performance Monitoring"** activity.
- Quantifies integrity of the distribution system
- Foundation and critical first step in Active Leak Control program
- Generate additional revenues (Reduction in Non-Revenue Water)
- Reduce operating cost (Chemicals / Electricity / Wear & Tear)

How has water loss changed over time?
How confidence are you in the calculations?

Water Audits depend upon good data. RCAP recommends using AWWA M-36 methodology and "FREE" software. AWWA software provides water loss measurement along with confidence score.

Meters

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Meters – Condition Assessment

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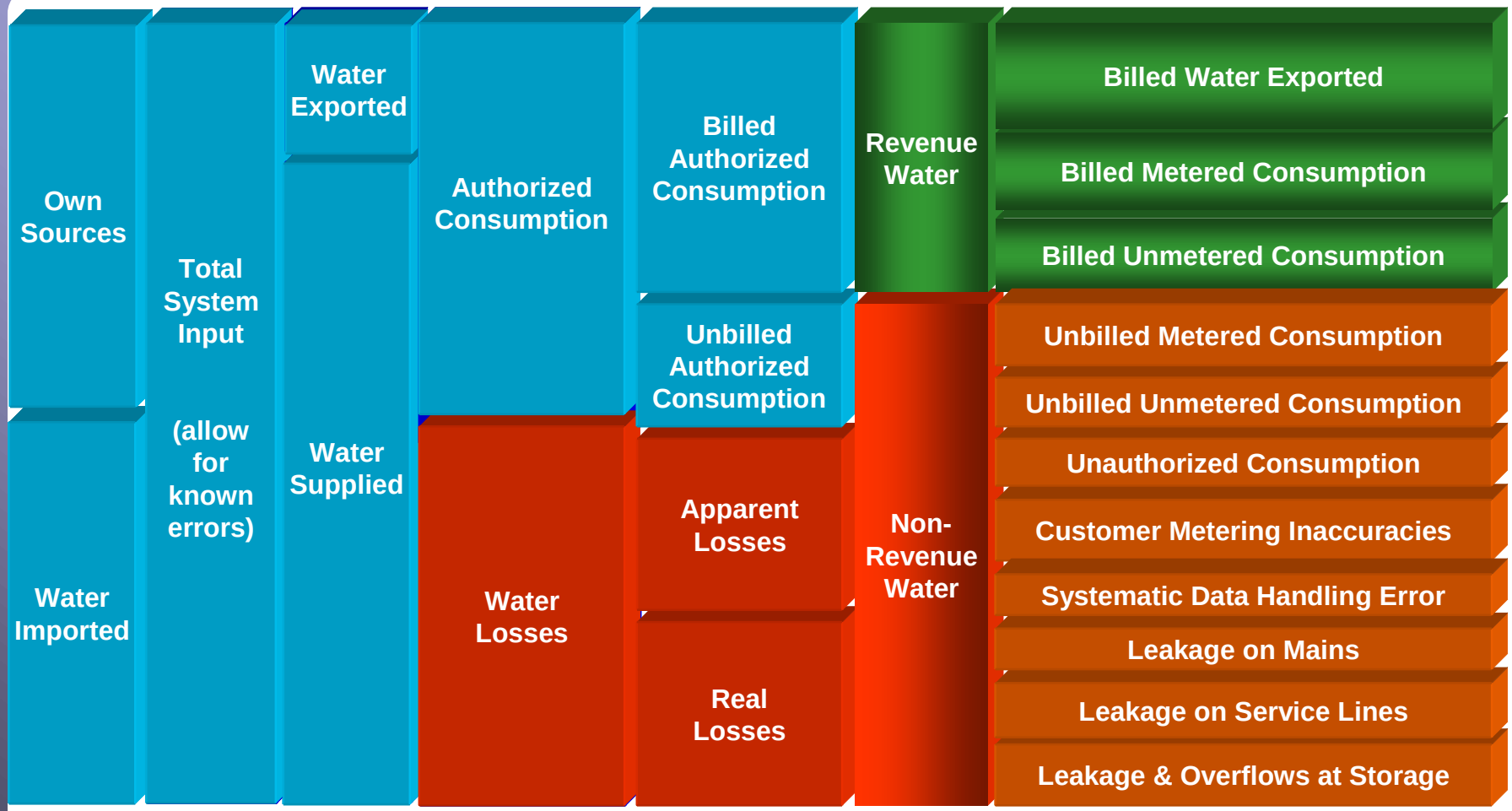

Focus on leakage: Mains, Service Lines, Overflows, etc.

