Planning for Water Demands

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Department of Human Ecology

Coalition for the Delaware River Watershed Forum
Major Issues for Water and Planning

• What are the **sustainable limits** to water supply?
• Is economic activity constrained by **lack of water supplies, inadequate capacity, or poor management of water infrastructure**?
• Could our urban centers improve by **reintegrating city form and function with water resources**?
• **PROBLEM**: Utilities don’t plan communities, and community planners often assume utilities will meet needs regardless.
• **ASCE national scores for Infrastructure**
  – Drinking water (D)
  – Wastewater (D+)
Key Background Information Needed*

- Existing water supplies and distribution systems
- Existing wastewater systems and receiving water capacity
- Existing stormwater systems
- Current system demands for water supply and wastewater
- Driving forces for water infrastructure needs
- Projected demands for water supply and wastewater
- Water stresses from existing and projected demands

NJDEP 2040 Demands Project

• 584 Public Community Water Supply (PCWS) systems
• Understand components of 2010 demands
  – Residential: indoor and outdoor, not including irrigation wells
  – Industrial
  – Commercial/Public Facilities/Institutional
• Model 2010 demands and compare to actual demands
• Project PCWS demands to 2040 – multiple scenarios

See www.danvanabs.com, Recent Projects
Population Results by PCWS System

- ~90% of NJ residents served by PCWS systems
- 13 PCWS systems – 50% of all customers
- 37 PCWS systems – 80% of all customers
- 547 systems – just 20% of all customers
- Most systems are tiny!
**New Jersey Water System Populations (Top ~50%) by Residential Development Density**

<table>
<thead>
<tr>
<th>System</th>
<th>High Density</th>
<th>Moderate Density</th>
<th>Low Density</th>
<th>Total</th>
<th>% of PCWS Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suez - Hackensack System</td>
<td>448,835</td>
<td>286,380</td>
<td>39,932</td>
<td>775,148</td>
<td>9.83%</td>
</tr>
<tr>
<td>NJ American - Raritan</td>
<td>263,497</td>
<td>294,324</td>
<td>148,708</td>
<td>706,529</td>
<td>8.96%</td>
</tr>
<tr>
<td>NJ American - Coastal North</td>
<td>103,861</td>
<td>191,690</td>
<td>71,594</td>
<td>367,145</td>
<td>4.66%</td>
</tr>
<tr>
<td>NJ American - Delaware Basin</td>
<td>257,948</td>
<td>37,473</td>
<td>979</td>
<td>296,400</td>
<td>3.76%</td>
</tr>
<tr>
<td>Passaic Valley Water Commission</td>
<td>82,799</td>
<td>189,811</td>
<td>18,424</td>
<td>291,034</td>
<td>3.69%</td>
</tr>
<tr>
<td>NJ American - Passaic</td>
<td>257,094</td>
<td>1,654</td>
<td>-</td>
<td>258,749</td>
<td>3.28%</td>
</tr>
<tr>
<td>Newark Water &amp; Sewer Dept</td>
<td>104,820</td>
<td>108,349</td>
<td>41,754</td>
<td>254,923</td>
<td>3.23%</td>
</tr>
<tr>
<td>Jersey City MUA</td>
<td>238,444</td>
<td>-</td>
<td>-</td>
<td>238,444</td>
<td>3.02%</td>
</tr>
<tr>
<td>Middlesex Water Company</td>
<td>113,203</td>
<td>70,866</td>
<td>12,429</td>
<td>196,498</td>
<td>2.49%</td>
</tr>
<tr>
<td>Trenton City Water Dept</td>
<td>101,201</td>
<td>82,855</td>
<td>8,375</td>
<td>192,431</td>
<td>2.44%</td>
</tr>
<tr>
<td>Liberty Water Company (Elizabeth)</td>
<td>116,348</td>
<td>5,473</td>
<td>1</td>
<td>121,822</td>
<td>1.55%</td>
</tr>
<tr>
<td>NJ American - Atlantic</td>
<td>21,665</td>
<td>73,312</td>
<td>19,359</td>
<td>114,336</td>
<td>1.45%</td>
</tr>
<tr>
<td>Suez - Toms River System</td>
<td>32,661</td>
<td>66,153</td>
<td>12,142</td>
<td>110,955</td>
<td>1.41%</td>
</tr>
</tbody>
</table>

8 of the largest 13 systems are investor-owned. Jersey City and Liberty are managed under PPP contracts.
Understanding Residential Demands

• Current average household and per capita demands
• How do rates vary:
  – Seasonally
  – By geographic area
  – By housing type
  – Other factors?
• How might residential per capita rates change?
## Results: Per Capita Residential Demands (Case Study Weighted Averages)

