Achieving Distribution System Control

SFPUC and Wholesale Customers
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Cliff Wilson
President
Wachs Water Services
“…having an asset management program in place can play a key role in minimizing damage due to infrastructure failure, particularly if the program had a special focus on the valve management program.

Knowing the exact location of each valve, whether the position of the valve was open or closed and having performed regular operability maintenance of the valves, made it more likely that the utility’s crew could quickly isolate the area of the break, and thereby, minimize the amount of water discharged and damage to surrounding properties.”
Managing Infrastructure Risk: The Consequence of Failure for Buried Assets

Factors that inflate direct consequential mains failure costs to include social and environmental costs

- Direct Utility cost
- Location - proximity to sensitive receptors
- Likely mode of failure - size and extent
- Critical services - high consequence customers
- Limited redundancy - no alternative supplies
- Limited ability to control and contain the failure

Multiplier of direct utility cost: X1 to X4+
“Valve Operation”

- Condition assessment and operation of each critical valve, and all valves 16” and larger, should be completed on a regularly scheduled (annually if possible) basis.

- Condition assessment and operation of the majority of valves in a distribution system should be conducted on a 3 – 5 year cycle or based on the criteria established by the agency. With historical performance data, the usability decay rate (the rate at which valve assets are rendered unusable due to locatability, accessibility and/or operability challenges) can be modeled and this cycle can be further refined to make best use of asset management investments.

- All gate valves should be physically cycled from full open to close and back open at least once every five years or based on the criteria established by the agency.”
How we efficiently CONTROL our systems (manage the consequences of failures)

Is as important as how we efficiently SUSTAIN our systems (manage the likelihood of failures)
Agenda

- Asset Management Principles
- Consequence of Failure
- Value of Control
- Control Tools
- National Statistics
- Services Offered
- Case Study Example
- Optimization
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• Asset Management Principles
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  • Optimization
1. What is the current state of my assets?

2. What is the required level of service?

3. Which assets are critical to sustain performance?

4. What are the best O&M and CIP strategies?

5. What is the best funding strategy?
Level of Service Goals define what your customers and employees can expect.

- External goals are those that directly impact the customers.
- Internal goals are those that are related to operations and that would not be easily understood by customers.
Customers desire roughly the same types of things from their utility

- Water that is safe and reliable
- Delivered at an adequate pressure
- Their concerns are addressed
Level of Service Categories

- Level of Service Goals will typically fall into one of the following categories:
  - Public Health and Safety
  - Customer Service
  - System Maintenance
  - Response Time
  - Water Loss Control
  - Drought and/or Demand Management
  - System Management
Risk = \textit{Probability} of failure times \textit{Consequence} of failure
Diminishing returns - 100% asset usability isn’t cost effective just as replacing every piece of pipe isn’t cost effective.
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What is “Consequence of Failure”
Factors that inflate direct consequential mains failure costs to include social and environmental costs

- Direct Utility cost
- Incidental scheduling
- Loss of revenue
- Critical services - high consequence customers
- Limited redundancy - no alternative supplies
- Limited ability to recover and continue the failure

Multiplier of direct utility cost: x4+  
Multiplier: x1
• Generally TBL is not well correlated with pipeline diameter
• High TBL is most closely correlated to location – not diameter
• Average TBL cost = $42K per break
• Top 10% CoF pipes average = >$1M
What Drives TBL CoF – WRF 4451

- CoF is driven by five factors
  - Location
  - Duration
  - Customer Value
  - Lack of redundancy
  - Failure mode

Location and duration are the biggest contributors to CoF

Managing the CoF
- Shorten the Time (duration)
- Minimize Impacted Area (footprint)

Through
- Better Information
- More Usable Assets
Risk: Both Sides of the Equation

Risk

Likelihood of Failure
- Condition
- Material
- Service history

Consequence of Failure
- Financial
- Environmental
- Social

Risk
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Increasing system control mitigates the consequences of failure and lowers costs.
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Control Tools

- Information
- Assets
How To Manage the Consequence of Failure

System Control

Information Usability
- Content
- Accuracy
- Availability

Asset Usability
- Findable
- Accessible
- Operable
Usability: Information on the Asset

What Constitutes **Information** Usability?

Is it **accurate**?

Does it have **meaningful** content?

Do I have **access** to it?
Useability: The Asset

What Constitutes **Asset** Usability?

- Can I **find** it?
- Can I **access** it?
- Can I mechanically **operate** it?
Undertake A Comprehensive Assessment Program

• Valve survey
• Valve assessment, exercise, rehabilitation and repair
• GIS representation and prioritization of work orders and field work
• Computerized Maintenance Management System (CMMS)
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Control: Asset Usability
60% is National Average Usability

2 of 5 valves on average are **not usable**
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Services Offered

• **System Control**
  – Valve Management
  – Hydrant Management
  – Water Loss
  – C-Factor

• **Data Management**
  – Field Data Capture
  – Data Integration
  – GIS Improvement
  – Maintenance Prioritization

• **Water Quality**
  – Unidirectional Flushing
  – Hydrant Flushing
  – Valve Position Correction

• **Water Loss**
  – Leak Detection
    • Leak Sounding
    • Leak Pinpointing
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- Optimization
City of Corona, CA

- Assessing system since 2010
- Potable valves & fire hydrants
- Recycled water valves
- 20,000+ valves
Valve Operability – Overall

20,682 Valves

Initial Operability

- 64%
- 36%

Current Operability

- 95%
- 5%
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Water Treatment Optimization

Distribution System Optimization
Distribution System Program
Key Monitoring Parameters

- Disinfectant residual
  - Water quality integrity
- Main break frequency
  - Physical integrity
- Pressure management
  - Hydraulic integrity

Identified in WRF 4109 – Criteria for Optimized Distribution Systems
Distribution System Performance Improvement Variables

- Disinfectant Residual
- Cross-Connection Control
- Customer Complaints
- DBP Control
- Energy Management
- External Corrosion Control
- Flushing
- Hydrant and Valve Maintenance
- Internal Corrosion Control
- Main Breaks

- Nitrification
- Pipe Rehabilitation and Replacement
- Inorganic Accumulation Control
- Pressure Management
- Security and Online Monitoring
- Storage Tank O&M
- Water Age Management
- Water Loss Control
- Water Sampling and Response
Summary

• Establish LOS
• Implement Asset Management Plan
• Undertake a Comprehensive Assessment Program
• Optimize Your Distribution System
Achieving Distribution System Control

Cliff Wilson  
Wachs Water Services  
cwilson@wachsws.com  
(630) 624-0719