Meters – Water Audit

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GIS Mapping and Computerized Maintenance Monitoring Software

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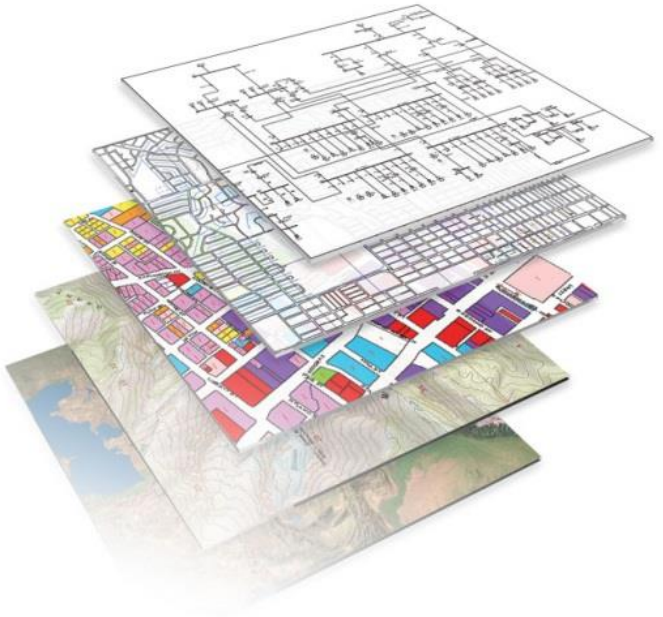
Computerized Maintenance Management System and GIS Mapping Software are essential tools to water distribution and sewer collection system maintenance program improvements.



How fast are the assets deterring? The rate of deterioration is just as important as condition when timing capital upgrades.

