Flushing Program

Learning Objectives

• Be able to describe the importance of flushing
• Prepare a simple checklist for flushing a hydrant
• Identify the components in developing a flushing program

Flushing

• Generally established as a corrective measure
• Can be implemented as a proactive method to maintain high quality water
• Flushing is considered a Best Management Practice (AWWA)
Why flush?

- Respond to customer complaints
- Expel contaminants from backflow episode
- Remove sediment and loose deposits
- Scouring
- Decreasing water age in dead end mains
- Restore chlorine residuals
- Prevent or respond to nitrification

Question: Flushing Programs

- How many people have an active flushing program?
- What are your triggers for flushing?

Flushing- A Four Step Program

- Step 1 – Determining the appropriateness of flushing as part of a utility maintenance program
- Step 2 – Planning and managing a flushing program
- Step 3 – Implementing a flushing program and data collection
- Step 4 – Evaluating and revising a flushing program
Flushing – Step 1

Questions to determine the appropriateness of a flushing program
- Do you utilize unfiltered surface water?
- Do you utilize an undisinfected groundwater supply?
- Do you utilize a source of supply with elevated iron and/or manganese?
- Do you experience positive coliform or elevated levels of HPCs?
- Do you use chloramination?
- Have you implemented a treatment change that could affect water quality?

Flushing – Step 1 (continued)
- Do you experience frequent customer complaints?
- Do you have difficulty maintaining a disinfectant residual in parts of the distribution system?
- Does your system lack an aggressive valve/hydrant/tank exercise program?
- Is the water entering the distribution system considered to be corrosive?
- Does sediment accumulate in your storage facilities?

• If you answered “yes” to any of the questions, then a flushing program will provide water quality improvements
• If you did not answer yes to any of the questions, other maintenance procedures may be more advantageous for your system

Flushing – Step 2

• Determine flushing plan objectives
  – Planning is critical for obtaining water quality objectives and minimizing costs
  – Need to consider both WQ considerations and hydraulic/maintenance considerations
• Determine flushing approach
  – Unidirectional
  – Conventional
  – Continuous blow-off
Conventional Flushing

- Most commonly used technique
- Implemented with minimal pre-design
- Consists of opening hydrants in the DS until specific criteria are met
  - Disinfectant residual
  - Reduction of color
  - Turbidity reduction
- **Consider hydrant location** to assure you don’t pull poor quality water into otherwise good quality areas… especially if flushing for nitriﬁcation remediation.
- Since isolation valves are not used, *flushing velocities are not maximized*

Conventional Flushing (Reactive)

- Primary water quality improvements
  - Restoration of disinfectant residual
  - Expulsion of some of the poor water quality in specified areas of DS
- Conventional flushing drawbacks
  - Customer complaints during and immediately after flushing events
  - Wasted water
  - Minimal improvements to overall water quality
  - Short lived WQ benefits
  - Potential for increased Coliform occurrences
  - Disposal of chlorinated water into watercourse

Unidirectional Flushing

- Performed by isolated sections of the DS
- Can be implemented system wide or on a “where-needed” basis
- Velocity dependent
  - $< 3$ ft/sec - remove silt, sediment, and reduce disinfectant demand
  - $> 5$ ft/sec - promote scouring, remove biofilm, loosen deposits and reduce disinfectant demand
  - $< 12$ ft/sec - remove sand from inverted siphons
Pipe Size, Flow and Velocity

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Unidirectional Flushing (Proactive)

- Operate valves
  - Allows for simultaneous implementation of preventative maintenance procedures of valves and hydrants
- Uses less water than conventional flushing
- Provides performance baseline for comparison with future events
- Reduces trouble-shooting efforts

Unidirectional Flushing

WTP — Storage Tanks
Unidirectional Flushing Guidelines

- Notify customers ahead of time
  - Pay special attention high need customers (hospitals, dialysis patients, restaurants, etc.)
- When possible perform late at night to avoid service disruptions
- Use diffusers and hoses to avoid property damage
- Water should originate from areas that have already been flushed
  - Start from the source and work outward

