Planning a Flushing Program

Tom Walski, Ph.D., P.E.
Overview

• Why flush?
• Different flushing goals
• Conventional vs. Unidirectional flushing
• When to use each?
• How to model flushing?
Why are we flushing?

- Remove solids
- Improve disinfectant residual
- Respond to complaints
- Remove biofilms
- Test hydrants
- Cleanup after contamination
Removing Solids

- Prevent turbidity/color
- Must increase velocity/shear stress
- Increase above normal peak velocity
- Flush with clean water
Improve Disinfectant Residual

• Bring fresh water into area
• Velocity/shear stress don’t matter
• Understand initial water quality
• Review die-off after flushing
• May need (automatic) blowoffs
Respond to Complaints

• Understand nature of complaint

• Response different for
  – Color/turbidity
  – Taste and odor

• Study chronic areas
Remove Attached Growth

- Understand nature of growth (biofilms, corrosion)
- Establish flushing criteria
- May need high velocities
Test Hydrants

• Ensure hydrants operate
• Operate every hydrant
• Flush with clean water, not random
• Document operation
• Record pressure, flow
Cleanup after Contamination

- Identify extent of contamination
- Flush clean to dirty
- Careful plan – don’t spread plume
- Frequent monitoring for confirmation
Common Threads

• “Flush with clean water behind you”
• Plan before you flush – modeling helpful
• Document pressures, flows, quality (if applicable)
• Safety…
• Safety…
• SAFETY
Types of Flushing

• Conventional
  – Easy
  – Achieves sufficiently high velocity
  – Must understand flow direction

• Unidirectional
  – Achieves higher velocity
  – Uses less water
Why are we flushing?

- Hydrant Testing
- Complaint Response
- Disinfectant Residual
- Taste & Odor
- Turbidity/Color
- Attached Growth

- Conventional
- Unidirectional
Modeling to Support Flushing

- Flushing runs
  - Shear stress/velocity important
  - Not tracking water quality

- Extended period simulation runs
  - Quality/age more important than shear
  - Tracking water quality from source

- Why are we flushing?
Pipe Run Creation
Highlight Plan for Area
Highlight Results
Operator Report Drawing
## Operator Reports

### Flushing Field Report

**Study:** Study - 1; **Area:** Area - 1; **Event:** Maple to east end

<table>
<thead>
<tr>
<th>Valve</th>
<th>Operation</th>
<th>Notes</th>
<th>Pressure (psi)</th>
<th>Measured Flow (gpm)</th>
<th>Predicted Pressure (psi)</th>
<th>Predicted Flow (gpm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISO-24</td>
<td>Open</td>
<td>Maple at Apple</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ISO-18</td>
<td>Closed</td>
<td>Pine at Maple</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ISO-22</td>
<td>Closed</td>
<td>Rt 210 south of Maple</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ISO-20</td>
<td>Closed</td>
<td>Rt 210 north of Maple</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Flushing**

- **Minimum:** 5.1
- **Recommended:** 10.2

**Volume (gal)**

- 3,724.5
- 7,448.9

<table>
<thead>
<tr>
<th>Start Time</th>
<th>End Time</th>
<th>Operator</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Water Quality**

- Initial
- Final

<table>
<thead>
<tr>
<th>Clear</th>
<th>Colored</th>
<th>Chlorine Residual</th>
<th>Turbidity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Pipe Run to be Cleaned**

- P-8, P-7, P-6

**Notes**
Identifying Older Water
Flushing Progress
Need for Dechlorination

- Always
- Never
- Site specific
Field Work
Field Testing Data

- Analysis provided range of decay

Site 1 – Free Residual Decay Range
Suggested protocol
Summary

• Need to identify flushing goal
• Modeling can help planning
• Water disposal must be considered
There is no single “right” way

Tom.Walski@Bentley.com