This presentation premiered at WaterSmart Innovations

watersmartinnovations.com
Water Loss Insanity

Small Southeast Town Gets Intense about Water Loss

Presented by:
Will Jernigan, P.E.
State Of Loss
How Non-Revenue Water Is Impacting The U.S.

Also In This Issue:
Next-Generation Arsenic Removal
Disinfection Byproducts: Treatment Options And Challenges
High and dry in Texas

Water fights (and not the fun kind) are plaguing the Lone Star State as climate change raises the heat—and the stakes.

Wendy Koch
INDEPENDENT, USA TODAY

BRUSHWOOD, TEXAS. In this browned patch of land in central Texas, C.J. Terry could be fined for using fresh water to keep his decade-old well from drying up, so he relies on every water let over from washing clothes.

Years ago, Carlos and Charo's restaurant along Lake Travis would attract locals. Now it's not evenensible.

PRAY FOR RAIN
1 THES. 5:17

http://droughtmonitor.unl.edu/
"Toilet to tap" wastewater recycling begins in Texas city

As much of Texas grapples with lingering drought, a second city in the Lone Star State has begun reusing treated wastewater in a state-approved recycling process to bolster drinking supplies.

Wichita Falls, near the Oklahoma border, on Wednesday began reusing millions of
California Couple Tries To Conserve Water, Ends Up Facing $500 Fine For Brown Lawn

BY KILEY KROH  JUNE 20, 2014 AT 12:27 PM  UPDATED: JULY 21, 2014 AT 11:29 AM

Michael Korte walks across his lawn in Glendora, Calif. Korte and his wife face a possible fine of up to $500 for not maintaining their lawn during the drought.

As California’s severe drought deepens and officials look to reduce water consumption in every possible way, the state appears to be sending mixed signals as to which water-related activity is the most egregious.

The entirety of California is currently experiencing drought conditions and more than 80

CREDIT: AP PHOTO/DAVIVAN GONZANES
Water Wasters May Face Jail Time

By Sara Jerome
@sarmje

When California water regulators authorized $500 fines for water wasting, the public marveled at how far the state was willing to go to face down the drought.

But one city is going beyond that. In Shasta Lake, water wasters can now be punished with jail time, according to reports.
### AWWA Tools for Water Loss Control

#### Water Audits and Loss Control Programs

**MANUAL OF WATER SUPPLY PRACTICES**

**M36**

**American Water Works Association**

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#### Water Audit Report for: Northern San Leandro Combined Water Sewer Storm Utility District (0007900)

<table>
<thead>
<tr>
<th>Category</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>Total annual cost of operating water system</td>
<td>$1,000,000,000/year</td>
</tr>
<tr>
<td>Average Customer metering inaccuracies</td>
<td>7.071 MG/Yr</td>
</tr>
<tr>
<td>Systematic data handling errors</td>
<td>5.000 MG/Yr</td>
</tr>
<tr>
<td>Unauthorized consumption</td>
<td>3.000 MG/Yr</td>
</tr>
<tr>
<td>Non-revenue water as percent by volume of Water Supplied</td>
<td>38.1%</td>
</tr>
</tbody>
</table>

---

### Performance Indicators:

- **WATER LOSSES**: 64.688 MG/Yr
- **Ownership sources**: 5 1,000.000 MG/Yr 1 MG/Yr

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### System Attributes:

- **Apparent Losses per service connection per day**: 38.95 gallons/connection/day
- **Infrastructure Leakage Index (ILI) [CARL/UARL]**: 8.52
- **Non-Revenue Water**: 75,000
- **Water imported**: 100,000
- **Water supplied**: 7,495,000

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### Financial:

- **Annual cost of Apparent Losses**: $54,788,450
- **Annual cost of Real Losses**: $7,368,338
- **Valued at Variable Production Cost**

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### Report Details:

- **Reporting Year**: 2013
- **Beginning of Year**: 01/01/2013
- **End of Year**: 12/31/2013

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**AWWA Free Water Audit Software**

**American Water Works Association. All Rights Reserved.**

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**AWWA Free Water Audit Software:**

**Analysis and Performance Indicators**

**Free Water Audit Software:**

**Water Audit Report**

**Philadelphia Water Department**

**Water Importers**

**Watershed Boundaries**

**Water Balance**

**Infrastructure Leakage Index (ILI) [CARL/UARL]**

**Non-Revenue Water**

**Total Cost of NRW - $2,177,912**

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**Infrastructure Leakage Index (ILI) [CARL/UARL]**