- A larger main should not be flushed from a smaller main due to flow and velocity restrictions
- Keep pipe lengths as short as possible to maximize velocity; use valve where appropriate
- If gate valves are used for isolation - they should be reopened prior to closing the hydrant.
  - This will remove slugs of water that are trapped behind the valve
- Maintain pressure above 20 psi
Unidirectional Flushing Optimization

- The keys to optimizing flushing programs
  - Plan ahead using as much information as is available
  - Collect and analyze data during flushing and use it to improve the plan during the next flushing event

Continuous Blow-Off

- Used in parts of distribution system that have known stagnation or circulation issues
- Typically velocities are \( \leq \) 1 ft/sec
- Can help restore or maintain disinfection residuals and reduce water age
- Can result in significant water loss
- Does not address source of water quality issues

Continuous Blow-Offs
Step 3 – Implementing a Flushing Program and Data Collection

• Identify loops - Flushing should be conducted from the source to the periphery of the DS and from larger pipes to smaller. A loop should be able to be flushed during one work shift.
• Determine flushing velocities - For thorough scouring, pipe velocities should be targeted @ 6 ft/sec
• Develop step-by-step procedures - Include detailed instruction for sequencing of valve and hydrant opening and closing

Step 3 – Implementing a Flushing Program and Data Collection

• Complete a trial run
  – Verify the crew is prepared and can respond to unforeseen challenges
• Conduct flushing program
  – Ideally program is conducted during off-peak hours to minimize service disruptions
  – Have safety protocol in place
• Data collection
  – Baseline
  – During flushing
  – Post flushing

Step 4 – Evaluating and Revising Program

Ask the following questions after flushing is complete
  – Were water quality objectives met?
  – What are the estimated costs/savings of the program?
  – Were there any positive secondary impacts of the program?
  – Were there any negative secondary impacts of the flushing program?
How to Flush a Hydrant – Opening and Closing

• Open and close hydrants (and valves) **SLOWLY** to prevent surges
  – For a velocity change of 1 ft/sec, a 50 to 60 psi pressure rise can be expected
• Open hydrant valves completely to prevent water from discharging through the barrel drain
  – This could undermine the hydrant support
  – This will also impact WQ if sampling from a partially open hydrant

How to Flush a Hydrant – Opening and Closing

• Restrain flow dissipaters to limit damage to property
• Discharge water directly to sewer when possible to prevent flooding
  – If not possible redirect traffic and use signage as necessary
• When is dechlorination appropriate?

How long to flush?

• Depends on the objective of flushing
• Sample water frequently until the objective is reached
  – Turbidity reduction
  – Color reduction
  – Chlorine residual increase
• Record the time of flushing to estimate the amount of water used
Hydrant Safety

• Use caution
  – Force of water
  – Objects may be in pipes (rocks, bolts …)
  – Make sure all attachments are on tight
  – Don’t stand in front of the attachments
• Be wary of traffic concerns
• If diverting to sewer with a hose, watch out for a cross connection
• Water hammer

Public Notification

• Notify the public for any flushing event
• Coordinate with Fire Department … two birds with one flush!
  – Flushing is seen by some as a waste of water
  – Important to let the public know why flushing is conducted
  • Improve water quality
  • Part of distribution system maintenance
  • Decrease reliance on chemical treatment and chemical use within the distribution system
  • Improve system hydraulics
  • Etc.

Resources

• AWWA Video – Unidirectional Flushing
• AWWA Water Distribution Operator Training Handbook
• AWWA Water Distribution Systems Handbook
• WRF Report: Guidance Manual for Maintaining Distribution System Water Quality
  – http://www.waterrf.org/Pages/Projects.aspx?PID=357
Questions?