Leveraging Hydraulic Models

presented by

Melissa Brunger, P.E.
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AGENDA

Hydraulic Modeling Applications

Case Studies

Conclusions/Lessons Learned
• System curves for pump station design
• Hydraulic grade lines (HGLs) for pipeline design
• Siting and sizing of elevated storage tanks
• Impact on water quality
• Construction sequencing
• Evaluate system operations
CASE STUDY 1: BY THE NUMBERS

- 30,000 = Connections
- 21 MGD = MD Demand
- 1 Surface Water Treatment Plant
- 17 Pump Stations
- 11 Pressure Zones (580’-1170’)
- 26 Storage Tanks
- 11 Wells
• All-pipes InfoWater model (Innovyze)
• Extended Period Simulation (EPS)
Trinity Aquifer Purpose
- Supply diversification
- Growing system demand
- Less Regulated than Edwards Aquifer

Test Well
- Drilled in Spring 2011
- Tested Capacity of 400 - 500 gpm

Moving Forward
- Land purchased in Spring 2013
- Started drilling additional wells in 2014
- Coordination with FNI for Design
Operational Modeling
• Incorporate new water supply
• Evaluate various demand conditions

Identify Improvements
• Transfer valves
• Piping connections

System Curve Development
• Existing and 10-year demands
• Various static head conditions
• Static Head
  – Minimum
  – Average
  – Maximum

• Demand Conditions
  – Average Day
  – Maximum Day

• Operations
  – With transfers
  – Without transfers
Water age without Trinity supply

Water age with Trinity supply

Less than 2 Days
2 - 5 Days
5 - 7 Days
7 - 10 Days
Greater than 10 Days

WATER AGE ANALYSIS
Wholesale Provider

Serves More Than **1.6 Million** People

77 Delivery Points

12” – 96” in Diameter

11 Remote and 8 High Service Pump Stations

Approximately **600 MGD** MD Demand
• All-pipes InfoWater model (Innovyze)
• Determine tank location, volume and elevations
• Determine ability to use one set of pumps to different service areas
PUMP STATION DESIGN: 2020 OPERATIONS
• Determine proposed pipeline flow and diameter
• Confirm pressure class
• Turn off Tawakoni HSPS once per week
• Pump more consistently using smaller pumps
• Operational strategies are not necessary with the new WTP and remote storage
CASE STUDY 3: BY THE NUMBERS

- 1.3 Million = Population
- 23 = Wholesale Customers
- 3 WTPs
- 22 Pump Stations
- 17 Pressure Zones
- 9 Elevated Storage Tanks
- 12 Ground Storage Tanks
- 8,842,325 LF of modeled lines
- H2OMAP Water model (Innovyze)
- Extended period simulation model
- Evaluate operations and pressures for various elevated storage sites

<table>
<thead>
<tr>
<th>Figure No.</th>
<th>Alternative</th>
<th>Tank Configuration</th>
<th>Area North of Northwest Highway</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Alternative 1/2/3</td>
<td></td>
<td></td>
<td>East High</td>
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<tr>
<td>2</td>
<td>Alternatives 4A/B/C</td>
<td>1 MG Tank</td>
<td></td>
<td></td>
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<tr>
<td>3</td>
<td>Alternative 4D</td>
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<tr>
<td>4</td>
<td>Alternative 1/2/3</td>
<td>2 MG Tank</td>
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<tr>
<td>5</td>
<td>Alternatives 4A/B/C with 36-inch Jupiter Road Line</td>
<td>2 MG Tank</td>
<td></td>
<td>Existing System Peak Day</td>
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<tr>
<td>6</td>
<td>Alternative 4D</td>
<td>2 MG Tank</td>
<td></td>
<td></td>
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<tr>
<td>7</td>
<td>Alternative 1 and 4A/B/C with 36-inch Jupiter Road Line</td>
<td>Two 1 MG Tanks</td>
<td></td>
<td>Transfer to North High</td>
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<tr>
<td>8</td>
<td>Alternative 1 and 4A/B/C without 36-inch Jupiter Road Line</td>
<td>Two 1 MG Tanks</td>
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<td>9</td>
<td>Supply from Jim Miller PS (Garland EST Offline)</td>
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<td>Tank Offline</td>
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<tr>
<td>10</td>
<td>Supply from Doran PS (Garland EST Offline)</td>
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<td>Tank Offline</td>
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<tr>
<td>11</td>
<td>Supply from Valves Only (Garland EST Offline)</td>
<td></td>
<td>Tank Offline</td>
<td>Existing System Average Day</td>
</tr>
</tbody>
</table>
• Evaluate pressures for various elevated storage sites
• Evaluate system operations without elevated storage
• Evaluate system operations for proposed tank sites

Figure 9
High Tank Alternatives System Operations (Two 1 MG ESTs without 36-inch) Modeled Existing System Peak Day Conditions

Tank Level (feet)

Flow (MGD)

Time

0:00 1:00 2:00 3:00 4:00 5:00 6:00 7:00 8:00 9:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00

Jim Miller PS Flow
Doran PS Flow
Alternative 4A/4B/4C Tank Level
Alternative 1 (Original Site) Tank Level
• Evaluate pressures when taking a pump station out of service to assist with pump station construction phasing.

**Minimum Pressure**
- Red: Less than 42 psi
- Purple: 42 psi - 80 psi
- Blue: 80 psi - 100 psi
- Yellow: Over 100 psi

**PS Online**

**PS Out of Service**
• Evaluate pressures when taking a pump station out of service to assist with ground storage construction phasing.

Average Day Demand

Peak Day Demand
• Evaluate use of a pump station without ground storage to assist with ground storage construction phasing.
Hydraulic modeling can lead to **monetary payoffs** providing **optimized facility sizing** and **efficient operations** over the life cycle of the asset.

Hydraulic modeling allows evaluation of a **broad range of options** at a relatively low cost.

Hydraulic modeling **provides assurances** that assumptions used for the design process are based on **sound engineering analysis**.

Hydraulic modeling results in **increased design efficiency** and **confidence** during the start-up process.
• May require additional time during design process
• Hydraulic model must be calibrated and up-to-date
• Coordination with operations staff is extremely important
• Hydraulic models provide more accurate system curves than spreadsheet calculations
• Hydraulic models have limitations and it is important to understand them