Pump Station Condition Assessments (A Proven and Defensible Approach)

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Outline

• Background and Drivers

• Methods
  ➢ Typical Findings
    (non BWSC specific)
  ➢ Prioritization and Grouping
    (non BWSC specific)

• Next Steps
Project Drivers

• Commission funds and maintains CIP
• CIP includes prioritized list of repairs and upgrades
• Independent and defensible review
Background

1 – Combined Station
4 – Sanitary Stations
4 – Stormwater Stations
1 – Booster Station
Section 2: Methods
Project Methods

1. Credible, objective data
2. Proven prioritization process
3. Defensible list of prioritized projects
1. Historical Data Review
2. Computerized Database / Tablet
3. Consequence of Failure Review
4. Field Visits
   • Field assessment (Condition and Performance)
   • Field Tests
5. Asset Criticality “model” / Prioritization
6. Projects/ Recommendations
Step 1: Data Review

- O&M Manuals / Reports
- As-built Drawings
- Site visits / traffic review
- Interviews with Operators
- Existing Photos
Step 2: Customize Database / Tablet
Step 3a: **Consequence of Failure**

(Asset Type) – Owner Input

- Civil/Site Assets
- Buildings and Structures
- Pump, Motors, and Equipment
- Piping and Valves
- HVAC
- Electrical Systems, VFDs
- Standby Power Systems
- Instrumentation and Control Systems

1: Low Consequence

5: High Consequence
Step 3b: **Consequence of Failure** (Station) – Owner Input

- UPPS
- Austin
- Commonwealth
- Sullivan
- Symphony
- Public Alley
- Summer
- Trilling Way
- Port Norfolk
- Notting Hill

**Parameters** (weighting) \* Parameter Score = Station Score

- Station Flow (weight = 0.6)
- Critical Customers (weight = 1.0)
- Sensitive Waters (weight = 0.8)
- Difficulty of Repair (weight = 0.4)
- Growth Area (weight = 0.3)
- Response Time (weight = 0.8)
- etc...
- etc...

\[ \text{Low Consequence} \quad 1: \text{Low} \quad \times \quad \text{Low Consequence} \]

\[ \text{High Consequence} \quad 10: \text{High} \quad \times \quad \text{High Consequence} \]
Step 4a: Field Visits

**Team** scoring for **each** asset

<table>
<thead>
<tr>
<th>Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Excellent</td>
</tr>
<tr>
<td>2 Slight visible degradation</td>
</tr>
<tr>
<td>3 Visible degradation</td>
</tr>
<tr>
<td>4 Integrity of component moderately compromised</td>
</tr>
<tr>
<td>5 Integrity of component severely compromised</td>
</tr>
</tbody>
</table>
Step 4b: Field Visits

Team scoring for each asset

Performance

1. Component functioning as intended
2. In-service, but higher than expected O&M
3. In-service, but function is impaired
4. In-service, but function is highly impaired
5. Component is not functioning as intended

Age Adjustment

- 0-50% of useful life → No adjustment
- 50-75% of useful life → Performance (+1)
- 75-100% of useful life → Performance (+2)
Step 4c: Field Visit
Condition and Performance Regions

Performance Ranking

<table>
<thead>
<tr>
<th>Region 1</th>
<th>Region 2</th>
<th>Region 3</th>
<th>Region 4</th>
<th>Region 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Immediate Action</td>
<td>Immediate Corrective Action</td>
<td>Schedule Near Term Corrective Action WO</td>
<td>Replace / Refurbish</td>
<td></td>
</tr>
</tbody>
</table>

Condition Ranking

1. Region 1
2. Region 2
3. Region 3
4. Region 4
5. Region 5

Safety, Reliability, Operability
Section 3: Typical Findings (non-BWSC specific)
Summary of Common Field Test Findings

1. Capacity / Drawdown Tests

2. Data Logger

3. Vibration

Brown and Caldwell
Summary of Common Electrical and HVAC Findings

- Local HMI / local operator interface
- Egress lighting
- NFPA 820 compliance / Intrinsically safe devices / ventilation
- Surge suppression
- Gas monitoring / alarms
- Secondary pump controls
- Smoke vs. fire detectors
Summary of Common Hydraulic / Mechanical Findings

- Station Bypass Potential
- Equipment Assess Removal
Summary of Common Structural Findings

- Hatches
- Ladders
- Cracked Walls / Structures
Station XYZ
Total Number of Assets Reviewed = 96

Highest Scoring Assets

<table>
<thead>
<tr>
<th>Asset</th>
<th>Asset Type</th>
<th>Comments</th>
<th>Asset Region</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roof</td>
<td>Structural</td>
<td>Damage membrane, evidence of leakage</td>
<td>4</td>
</tr>
<tr>
<td>Pump 2</td>
<td>Pumps</td>
<td>High vibration, leaking seal</td>
<td>4</td>
</tr>
<tr>
<td>Control Panel</td>
<td>Electrical</td>
<td>No local HMI</td>
<td>3</td>
</tr>
<tr>
<td>Exhaust Fan</td>
<td>HVAC</td>
<td>Noise, No gas monitoring</td>
<td>2</td>
</tr>
</tbody>
</table>
Step 5a: **Criticality Review “Model”** (Criticality of assets)

- **C&P Region** (1-5)
- **Station Consequence of Failure**
- **Asset Type Consequence of Failure** (1-5)
- **Asset Criticality score**

