North End
Water Pressure Study
City of Dover, New Hampshire
City Council Presentation - November 1, 2006

PROJECT AREA
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SCHEMATIC OF DOVER WATER SYSTEM
EARTH TECH TASKS

- Review Historical Data
- Attend Neighborhood Meeting
- Conduct Fire Flow Tests
- Install Pressure Data Recorders
- Investigate Alternatives
- Utilize Computer Hydraulic Water Model
- Compare Advantages & Disadvantages
- Prepare Cost Estimate
HISTORICAL PRESSURE ISSUES

- Pressures Low 40 psi Range
  - Old & New Rochester Roads Area
  - Sixth Street Area
- Customer Complaints
  - Neighborhood Meeting
- Industry Standard
  - Min. Working Pressure 35 psi (Non-emergency)
  - Min. Working Pressure 20 psi (Emergency)
  - Normal Working Pressure 60 to 80 psi
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FIRE FLOW TESTS

• Purpose
  • Provide data to confirm the model calibration in the North End,
  • Estimate flow available for fire protection at specific locations in the North End,
  • Indicate relative strengths and weaknesses of the North End of the water system.

• Results
  • Sufficient Fire Flow provided in North End while maintaining adequate minimum water pressure of 20 psi
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PRESSURE DATA RECORDERS

- Pressure recorded every 2 minutes over 4.5 days from Thursday, 8/3/06 to Tuesday, 8/8/06

<table>
<thead>
<tr>
<th></th>
<th>Hydrant #55 on Old Rochester Road</th>
<th>Hydrant #984 on Sixth Street</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Pressure</td>
<td>39.5 psi</td>
<td>38.2 psi</td>
</tr>
<tr>
<td>Maximum Pressure</td>
<td>42.1 psi</td>
<td>44.1 psi</td>
</tr>
<tr>
<td>Minimum Pressure</td>
<td>31.7 psi</td>
<td>34.8 psi</td>
</tr>
</tbody>
</table>
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PRESSURE DATA - SIXTH STREET - HYDRANT #984

8/3/06 9:36 PM 8/4/06 9:36 AM 8/4/06 9:36 PM 8/5/06 9:36 AM 8/5/06 9:36 PM 8/6/06 9:36 AM 8/6/06 9:36 PM 8/7/06 9:36 AM 8/7/06 9:36 PM

Pressure (psi)

RECOMMENDED MINIMUM PRESSURE
## PRESSURE DATA RECORDERS

- Pressures recorded every 2 minutes over 4 days from Friday, 10/06/06 to Tuesday, 10/10/06

<table>
<thead>
<tr>
<th></th>
<th>83 Old Rochester Road</th>
<th>Hydrant #55 on Old Rochester Road</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Average Pressure</strong></td>
<td>37.3 psi</td>
<td>39.0 psi</td>
</tr>
<tr>
<td><strong>Maximum Pressure</strong></td>
<td>46.0 psi</td>
<td>43.0 psi</td>
</tr>
<tr>
<td><strong>Minimum Pressure</strong></td>
<td>13.5 psi</td>
<td>32.0 psi</td>
</tr>
</tbody>
</table>
**ANALYSIS**

- Computer hydraulic water model
- Field tests (Fire Flow and Pressure Recording)
- Elevation constraints
- Minimum pressure requirement of 35 psi is met by the existing water system service area!
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AREAS OF LOW WATER PRESSURE DUE TO ELEVATION

EL. 220 FT & HIGHER
EL. 185 FT – 220 FT
FINDINGS

• Water System Meets Required Standards
• House services Investigated appeared ‘normal’
• Recorded pressures at a home with low pressure
• Operational changes can be made to offer small improvements in daily pressure
• If the City wants to dramatically increase pressures it will cost money
SYSTEM IMPROVEMENTS – TANK WATER LEVEL

- Currently, City operates water level in tank 5 feet below overflow level
- Increase water level in tank - maximize use of the water storage tank and increase water pressures throughout water system
- Change in operation will increase pressures by almost 2 psi throughout water system
SYSTEM IMPROVEMENTS – WATER MAIN INSTALLATION

