Decision making under uncertainty: A water supply infrastructure planning tool

Tirusew Asefa, Ph.D. P.E., D.WRE, F.ASCE

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Who We Are

New Port Richey

Hillsborough

Pinellas

Tampa

St. Petersburg
Planning for Multiple Futures: A Level of Service Approach‡

Analyze shortages to determine future supply

Demand-Supply Variability
Regional Performance Evaluation Model

Demographics & Weather → LTDFS (Monthly) → Long-term Demand Realizations

Historical Climate Data → Flow Modeling System (Monthly) → 100-Year Streamflow Realizations → Latin Hypercube Sampling

Flow Network Description
Operational Constraints
OROP Driven By Well GW Production
Prescribed Desal Production

Surface Water Availability Model (Daily) → Demand-Flow Pair Realizations

TBW System Operations Model (Daily)

Inter-Process Communication

Operations Schedules
Projects Recommended in 2018 Study

Three New Water Supply Projects

- Surface Water Treatment Plant Expansion with existing source water
- Desalination Facility Expansion with existing source water
- New Groundwater Treatment Plant via Net Benefit from SHARP Program
<table>
<thead>
<tr>
<th>Model ID</th>
<th>SWTP Location</th>
<th>Withdrawal Location</th>
<th>Treatment Capacity</th>
<th>Pipeline Assumptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>125 (baseline)</td>
<td>Existing site – no expansion</td>
<td>Existing locations – no expansion</td>
<td>No expansion</td>
<td>Regional pipeline from AAF to SCH_3 demand node</td>
</tr>
<tr>
<td>126</td>
<td>Existing site</td>
<td>Existing locations</td>
<td>+20 mgd treatment capacity at existing site</td>
<td>10 mgd minimum flow in the direction of SCH_3 only</td>
</tr>
<tr>
<td>128</td>
<td>Existing site</td>
<td>Existing locations</td>
<td>+30 mgd treatment capacity at existing site</td>
<td>Pipeline flow is comprised only of regional water via AAF</td>
</tr>
<tr>
<td>129</td>
<td>Directly from reservoir</td>
<td>New SWTP with 20 mgd treatment capacity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>130</td>
<td>Directly from reservoir</td>
<td>New SWTP with 30 mgd treatment capacity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>131</td>
<td>From the reservoir influent / effluent pipe</td>
<td>New SWTP with 20 mgd treatment capacity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>132</td>
<td>From the reservoir influent / effluent pipe</td>
<td>New SWTP with 30 mgd treatment capacity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>133</td>
<td>Near regional reservoir (new site)</td>
<td>New SWTP with 20 mgd treatment capacity</td>
<td>Regional pipeline between AAF and SCH_3 demand node</td>
<td></td>
</tr>
<tr>
<td>134</td>
<td>Directly from reservoir</td>
<td>New SWTP with 30 mgd treatment capacity</td>
<td>No minimum flow requirement</td>
<td></td>
</tr>
<tr>
<td>135</td>
<td>Directly from reservoir</td>
<td>New SWTP with 20 mgd treatment capacity</td>
<td>Bidirectional flow is allowed (i.e., flow can go toward SCH_3 or toward AAF)</td>
<td></td>
</tr>
<tr>
<td>136</td>
<td>From the reservoir influent / effluent pipe</td>
<td>New SWTP with 30 mgd treatment capacity</td>
<td>Pipeline flow may be comprised of regional water via AAF or production from the new SWTP near the reservoir</td>
<td></td>
</tr>
</tbody>
</table>
The Benefits of New Infrastructure

Possible Shortfall (MGD)

Baseline infrastructure = Existing infrastructure, TECO Big Bend Connector Tunnel & Southern Hillsborough County Pipeline
The Benefit of New Infrastructure

Possible Shortfall (MGD)

Baseline infrastructure = Existing infrastructure, TECO Big Bend Connector Tunnel & Southern Hillsborough County Pipeline

Baseline Infrastructure

With Surface Water Treatment Expansion
Coupled Water Supply and Financial Model

Reliability Model
Modeling water deliveries to member governments

- Daily water supply and distribution routing models
- Daily deliveries to customers to meet demands

Financial Model
Historic budgets and financial outcomes

- Monthly water sales revenues
  - Annual Debt Service
  - Net Revenues
  - Reserve Fund Balance

Covenant Ratios
Uniform Rate

Long-term Master Water Plan
December 2018

8. System wide Reliability and Future Needs
Coupled Water Supply and Financial Model

Tampa Bay Water must meet *covenant thresholds* to maintain a good credit rating *(and low interest rate on debt for infrastructure)*

**Rate Covenant:**
\[
\frac{\text{Net Revenue} + \text{Reserve Fund}}{\text{Debt Service}} \geq 1.25
\]

**Debt Covenant:**
\[
\frac{\text{Net Revenue}}{\text{Debt Service}} \geq 1.0
\]
Financial Model Structure

Annual Estimate

Uniform Rate

Water Demand

Reliability Model
Financial Model Structure

1. Reserve Fund Transfers
   - Rate Stabilization Fund
   - CIP Fund
   - Utility Reserve Fund
   - Other Funds & Interest
   - R&R Fund

2. Debt Service
   - Existing Debt
   - Acquisition Credits

3. Annual Estimate
   - New Projects

4. Operational Expenses
   - Fixed OpEx
   - Variable OpEx

5. Uniform Rate
6. Variable Rate

7. Water Demand
   - Management Policy Intervention

8. Reliability Model
   - Water Demand Reliability
What can Management Explore?

- Repayment schedule of future and existing debt
- Uniform rate setting and reserve fund transfer policy
- Timing & sequencing of potential future infrastructure projects
- Inflation rate of operating costs
- Rate of water demand growth
- Interest and miscellaneous income
- Targets for debt and rate covenants
- Water availability and withdrawal permit capacity
- Differences between budgeted and actual finances
Financial Feedbacks – Baseline Scenario

No management involvement – model balances uniform rate
“Hands-off” policy approach
Management wants no rate increase on the uniform rate
“Fixed” policy approach
Management wants minor increase on the uniform rate
“Controlled Growth” policy approach
**Investment vs. Demand Growth**

- **High demand + dry futures** may lead to severe water delivery shortfalls
- **But, low demand futures** can mean a high Uniform Rate to meet financial objectives

High demands and drought conditions = **risk to water supply**

Low demands and/or high investment = **risk to financial stability**
• Understanding both demand and supply uncertainty allows for risk assessment

• Uncertainty does NOT mean no decision

• Coupling financial model allow implication to rate payers

• Next: Pilot model complete; currently on implementation
Participants

**Tampa Bay Water**
- Tirusew Asefa
- Nisai Wanakule
- Hui Wang
- Sandro Svrdlin

**UNC Chapel Hill**
- David Gorelick
- Christina Petagna
- Greg Characklis

**Cornell**
- David Gold
- Lillian Lau
- Patrick Reed