Likelihood of failure
Section 4: Prioritization / Grouping
## Asset Prioritization Summary

<table>
<thead>
<tr>
<th>Asset Priority</th>
<th>Percentile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Priority 1 (0-2 years)</td>
<td>90\textsuperscript{th}-% to 100\textsuperscript{th}-%</td>
</tr>
<tr>
<td>Priority 2 (2-5 years)</td>
<td>70\textsuperscript{th}-% to 90\textsuperscript{th}-%</td>
</tr>
<tr>
<td>Priority 3</td>
<td>50\textsuperscript{th} % to 70\textsuperscript{th}-%</td>
</tr>
<tr>
<td>Priority 4</td>
<td>0-% to 50\textsuperscript{th}-%</td>
</tr>
</tbody>
</table>
High Criticality Asset and Projects

- High Criticality (Priority) Asset
- Project 1: High Priority
- Project 2: High Priority
- Project 3: High Priority
### Overall Summary of Criticality Prioritization

<table>
<thead>
<tr>
<th>Priority</th>
<th>Percentile</th>
<th>Assets Count</th>
<th>Total Cost ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Priority 1</td>
<td>90% to 100%</td>
<td>39</td>
<td>$XXX,XXX,XXX</td>
</tr>
<tr>
<td>Priority 2</td>
<td>70% to 90%</td>
<td>71</td>
<td>$XXX,XXX,XXX</td>
</tr>
<tr>
<td>Priority 3</td>
<td>50% to 70%</td>
<td>102</td>
<td>No cost estimate</td>
</tr>
<tr>
<td>Priority 4</td>
<td>0% to 50%</td>
<td>174</td>
<td>No cost estimate</td>
</tr>
</tbody>
</table>
Prioritize CIP expenditures to maximize criticality reduction.

<table>
<thead>
<tr>
<th>Asset Region (C&amp;P)</th>
<th>Likelihood of Failure</th>
<th>Consequence of Failure</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
</tr>
</tbody>
</table>

Station and Asset Type Score

High Risk

Moderate Risk

High

Low Risk

Low
# Grouping of Projects By Station

<table>
<thead>
<tr>
<th>Station</th>
<th>Priority 1</th>
<th>Priority 2</th>
<th>Total Cost ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Asset Count</td>
<td>Cost ($)</td>
<td>Asset Count</td>
</tr>
<tr>
<td>Station 1</td>
<td>3</td>
<td>-------</td>
<td>13</td>
</tr>
<tr>
<td>Station 2</td>
<td>4</td>
<td>-------</td>
<td>9</td>
</tr>
<tr>
<td>Station 3</td>
<td>9</td>
<td>-------</td>
<td>1</td>
</tr>
<tr>
<td>Station 4</td>
<td>4</td>
<td>-------</td>
<td>4</td>
</tr>
<tr>
<td>Station 5</td>
<td>-------</td>
<td>4</td>
<td>-------</td>
</tr>
<tr>
<td>Station 6</td>
<td>4</td>
<td>-------</td>
<td>-------</td>
</tr>
<tr>
<td>Station 7</td>
<td>1</td>
<td>-------</td>
<td>2</td>
</tr>
<tr>
<td>Station 8</td>
<td>-------</td>
<td>2</td>
<td>-------</td>
</tr>
<tr>
<td>Station 9</td>
<td>-------</td>
<td>3</td>
<td>-------</td>
</tr>
<tr>
<td>Station 10</td>
<td>-------</td>
<td>3</td>
<td>-------</td>
</tr>
<tr>
<td><strong>Grand Total</strong></td>
<td>39</td>
<td>-------</td>
<td>71</td>
</tr>
</tbody>
</table>
## Priority Summary by Asset Type

<table>
<thead>
<tr>
<th>Asset Type</th>
<th>Priority 1</th>
<th>Priority 2</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Asset Count</td>
<td>Cost ($)</td>
<td>Asset Count</td>
</tr>
<tr>
<td>Building</td>
<td>2</td>
<td>------</td>
<td>6</td>
</tr>
<tr>
<td>Centrifugal Pumps</td>
<td>5</td>
<td>------</td>
<td>5</td>
</tr>
<tr>
<td>Cranes</td>
<td></td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Electrical Infra.</td>
<td>6</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Electrical Power</td>
<td>3</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Generators</td>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>HVAC</td>
<td>1</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Instrumentation</td>
<td>3</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Motors</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Odor Control</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Piping</td>
<td></td>
<td>22</td>
<td>22</td>
</tr>
<tr>
<td>SCADA</td>
<td>2</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Submersible Pumps</td>
<td>7</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Wetwell</td>
<td>5</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>VFD</td>
<td></td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>39</td>
<td></td>
<td>71</td>
</tr>
</tbody>
</table>
Prioritize and Group expenditures to maximize criticality reduction.
Section 5: Next Steps
Next Steps

• Reviewing higher priority projects with BWSC staff
• Further grouping of project by station
• Further grouping of projects by asset type
## Summary

<table>
<thead>
<tr>
<th>Step 1</th>
<th>Step 2</th>
<th>Step 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proper planning and input</td>
<td>Field time</td>
<td>Defensible, prioritized improvements</td>
</tr>
</tbody>
</table>

### Tools

- Electronic condition assessment forms
- Computer tablet (C&P Regions)
- Data loggers
- Vibration
- Criticality prioritization model
Questions?