Reducing Water Loss in
Community Water Systems
-NH’s Leak Detection Contract-

Derek Bennett
NHDES - Drinking Water & Groundwater Bureau

NH Water & Watersheds Conference
March 23, 2012
What is leak Detection

- **Visual Inspection**
  - Wet spots on the ground
  - Most leaks don’t surface

- **Audible Inspection**
  - Sound water creates as it leaves a restricted opening
  - Sound of escaping water hitting the surrounding soil
  - Sound resonates along the pipe wall
  - Determine if sound is near or far and pinpoint the leak
Why Leak Detection

- Inflated production costs
- Stressed water supplies & infrastructure
- Stress to environment
- No beneficial end use
- No revenue
- Example to customers
Project Timeline

- **Project Requests**
  - 04/2009 Sent request for projects to all systems
  - 05/2009 Project requests due
  - 06/2009 Deadline extended

- **Proposals**
  - 07/2009 Posted RFP for Leak Consultants
  - 09/2009 Proposals due
  - 10/2009 Contractor selected by review panel

- **Contract**
  - 11/2009 Contract signed by consultant
  - 01/2010 Signed by Governor & Executive Council

- **Surveys**
  - 04/2010 First survey day
  - 09/2011 Last survey day
Project Requests
What did we ask for?

- Requested
  - Breakdown of pipe materials and age
  - Dates that survey may occur
  - Proposed repair schedule
  - Date & Results of most recent survey (if known)
  - Most recent water audit (if available)

- Ranked
  - Readiness to proceed
  - Potential water savings of project
  - Benefit to water system as a result of overall demand reduction
  - Demonstration that the water system will repair water system leaks identified by the third-party contractor in a timely manner
Summary of Project Requests

- 27 Water Systems (568 miles) submitted requests
  - 200K could adequately cover surveys
  - Ranking not required
- 16 complete surveys (100% of the system)
  - 422 miles
- 11 partial surveys (10-62%)
  - 146 miles
Request For Proposals

- **Requested**
  - Cost and time breakdown for each project
  - A summary of the three most recently completed leak detection surveys
  - Technical qualifications and training received for each staff member
  - Description of the equipment that the company will use to perform the surveys

- **Ranked**
  - Total cost of projects
  - Time to complete
  - Experience
Ten Proposals

- American leak Detection Services - Newbury, MA
- DSM Solutions – Marcellus, NY
- EJ Prescott – Pembroke, NH
- Granite State Rural Water – Penacook, NH
- Heath Consultants – Greenburg, PA
- Prowler Water Conservation – Leicester, MA
- Sarian Company – Sandwich, MA
- Troupe Water Services – Exeter, NH
- Water & Waste Pipe Testing Inc Rowley, MA
- Water Systems Optimization, Nashville, TN
## Cost Per Mile / Survey Rate

<table>
<thead>
<tr>
<th>Total</th>
<th>Per Mile</th>
<th>Days</th>
<th>Miles Per Day</th>
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<tr>
<td>Total</td>
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<td>Days</td>
<td>Miles Per Day</td>
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Contract Language

- **Initial Survey**
  - Contact points: Gate valves, hydrants, meter/curb valves, and blow-off’s
  - Ground microphone: large main, non-metal pipe, excessive distance
  - Resonance plate with ground mic where main more than three feet off hard surface.

- **Pinpointing Phase**
  - Confirm locations of mains & services
  - Intensified pattern of sonic tests over pipe
  - Digital correlator as necessary

- **Leak Report**
  - Classified by size, source, location
  - Frequency of report updates
  - Final report
Sound Travel Distance

- 2 GPM Leak at 60 PSI
  - 6 inch CI Pipe 600 to 1000 feet
  - 12 inch CI Pipe 400 to 800 feet
  - 6 inch AC Pipe 400 to 800 feet
  - 12 inch AC Pipe 300 to 500 feet
  - 6 inch PVC Pipe 200 to 300 feet
  - 12 inch PVC Pipe 100 to 200 feet

http://www.subsurfaceleak.com/find_leaks.html
Hydrant to Hydrant Not Enough
### Source of Leaks