Scheduling Predictive Maintenance

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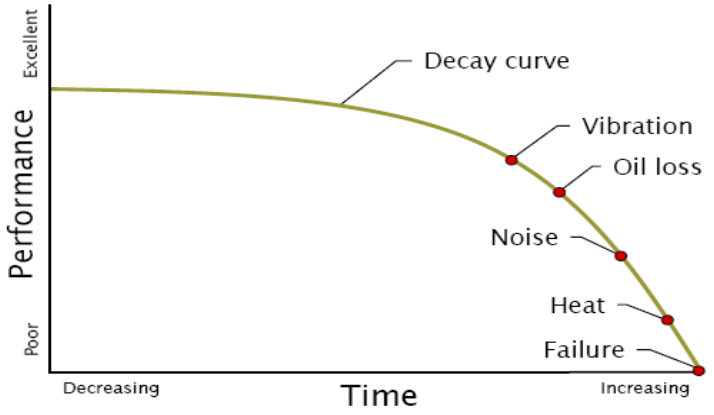
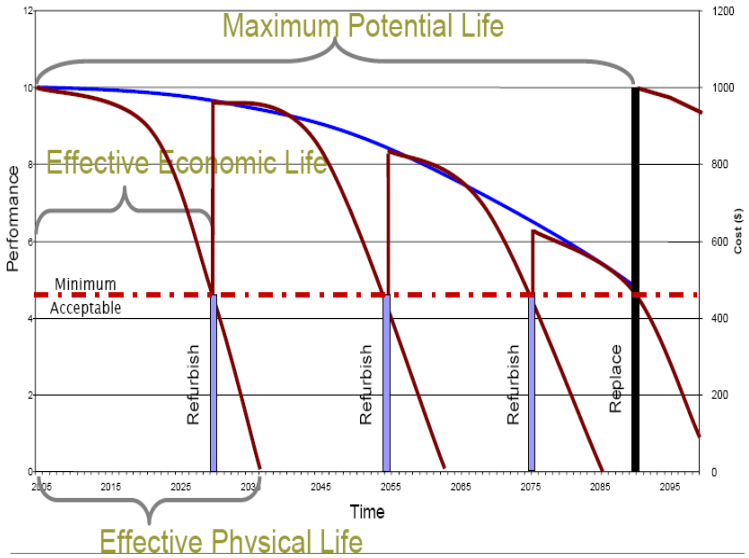
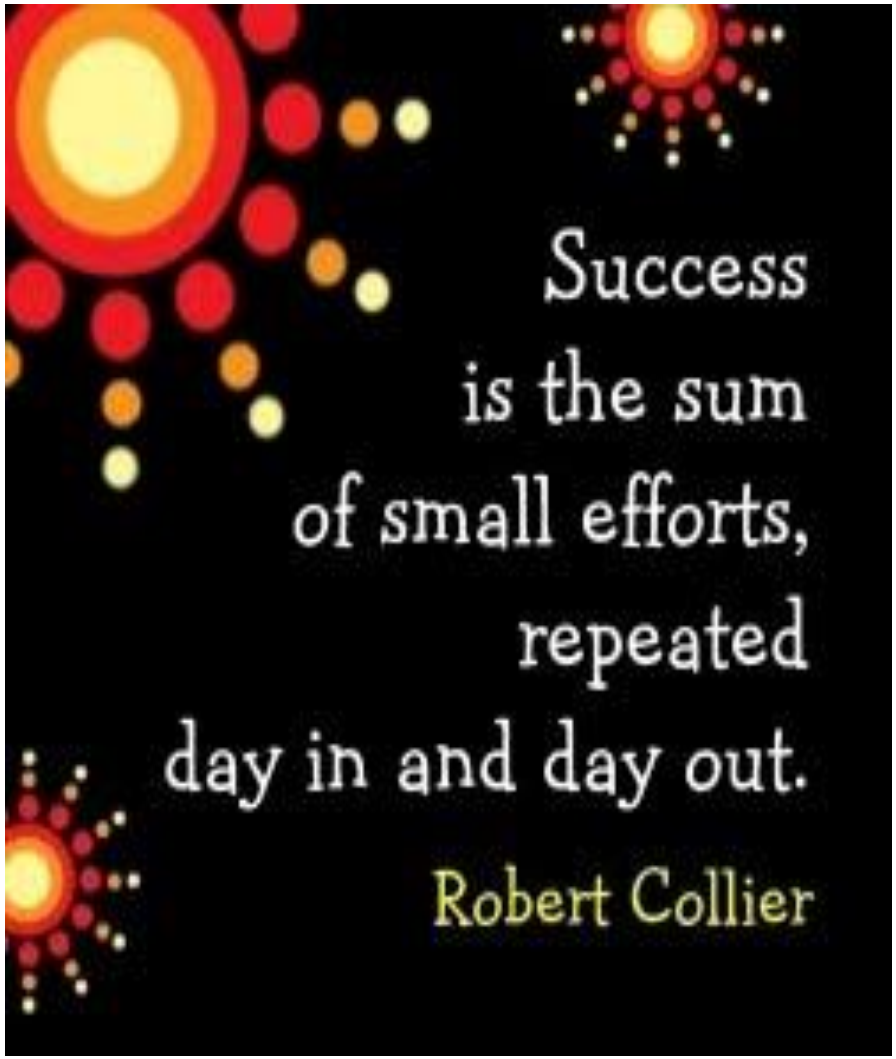
- Information on asset condition and performance will become the basis for asset renovation and replacement decisions.
- Better capital improvement project decisions will save money by renovating assets before additional damage occurs.
- Additional savings can be achieved by scheduling asset replacement to avoid unproductive maintenance.





Questions



Questions?

Upcoming Webinars

Friday Sept 22nd
Completing a Capital Improvement Plan

Wednesday Sept 27th
Best Practices for Preventive and Predictive Maintenance

Friday Sept 29th
Budgeting for Sustainability

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If you need more information about preparing a basic asset inventory, or would like information about RCAP's services to help communities with inventory development, data collection, GIS development and mapping, and the GIS Cooperative, please contact us!

CONTACT RCAP FOR HELP!

Sherry Loos, GISP
smloos@wsos.org
330-677-3438

Joe Lawrie
jflawrie@wsos.org
330-677-3438

RCAP GIS

Thank you!

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Please don't forget to fill out the evaluation form that will be emailed to you!

Ohio RCAP Provides Free & Low Cost Services thanks to the generous support of the following agencies.

Ohio EPA
Division of Drinking and Groundwaters

OHIO WATER DEVELOPMENT AUTHORITY

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

USDA Rural Development

HHS:OCS