**Non-Revenue Water**

**Total Cost of NRW - $2,177,912**

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IWA/AWWA Standard Water Balance

- **Own Sources**
  - Total System Input
  - Water Exported
  - Authorized Consumption
  - Billed Authorized Consumption

- **Water Imported**
  - (allow for known errors)
  - Water Supplied
  - Water Losses
  - Apparent Losses
  - Real Losses

- **Non-Revenue Water**
  - Billed Water Exported
  - Billed Metered Consumption
  - Billed Unmetered Consumption
  - Unbilled Metered Consumption
  - Unbilled Unmetered Consumption
  - Unauthorized Consumption
  - Customer Metering Inaccuracies
  - Systematic Data Handling Errors
  - Leakage on Mains
  - Leakage on Service Lines
  - Leakage & Overflows at Storage

**Total System Input**

- Water supplied (own sources + water imported) - allowances for known errors
- **Fire Dept Usage**
- **Operational Flushing**
- **Tools for control include efficient flushing practices and awareness campaigns**

### Non-physical / revenue loss - slow meters, billing issues and theft
- Cost impacts at ‘retail’ rate
- Tools for control include data management, quality control policies/practices, & meter testing & repair

### Physical loss - leakage
- Cost impacts at ‘wholesale’ rate
- Tools for control include leakage and pressure management

- **Leakage & Overflows at Storage**
- **Leakage on Mains**
- **Customer Metering Inaccuracies**
- **Systematic Data Handling Errors**
- **Unauthorized Consumption**
- **Unbilled Unmetered Consumption**
- **Unbilled Metered Consumption**
- **Unauthorized Consumption**

### Revenue Water
- **Billed Water Exported**
- **Billed Metered Consumption**
- **Billed Unmetered Consumption**
- **Unbilled Metered Consumption**
- **Unbilled Unmetered Consumption**

### Water Imports
- **Water Supplied (allow for known errors)**

### Water Exportations
- **Water Exported**

### Water Balance
- **IWA/AWWA Standard Water Balance**

- **Physical loss - leakage**
- **Cost impacts at ‘wholesale’ rate**
- **Tools for control include leakage and pressure management**

- **Non-physical / revenue loss - slow meters, billing issues and theft**
- **Cost impacts at ‘retail’ rate**
- **Tools for control include data management, quality control policies/practices, & meter testing & repair**

- **Fire Dept Usage**
- **Operational Flushing**
- **Tools for control include efficient flushing practices and awareness campaigns**
Unaccounted For Water

Unaccounted For Water Percentage
COMMITTEE REPORT:
Applying worldwide BMPs in water loss control

- Inconsistent use and interpretation
- Unreliable indicator of performance
- Fails to segregate loss into its components for effective management

Water Loss Control Terms Defined

Why the terms 'unaccounted-for' water and 'unaccounted-for percentage' just don’t work!

Tracking water loss in drinking water utilities as the percentage of the estimated losses over the volume supplied is believed to have been first documented in the 1957 AWWA Committee Report "Revenue Producing vs. Unaccounted-for Water." In the ensuing decades after this paper was published, many state and regional water regulatory agencies adopted
Unaccounted-For No More
Water Loss Reductions by Phase

- M36 Audit & Supply Verification
- Customer Meter Testing & Launch of DMAs
- Ongoing DMAs & Meter Testing

Water Loss Costs:

- Phase 1: $35,000
- Phase 2: $30,000
- Phase 3: $25,000
- Phase 4: $20,000

Water Loss Reductions:

- Phase 1: 60 MG/yr
- Phase 2: 50 MG/yr
- Phase 3: 40 MG/yr
- Phase 4: 30 MG/yr

Water Loss Reductions:

- Phase 1: 40 MG/yr
- Phase 2: 30 MG/yr
- Phase 3: 20 MG/yr
- Phase 4: 10 MG/yr

Consumption Reductions:

- Phase 1: 40 MG/yr
- Phase 2: 30 MG/yr
- Phase 3: 20 MG/yr
- Phase 4: 10 MG/yr
Step 1 – AWWA M36 Audit
## Step 1 – AWWA M36 Audit

### Active meters by size

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<td>3/4&quot;</td>
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</tr>
<tr>
<td>1&quot;</td>
<td>5</td>
</tr>
<tr>
<td>2&quot;</td>
<td>10</td>
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<td>8&quot;</td>
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### Active meters by size

