Residential Fire Sprinkler Concerns
A Water Purveyor’s Perspective
October 4, 2012
Bill Kirkpatrick, Engineering Manager

Water Supplier Reliability Issues
- Water Supply
- Water Facilities
- Water Quality
- Cost

General Policy Issues
Balancing Competing Interests
- Service
  - Reliability
  - Flexibility
  - Quality
- Cost
  - “Home Rule”
  - Affordable
  - Universal
- Liability
  - Supply
  - Operational

Service
- Reliability
  - 24/7 x 150 years

Cost
- Home Rule - California has it all
  - Private
    - Individual
    - Corporation
  - Municipal
  - Special District / Agency

All agency’s issues include political considerations

Liability
- Supply Reliability -
  Need to build redundancy and reliability
- Operational Risk
  Issues with maintaining pressurized water pipe and appurtenances
Cost

- Affordability
  Essential service - public health - economic development - recreation - and public fire supply

- Universal
  Responsibility to serve equitably without administrative burden

Discussion

- Background
- Meter Sizing Study
- Recommendations
- Examples/Configuration
- Cost

Background

- SFM Task Force
  - Phase I - Water Supply
  - Phase II - Installation
  - Phase III - Training and Education
- Retrofitting
- Meter sizing

Background

- 2010 CRC, Section R313.1-5
- NFPA-13D
- Domestic allowance
- Pre-2011 practice vs. new code

Determining Meter Size

<table>
<thead>
<tr>
<th>Pre-2011 Practice</th>
<th>New Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fire Flow plus Total Peak Domestic Flow</td>
<td>Fire Flow plus 5 gpm Domestic Allowance</td>
</tr>
<tr>
<td>82 gpm (FF = 4 heads @ 20.5 gpm) + 20 gpm (Peak Domestic)</td>
<td>82 gpm (FF = 4 heads @ 20.5 gpm) + 5 gpm (Domestic Allowance)</td>
</tr>
<tr>
<td>102 gpm</td>
<td>2” meter</td>
</tr>
<tr>
<td>87 gpm</td>
<td>1.5” meter</td>
</tr>
</tbody>
</table>

EBMUD Meter Sizing Study

- Research
- Hydraulics
- Surveys
- Cost
Research – Domestic Allowance

- Toilet – 4 gpm
- Sink – 2 gpm
- Shower – 3 gpm
- Washing machine – 4 gpm
- Dishwasher – 3 gpm
- Irrigation – 10-15 gpm

Research – Domestic Allowance

American Water Works Association Research Foundation sponsored study: Residential End Uses of Water, Report No. 90781, 1999

• Only 20% of flows ≤ 5 gpm
• 90% of flows ≤ 15 gpm

Research – Domestic Allowance

Hydraulics – Meter Size Based on Flow

<table>
<thead>
<tr>
<th>Number of Sprinkler Heads</th>
<th>Flow per Sprinkler Head (gpm)</th>
<th>Total Sprinkler Flow (gpm)</th>
<th>Domestic Demand (gpm)</th>
<th>Total Flow (gpm)</th>
<th>Required Meter Size (inch)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10</td>
<td>15</td>
<td>30</td>
<td>45</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>13</td>
<td>26</td>
<td>15</td>
<td>41</td>
<td>1</td>
</tr>
<tr>
<td>1</td>
<td>17</td>
<td>34</td>
<td>15</td>
<td>49</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>20</td>
<td>40</td>
<td>15</td>
<td>55</td>
<td>1.5</td>
</tr>
<tr>
<td>3</td>
<td>23</td>
<td>69</td>
<td>15</td>
<td>84</td>
<td>1.5</td>
</tr>
<tr>
<td>4</td>
<td>26</td>
<td>92</td>
<td>15</td>
<td>107</td>
<td>1.5</td>
</tr>
<tr>
<td>5</td>
<td>29</td>
<td>115</td>
<td>15</td>
<td>130</td>
<td>1.5</td>
</tr>
<tr>
<td>6</td>
<td>32</td>
<td>138</td>
<td>15</td>
<td>153</td>
<td>1.5</td>
</tr>
</tbody>
</table>

Maximum flow through 1-inch meter = 50 gpm
Maximum flow through 1.5-inch meter = 100 gpm

Hydraulics - Pressure loss

Assuming flow of 31 gpm

<table>
<thead>
<tr>
<th>1-inch lateral and meter</th>
<th>1.5-inch lateral and meter</th>
<th>2-inch lateral and meter</th>
<th>2.5-inch lateral and 1-inch meter</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1</td>
<td>3.3</td>
<td>1.1</td>
<td>2.7</td>
</tr>
<tr>
<td>2.9</td>
<td>3.5</td>
<td>1.5</td>
<td>3.9</td>
</tr>
</tbody>
</table>

Estimated Pressure Loss Through Service Lateral (Hazen-Williams)

| Calculated Pressure Loss (psi) Through 30' Service Lateral | 21.2 | 3.7 | 1.1 | 2.7 |
| Estimation Pressure Loss Through Meter (psi)               | 2.9  | 1.0 | 0.5 | 2.9 |
| Total Pressure Loss (psi) Through Service Lateral and Meter| 24.1 | 4.7 | 1.5 | 6.6 |

Meter capacity (gpm)

| 50 | 100 | 180 | 50 |

Why 15 gpm?