<table>
<thead>
<tr>
<th>Residential Density/Region</th>
<th>Coastal Plain</th>
<th>Piedmont</th>
<th>Highlands/Ridge &amp; Valley</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Density (HD) Annual</td>
<td>47.92</td>
<td>58.46</td>
<td>42.04</td>
</tr>
<tr>
<td>Medium Density (MD) Annual</td>
<td>59.04</td>
<td>61.20</td>
<td>53.52</td>
</tr>
<tr>
<td>Low Density (LD) Annual</td>
<td>93.27</td>
<td>73.95</td>
<td>61.09</td>
</tr>
<tr>
<td>High Density (HD) Summer</td>
<td>53.49</td>
<td>62.61</td>
<td>42.47</td>
</tr>
<tr>
<td>Medium Density (MD) Summer</td>
<td>75.88</td>
<td>76.62</td>
<td>59.42</td>
</tr>
<tr>
<td>Low Density (LD) Summer</td>
<td><strong>141.05</strong></td>
<td><strong>108.92</strong></td>
<td>81.75</td>
</tr>
<tr>
<td>High Density (HD) Non-Summer</td>
<td>45.13</td>
<td>56.27</td>
<td>41.82</td>
</tr>
<tr>
<td>Medium Density (MD) Non-Summer</td>
<td>50.59</td>
<td>53.17</td>
<td>50.62</td>
</tr>
<tr>
<td>Low Density (LD) Non-Summer</td>
<td>69.36</td>
<td>56.61</td>
<td>50.84</td>
</tr>
</tbody>
</table>

### Density Ratio

<table>
<thead>
<tr>
<th>Ratio of Summer Use to Non-Summer Use (Per Capita Per Day)</th>
<th>Density</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>high</td>
<td>1.15</td>
</tr>
<tr>
<td>Medium</td>
<td>medium</td>
<td>1.50</td>
</tr>
<tr>
<td>Low</td>
<td>low</td>
<td>2.04</td>
</tr>
</tbody>
</table>
Variations in Residential Water Demand
(Derived from data representing 3.6 million people in NJ)

High Density Residential Per Capita Demands: Case Study PCWS Systems

Medium Density Residential Per Capita Demands: Case Study PCWS Systems

Low Density Residential Per Capita Demands: Case Study PCWS Systems

1326 Results

1447 Results

489 Results
Drivers for Change

- Population growth and demographic change
- Economic growth and business demands
- New regulatory requirements
- Changing public expectations
- Aging and failing infrastructure
- Increasing infrastructure costs
- Climate change – more frequent hot and dry periods, not always at the same time
What About 2040?

- New Jersey total water demands have been flat despite adding 1.06 million people (15%), 1990-2010

- Complicating factors during this period: industrial demand reductions, changes in non-revenue water

- Population trends uncertain, highly dependent on net migration

- Per capita residential demands expected to decline
2010 Census Population: **8.79 million**
2040 Population Projection: **10.2-10.4 million**
Projected Growth to 2040: **1.4-1.6 million**
Scenarios for Projecting 2040 Demands

- **Static**: Residential per capita demand not changed
- **Conservation Scenario**: Reduction of Residential per capita demand toward but not below 35 gpcd
- **Commercial**: Varies with population change
- **Industrial**: No change
- **Non-Revenue Water**: Two options applicable to each scenario
  - NRW status quo – existing or current averages
  - NRW aggressively controlled
### Implications for 2040 Water Demands
(37 Largest Systems, 80% of Current Demands)

<table>
<thead>
<tr>
<th>Total MGD</th>
<th>Scenario</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>702.879</td>
<td>2008-2015 average demands</td>
<td>Baseline Condition</td>
</tr>
<tr>
<td>726.174</td>
<td>No Conservation with Nominal Water Losses</td>
<td>3.31% higher than Baseline</td>
</tr>
<tr>
<td>684.463</td>
<td>No Conservation with Optimum Water Losses</td>
<td>2.62% less than Baseline</td>
</tr>
<tr>
<td>680.541</td>
<td>Conservation with Nominal Water Losses</td>
<td>6.28% less than No Conservation scenario</td>
</tr>
<tr>
<td>641.464</td>
<td>Conservation with Optimum Water Losses</td>
<td>6.28% less than No Conservation scenario</td>
</tr>
</tbody>
</table>

Conservation/Optimum Water Loss scenario is 11.67% less than No Conservation/Nominal Water Loss scenario, despite 1.4 million new residents. 11 increase, 26 decrease.
Uses of the Results

- **Verify demands** – statewide results aren’t necessarily correct for any one system but the approach is replicable.
- **System and subsystem demand projections** – evaluate existing or potential stresses to system.
- **AMI/AMD targeting** – priorities using demand patterns.
- **Drought conservation** – target areas with high annual demands and high summer:non-summer ratios.
- **Consumptive water uses** – controlling lawn irrigation will be important to future water supply sufficiency.
- **Development patterns** have a major influence on demands – strengthens the case for cluster development, redevelopment.
Contact Information

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