WATER LOSS AUDITING

AN INTRODUCTION

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WHAT IS WATER LOSS?
WHY CARE ABOUT WATER LOSS?

- WATER RESOURCE MANAGEMENT CONCERNS
- FINANCIAL CONCERNS
- OPERATIONAL CONCERNS
- SYSTEM INTEGRITY
EXAMPLE: 500,000 GPD CWS

Yearly production: 182.5 MG/yr
- Loss: 54.75 MG/yr (@ 30% loss rate)

At $3.00/1,000 gal treatment cost:
- $164,250 lost per year.

With water loss reduced to 12%:
- Loss reduced to $65,700

CHANGING MINDSETS

HOW MOST PWS THINK OF WATER LOSS

Water Produced - Water Sold = Unaccounted for water
From "Unaccounted For" to Non-Revenue:

Types of Non-Revenue Water

- Inaccurate Meters
- Poor Data Handling
- Water Use by Water Utility for flushing or other purposes
- Lost Water
- Illegal Water Use
- Poor Data Handling

If you don't understand the problem, you may apply the wrong solution!
WHAT IS WATER LOSS AUDITING?

A SYSTEMATIC METHOD TO ACCOUNT FOR ALL WATER IN A PWS

ALSO ASSESSES VALIDITY OF DATA
SUPPLY SIDE

• ACCOUNT FOR ALL OF THE INPUTS INTO THE SYSTEM FROM ALL SOURCES.
**DEMAND SIDE**

<table>
<thead>
<tr>
<th>Authorized Consumption</th>
<th>Billed Authorized Consumption</th>
<th>Revenue Water</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Billed Water Exported</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Billed Metered Consumption</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Billed Unmetered Consumption</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Unbilled Authorized Consumption</th>
<th>Non-Revenue Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unbilled Metered Consumption</td>
<td>Systematic Data Handling Error</td>
</tr>
<tr>
<td>Unbilled Unmetered Consumption</td>
<td>Leakage on Mains</td>
</tr>
<tr>
<td>Unauthorized Consumption</td>
<td>Leakage on Service Lines</td>
</tr>
<tr>
<td>Customer Metering Inaccuracies</td>
<td>Leakage &amp; Overflows at Storage</td>
</tr>
</tbody>
</table>

- **ACCOUNT FOR ALL OF THE WATER “USES” FROM THE SYSTEM.**
OTHER DATA:

• SYSTEM DATA
  • LENGTH OF MAINS
  • # ACTIVE AND INACTIVE SERVICE CONNECTIONS
  • METER LOCATION
  • AVERAGE OPERATING PRESSURE

• FINANCIAL DATA
  • ANNUAL COST OF OPERATING SYSTEM
  • CUSTOMER RETAIL UNIT COST
  • VARIABLE PRODUCTION COST
RESULTS: REAL VS. APPARENT LOSSES

Apparent Losses:

Real Losses:
RESULTS: PERFORMANCE INDICATORS

• SYSTEM ATTRIBUTES:
  • UNAVOIDABLE ANNUAL REAL LOSS (UARL)
  • CURRENT ANNUAL REAL LOSS (CARL)

• INFRASTRUCTURE LEAKAGE INDEX (ILI)
  • ILI = CARL / UARL

• OPERATIONAL EFFICIENCY
  • REAL AND APPARENT LOSSES PER SERVICE CONNECTION
  • REAL LOSSES PER MILE OF MAIN
  • REAL LOSS PER CONNECTION PER PSI
  • PERCENTAGES OF REAL AND APPARENT LOSS

• FINANCIAL INDICATORS
  • NON-REVENUE WATER AS % OF WATER SUPPLIED
  • NON-REVENUE WATER AS % OF OPERATIONAL COST

• DATA VALIDITY SCORE
RESULTS: CATEGORIES OF REAL WATER LOSS

Current Annual Real Losses
Represents the total water that's being lost from the system

Unavoidable Real Losses

Economic Level of Real Losses
Water Loss Reduction that is ECONOMICALLY justified
BE CAREFUL WHEN WORKING IN REAL LOSS PERCENTAGES

<table>
<thead>
<tr>
<th>System Consumption (gal/service line/d)</th>
<th>Real Losses (gal/service line/d)</th>
<th>System Input (gal/service line/d)</th>
<th>Real Losses as % of System Input Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>150</td>
<td>60</td>
<td>210</td>
<td>28.6</td>
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<td>300</td>
<td>60</td>
<td>360</td>
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<td>600</td>
<td>60</td>
<td>660</td>
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<td>1200</td>
<td>60</td>
<td>1260</td>
<td>4.8</td>
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<tr>
<td>1800</td>
<td>60</td>
<td>1860</td>
<td>3.2</td>
</tr>
<tr>
<td>2400</td>
<td>60</td>
<td>2460</td>
<td>2.4</td>
</tr>
</tbody>
</table>
EXAMPLE: TOWN “A”

Going in, real water loss believed to be around 38% of production. Apparent loss unknown.