<table>
<thead>
<tr>
<th>Source of Leakage</th>
<th>Number</th>
<th>GPM</th>
<th>% of Total No.</th>
<th>% of Total Est. GPM</th>
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<td>Mains</td>
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<td>80</td>
<td>23</td>
<td>54</td>
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<tr>
<td>Services</td>
<td>8</td>
<td>53</td>
<td>47</td>
<td>35</td>
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<td>Valves</td>
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<td>10</td>
<td>6</td>
<td>7</td>
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<td>6</td>
<td>24</td>
<td>4</td>
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<td><strong>17</strong></td>
<td><strong>149</strong></td>
<td><strong>100</strong></td>
<td><strong>100</strong></td>
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### Estimated Leaks

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<th>Classification</th>
<th>Number</th>
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<th>GPD</th>
<th>GPY</th>
<th>AF/Y</th>
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<td><strong>149</strong></td>
<td><strong>214,560</strong></td>
<td><strong>78,314,400</strong></td>
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Leak Occurrence by Type

- 123 leaks located
  - Mains 30
  - Services 52
  - Valves 18
  - Hydrants 28
- How many others?
Total Loss by Leak Type

- 841 GPM
- 1,200,000 GPD
- 442,000,000 GPY
- Services 397 gpm
- Mains 378 gpm
- Valves 28 gpm
- Hydrants 38 gpm

Pie chart showing:
- Main 45%
- Service 47%
- Valve 3%
- Hydrant 5%
Leak Occurrence by Size

Classification

- Type 1 (15+ GPM): 12
- Type 2 (5-15 GPM): 49
- Type 3 (<5 GPM): 62
Size of Leak & Response Time

**LARGE LEAKS**

- **Flow Rate**
  - Awareness
  - Location
  - Repair

**SMALL LEAKS**

- **Flow Rate**
  - Awareness
  - Location
  - Repair
Automate Leak Identification

DAILY MINIMUMS

GPM

DAY


- PS1Z1
- PS1Z2
- PS3
- PS5
- PS6
- PS7
Leak Database

- Leak Identification
  - Location of Break
  - Date Found
  - Reported By
  - Type of Leak
  - Estimated Loss Rate

- Leak Repair
  - Possible Cause
  - Pipe Material
  - Pipe Diameter
  - Average pressure
  - Failure Type
  - Possible Cause
  - Date Repaired

Frequent sweeps
Data Loggers
Pressure Reduction
Main Replacement
Summary of Survey Results

- 123 leaks identified over 568 miles
  - 1 leak per 4.6 miles surveyed
- Approximately 841 gpm
  - 442 million gallons per year
  - .78 million gallons per mile per year
  - 1.5 gpm per mile average
- Approximately 841 gpm for $110,000
  - $131 per gpm located
Conclusions

- Going rate: $200 per mile (4 miles per day)
- Accurate maps are essential
  - Locate lines ahead of time
  - Locate / clean out / maintain curb valves
- Almost half of all leaks were on services
  - Have good policy for responsibility
- Cumulatively, small leaks over the long term can lose as much water (and revenue) as large leaks
- Accurate data on leak type and location can help prioritize areas for replacement / enhanced detection
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<th>GPM / MILE</th>
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<th>GPM / MILE</th>
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<td>Service Leakage</td>
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<tr>
<td>Revenue Water</td>
<td>646.8 (72%)</td>
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<td>Non Revenue Water</td>
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<tr>
<td>Reduced to</td>
<td>177.8 (19.6%)</td>
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Find the Economic Level of Loss

- Capacity
- Existing Loss Level
- Economic Loss Level
- Unavoidable Level
- Consumption

Years

Total Demand
Leakage targets

Leak location

Repair times

New technology

Zonal / area monitoring

Pressure Management

Mains rehabilitation

Performance monitoring and data management
Financing & Funding Energy Efficiency Improvements

- Core Electric Utility Programs
  - Mark Toussaint, Public Service of New Hampshire
- PUC REF & GHGERF
  - Kate Epsen, Public Utilities Commission
- Pay for Performance Program
  - Tom Rooney, TRC Solutions
- Power Purchase Agreements
  - Clay Mitchell, Revolution Energy
- Performance Contracting
  - Ned Raynolds, Johnson Controls
- Water System Example
  - To Be Determined
- WWTF Example
  - To Be Determined

May 22, 2012
PSNH Headquarters
Manchester, NH
Leak Occurrence by Material