- No study/data to support 5 gpm
- 5 gpm too low from water main to meter
- Typical flows 80% higher
- Irrigation flow / fire occurrence
- Code language
- Human / appliance reaction

- Estimate ~70% 1-inch meter regardless of 5 gpm or 15 gpm
  ~30% 1.5-inch
Hydraulics - Pressure loss

Assuming flow of 41 gpm (2 heads at 13 gpm + 15 gpm domestic)

- 1-inch lateral and meter
- 1.5-inch lateral and meter
- 2-inch lateral and meter
- 1.5-inch lateral and 1-inch meter

Calculated Pressure Loss (psi) Through 30’ Service Lateral (Hazen Williams)

<table>
<thead>
<tr>
<th>Service Lateral</th>
<th>26 gpm</th>
<th>31 gpm</th>
<th>34 gpm</th>
<th>41 gpm</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-inch lateral and meter</td>
<td>35.6 6.2 1.8 6.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.5-inch lateral and meter</td>
<td>4.8 1.3 0.7 4.8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-inch lateral and meter</td>
<td>40.5 7.7 2.5 11.1</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Estimated Pressure Loss Through Meter (psi) 4.8 1.5 0.7 4.8

Total Pressure Loss (psi) Through Service Lateral and Meter 40.5 7.7 2.5 11.1

- Meter capacity (gpm) 50 100 160 50

Backflow Preventers

<table>
<thead>
<tr>
<th>Backflow Device</th>
<th>Pressure Loss at Given Flow (psi)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-inch</td>
<td>26 gpm 31 gpm 34 gpm 41 gpm</td>
</tr>
<tr>
<td>Reduced pressure</td>
<td>12.0 12.3 12.3 13.1</td>
</tr>
<tr>
<td>1.5-inch</td>
<td>4.7 4.7 4.7 5.0</td>
</tr>
<tr>
<td>Reduced Pressure</td>
<td>11.5 11.5 11.5 11.5</td>
</tr>
</tbody>
</table>

Data is from manufacturers’ specifications sheets:

1. Average of headlosses from 6 Fabco, Watts, and Wilkins 1-inch double check valves.
2. Average of headlosses from 11 Fabco, Watts, and Wilkins 1.5-inch reduced pressure valves.
3. Average of headlosses from 5 Fabco, Watts, and Wilkins 1-inch double check valves.
4. Average of headlosses from 10 Fabco, Watts, and Wilkins 1.5-inch reduced pressure valves.

Water Shut-off Risk

- What is fire probability given statistical opportunity?
  - Probability \( P_{off} = \frac{\text{# houses off}}{\text{total #EBMUD}} \)
    - \( \approx 5\% \)
  - Probability \( P_{fire} = \text{Chance is < 1 in 300 per year (NFPA)} \)
    - \( 0.33\% \)
  - Probability \( = P_{off} \times P_{fire} \)
    - \( 0.0165\% \)
**Water Shut-off Cost vs. Risk**

- Cost of **two** service configuration, no shut-off
- Additional service lateral (unpaved) and BFP ~ $1,700
- Monthly cost would increase + $12.60/mo. @ EBMUD
- Ten year PW = $12.60x12x10 = $1,512
- PW10 ~ $3,200
- PW60 ~ $10,800 for a near zero risk

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**1-inch Meter Examples**

- **1.5-inch tap and lateral**
- **1-inch meter**
- **Examples**

  **1-inch meter**
  - 26 gpm (FF = 2 heads @ 13 gpm)
  - + 15 gpm (Domestic Allowance)
  - 41 gpm → 1" meter

  **1.5-inch meter**
  - 35 gpm (FF = 2 heads @ 17.5 gpm)
  - + 15 gpm (Domestic Allowance)
  - 50 gpm → 1" meter

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**Final Configuration**

- Minimum 1.5-inch lateral with 1-inch meter for flows ≤ 50 gpm

  - Size based on FF + 15 gpm or the Total Peak Domestic Demand, whichever is greater

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**Special Case Reviews**

- 1-inch lateral installed, no meter set
- Total flow just over 50 gpm => 1.5"
- Total flow just over 100 gpm => 2"
- Solutions?: Check pressures, reduce Sprinkler FF, or add domestic S-O valve

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**FY12 Monthly Meter Service Charges**

<table>
<thead>
<tr>
<th>Meter Size</th>
<th>Monthly Meter Charge (including Seismic)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5-inch Meter (former standard SFR combination meter size)</td>
<td>$35.32</td>
</tr>
<tr>
<td>1-inch Meter (new standard SFR combination meter size)</td>
<td>$21.27</td>
</tr>
<tr>
<td>5/8- or 3/4-inch Meter (most existing SFR without fire sprinklers)</td>
<td>$12.60</td>
</tr>
</tbody>
</table>
Cost Change

- No changes to EBMUD's Schedule of Rates and Charges

- Installation = $106 less for new configuration

- One-inch meter = $14.05 reduction in monthly charge from 1.5-inch meter

A Water Purveyors Perspective

- Thank you

- Any questions?