- Ongoing water main design for Old Rochester Road and Longhill Road – provides pipe “loop” in North End
- Replace water main on Central Ave with 16-inch water main
- Primary benefits increase in fire flow, stabilization of pressures and improved water quality
- Slight increase in available pressure
INCREASE MINIMUM PRESSURE GOAL

- City may decide to increase minimum pressure goal to 50 psi
- Elevation constraints
- Pumping required to increase pressure
SYSTEM IMPROVEMENTS – BOOSTER PUMPING

• Construction of booster pumping station for North End is not recommended without a dedicated water storage tank
• Booster pumps alone would operate all of the time to maintain pressures
• During maintenance, one or more pumps would be unavailable which could impact water pressures
• Does not provide adequate system redundancy and safety
• Typically used for small developments, not large portions of distribution systems.
SYSTEM IMPROVEMENTS – NORTH END PRESSURE ZONE

- Booster Pumping Station
- 1.5 Million Gallon Water Storage Tank
  - Elevated (Hydropillar)
  - Standpipe on Hill
- Pressure Reducing Valves (Manholes)
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PROPOSED NORTH END PRESSURE ZONE
SYSTEM IMPROVEMENTS – CONNECTION TO ADJACENT SYSTEMS

- Water Connection to Somersworth and Rochester
  - Approximately 21,700 feet water main
  - Pressure Reducing Valves
  - Large “Master” Water Meters
- Potential water quality issues
- Less control over water system
- Political issues
# North End Water Pressure Study

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## Planning Cost Estimates* - New Pressure Zone

<table>
<thead>
<tr>
<th>2006 Estimated Construction Costs**</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5 Million Gallon Hydropillar</td>
<td>$3,240,000.00</td>
</tr>
<tr>
<td>Booster Pumping Station</td>
<td>$710,000.00</td>
</tr>
<tr>
<td>Pressure Reducing Valve Systems</td>
<td>$250,000.00</td>
</tr>
<tr>
<td>40% Engineering &amp; Contingency</td>
<td>$1,680,000.00</td>
</tr>
<tr>
<td><strong>Total Budget Cost Estimate</strong></td>
<td><strong>$5,690,000.00</strong></td>
</tr>
</tbody>
</table>

*The cost estimate does not include land acquisition or cost to provide three phase power to the site

**Construction costs are based on year 2006 construction (ENR CCI 7763). Cost estimates must be adjusted after final design.
# North End

**Water Pressure Study**

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## PLANNING COST ESTIMATES* – WATER CONNECTION

<table>
<thead>
<tr>
<th>2006 Estimated Construction Costs**</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Water Main</td>
<td>$1,850,000.00</td>
</tr>
<tr>
<td>Water Meter Systems</td>
<td>$350,000.00</td>
</tr>
<tr>
<td>Pressure Reducing Valve Systems</td>
<td>$250,000.00</td>
</tr>
<tr>
<td>40% Engineering &amp; Contingency</td>
<td>$930,000.00</td>
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<tr>
<td><strong>Total Budget Cost Estimate</strong></td>
<td><strong>$3,260,000.00</strong></td>
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</tbody>
</table>

*The cost estimate does not include land acquisition or cost to provide three phase power to the site

**Construction costs are based on year 2006 construction (ENR CCI 7763). Cost estimates must be adjusted after final design.
QUESTIONS?
### DECISION MATRIX

<table>
<thead>
<tr>
<th>Factor</th>
<th>Weight</th>
<th>Pressure Zone</th>
<th>Connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>System Redundancy</td>
<td>15%</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Additional Pressure Available</td>
<td>15%</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Available Flow</td>
<td>15%</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Effect on water quality</td>
<td>10%</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Community opinion</td>
<td>10%</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Regulatory constraints</td>
<td>5%</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Intermunicipal agreements and regulations</td>
<td>10%</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Property owned by City</td>
<td>5%</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Cost Factors (Average of the following items.)</td>
<td>15%</td>
<td>1.7</td>
<td>1.7</td>
</tr>
<tr>
<td>Estimated construction cost</td>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Maintenance</td>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Cost to purchase water</td>
<td></td>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>

**RELATIVE SCORE**

|                  |        | 1.75         | 1.50       |