Actual losses:
Apparent Loss: 9.442 MG/yr (9%)
Real Loss (CARL): 3.560 MG/yr (4%)
Too small to calculate UARL or ILI
EXAMPLE: TOWN “B”

Going in, real water loss known to be high, but exact percentage unknown.

Actual Losses
Apparent Losses: 12.105 MG/yr (5.5%)
Real Losses (CARL): 63.3 MG/yr (29%)
To small to calculate UARL or ILI
EXAMPLE: TOWN “C”

Going in, real water loss believed to be very high, greater than 50%.

Actual Losses
  Apparent Losses: 25.787MG/yr (2.4%)
  Real Loss (CARL): 386.9 MG/yr (50.2%)
  UARL: 49.3 MG/yr

ILI = 8.81
EXAMPLE: RURAL WATER DISTRICT

Going in, real water loss believed to be very high, greater than 50%.

Actual Losses
  Apparent Losses: 1.3 MG/yr (1.6%)
  Real Loss (CARL): 29.3 MG/yr (49.2%)
  UARL: 14.85 MG/yr

ILI = 1.97
WATER LOSS AUDITING PILOT PROJECT

INNOVATIVE USE OF DWSRF SET-ASIDE FUNDING DESIGNATED FOR SOURCE WATER PROTECTION.

LOCAL ODEQ INSPECTORS TO CONDUCT WATER LOSS AUDITS AT SMALL COMMUNITY WATER SYSTEMS.

TOP-DOWN WATER LOSS AUDITS USING THE AWWA METHOD AND SOFTWARE.
WHY ARE WE DOING IT?

• TO INTRODUCE THE CONCEPT OF ACCURATE WATER LOSS AUDITING STATE-WIDE

• TO DEMONSTRATE THE USEFULNESS OF THE TOOL

• PROGRAM DEVELOPMENT
PROJECT GOALS

TO CONDUCT WATER LOSS AUDITS AT 40 SMALL COMMUNITY WATER SUPPLIES:

• TYPES AND AMOUNTS OF NON-REVENUE WATER

• RECOMMENDATIONS TO ADDRESS PROBLEMS

• COORDINATION WITH CONTRACTOR TO PINPOINT AND ADDRESS SOURCES OF WATER LOSS

• INFORMATION ON FUNDING FOR PROJECTS TO ADDRESS WATER LOSS
COMPLETED STEPS

• CORE GROUP OF ECLS AND DWSRF STAFF TRAINED IN AWWA WATER AUDIT METHOD
  • JANUARY 2015
  • CONDUCTED BY SWEFC

• 40 VOLUNTEER SYSTEMS SELECTED
• SYSTEMS FROM ALL PARTS OF THE STATE
• LESS THAN 10,000 POPULATION
CURRENT STATUS

- AUDITS FOR 40 SYSTEMS COMPLETE
- TARGET COMPLETION DATE FOR RECOMMENDATIONS END OF DECEMBER 2015
- CONTRACTOR TO FOLLOW UP WITH LEAK DETECTION EQUIPMENT AND METER ANALYSIS TO ADDRESS AUDIT RESULTS.
COMPLETION OF PILOT PROJECT

• FINAL REPORT
  • TOTAL VOLUME OF WATER LOST / TOTAL REVENUE LOST
  • EACH SYSTEMS EXPERIENCE TO BE RELATED AS A CASE STUDY
  • OVERALL RESULTS TO BE USED TO INFORM FUTURE WORK
    • ADDITIONAL WATER AUDITS BY DEQ
    • TRAINING CWS STAFF TO CONDUCT THEIR OWN AUDITS
    • GROUNDWORK FOR POSSIBLE WATER AUDITING PROGRAM
QUESTIONS?

For more information, please contact:

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