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<td>159</td>
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### Active 5/8” meters by Consumption Tier

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<th>Consumption</th>
<th>Tier (Gal)</th>
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<td>0</td>
<td>High</td>
<td>1,496,000 - 2,244,000</td>
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<tr>
<td>3</td>
<td>Medium</td>
<td>748,000 - 1,496,000</td>
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<tr>
<td>677</td>
<td>Low</td>
<td>1 - 748,000</td>
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<tr>
<td>109</td>
<td>0</td>
<td>0</td>
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### Medium Consumption Accounts:

- **DOS ARCOS**
  - WA
  - ACTIVE
  - 1311 MALCOLM BLVD
  - 3/4"
- **ALAN F JACKS MD**
  - WA
  - ACTIVE
  - 1776 CASTLE DR
  - 5/8"
- **RUTHERFORD CLG SPRINKLER SYS**
  - BOTH
  - ACTIVE
  - 980A MALCOLM BLVD
  - 5/8"

### Annual volume and revenue by meter class

<table>
<thead>
<tr>
<th>Class</th>
<th>Volume (Gal)</th>
<th>Revenue ($)</th>
<th>% Volume</th>
<th>% Revenue</th>
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<tbody>
<tr>
<td>small</td>
<td>30,653,000</td>
<td>375,037</td>
<td>74 %</td>
<td>88 %</td>
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<tr>
<td>large</td>
<td>10,769,000</td>
<td>51,557</td>
<td>26 %</td>
<td>12 %</td>
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Step 1 – AWWA M36 Water Audit

![Bar chart showing water audit results]

- Supply
- Consumption
- Water Loss
- Annual Water Loss cost

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<th>$/yr</th>
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18
Step 2 – Supply Volume Verification
Step 2 – Supply Volume Verification

- Supply Over-registration

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<tr>
<th>Year</th>
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<th>Supply</th>
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<th>Annual Water Loss cost</th>
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### Step 3 – Bottom Up Meter Testing/Repair

#### Rutherford College Large Meter Test Results

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<th>CUSTNAME</th>
<th>MAKE</th>
<th>MODEL</th>
<th>SIZE</th>
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<th>2</th>
<th>6</th>
<th>10</th>
<th>20</th>
<th>50</th>
<th>100</th>
<th>160</th>
<th>300</th>
<th>Typ Flow</th>
<th>Overall Accuracy</th>
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<tbody>
<tr>
<td>PURCHASE</td>
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<td>Turbine</td>
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<td>50%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
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<tr>
<td>PURCHASE</td>
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#### Small Meter Testing Results

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<thead>
<tr>
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<th>Accuracy (%)</th>
<th>Start Reading</th>
<th>Finish Reading</th>
<th>2 gpm</th>
<th>Accuracy (%)</th>
<th>Start Reading</th>
<th>Finish Reading</th>
<th>1/4 gpm</th>
<th>Accuracy (%)</th>
<th>Start Reading</th>
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<th>Overall Average Accuracy (%)</th>
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</table>
Step 3 – Establishment of District Metered Areas (DMAs)

Heavner

110,000
10%

Hwy 70
366,954
33%

Lovelady
625,994
57%
Step 3 – Establishment of District Metered Areas (DMAs)
Step 3 – Bottom up Customer Meter Testing & DMA Setup

- Customer meter under-registration
- Leakage found
- Initial survey

Water Loss
Supply
Consumption
Annual Water Loss cost

MG/yr

$/yr

18
[VALUE]
6

1 2 3

$35,000
$30,000
$25,000
$20,000
$15,000
$10,000
$5,000
$
Step 4 – Ongoing DMA Monitoring & Customer Meter Testing
Step 4 – Ongoing Water Loss Monitoring with DMAs & Meter Testing Program

Leakage found from Ongoing DMA monitoring

<table>
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<tr>
<th>Year</th>
<th>Water Loss</th>
<th>Supply</th>
<th>Consumption</th>
<th>Annual Water Loss cost</th>
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<td>18</td>
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</table>

MG/yr $/yr
Water Loss Reductions by Phase

M36 Audit & Supply Verification
Customer Meter Testing & Launch of DMAs
Ongoing DMAs & Meter Testing

Water Loss
Supply
Consumption

Annual Water Loss cost

1 2 3 4

$35,000
$30,000
$25,000
$20,000
$15,000
$10,000
$5,000
$-
Drivers that Compel Change
Water Loss Insanity
Small Southeast Town Gets Intense about Water Loss

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