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## Flushing Tips: Implementing Unidirectional Flushing Program



### How to Implement a Unidirectional Flushing Program and Improve Your Efficiency, Conservation

By [Lara Kammereck & Dan Reisinger](#)

Unidirectional Water Main Flushing (UDF) is increasingly used across North America to improve operations, enhance the water system and improve service standards. Water main flushing has long been considered an effective method to remove unwanted tastes, odors or discolorations of the water, and to improve chlorine residual. UDF, a specific type of water main flushing, provides greater cleaning and uses less water than conventional flushing. This article focuses on the implementation of a UDF program, and implementation considerations are discussed for program planning and field activities.

## Conventional Flushing

The conventional flushing method consists of opening hydrants in the different targeted areas and discharging the water until the accumulations are removed and the water becomes clear. This method of flushing is easily conducted by maintenance and operations crews, but requires a large amount of water and may not completely clean the pipe network. The graphic in Figure 1 shows how the water flows to an open hydrant, using the conventional flushing method. The water moves freely from all directions to an open hydrant. Since there is no flow in a given pipe, velocities may be too low to adequately clean, or scour, the pipes.

## Unidirectional Flushing

UDF isolates each pipeline to create flow in a single direction to quickly and efficiently clean the pipe. By concentrating flow, UDF creates higher velocities that are better able to clean the pipe. The cleaned mains may have improved water clarity or color, reduced turbidity and improved chlorine residual. The graphic in Figure 2 shows how the water flows through an isolated pipeline in a single direction, by closing valves and using specific hydrants. The major advantages of this method are improved cleaning of accumulated deposits on pipes, less required water than conventional flushing, and an impact reduction for customers.

By using less water, UDF can be an important component of a water use efficiency or conservation program. UDF is typically performed in a set sequence to make sure a clean source of water is always used. In general, flushing should begin from a clean water source and flush from larger to smaller pipes. Flushing pipe length is limited to maintain efficient and safe execution, typically to approximately 1,500 ft. Minimum pressures should be maintained within the system at all times.

The major disadvantage of UDF is the planning needed to develop the flushing program, as well as additional crew time that is necessary to inspect the required valves and hydrants prior to the flushing. It may also require more hydrants to be flushed than in a conventional program. However, the increased crew time may be offset by utilizing UDF activities as part of valve exercising and hydrant testing programs.

## Creating a UDF Program – What’s Next?

A UDF program should be well planned prior to implementation to help establish safe conditions for operators and the public and maintain service to customers. There are a number of reliable resources available for designing a UDF program, including “Courtesy Flush: Implementing a Unidirectional Flushing Plan to Reduce Water Use and Improve System Operation” (Water Finance & Management, 2014). Planning can also help re

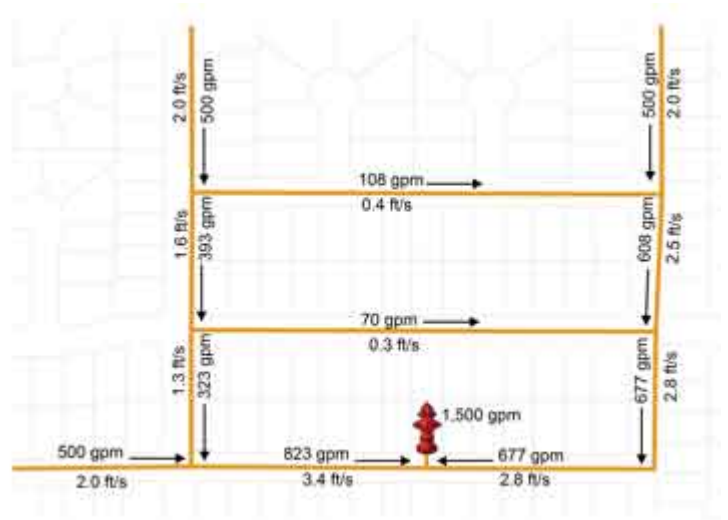


Figure 1: With conventional flushing, water flows freely from all directions to an hydrant.

time-consuming changes to flushing sequences in the field.

## Tip 1: Early Review

To aid in UDF planning and implementation, it is recommended to have early review by appropriate staff to identify and mitigate issues in planning. UDF activities will likely require cooperation of multiple departments, agencies and customers, including stormwater, traffic, fire department and critical customers.

Critical customers may include hospitals, medical and dental offices, industrial sites, laundromats and customers with special needs.

## Tip 2: Timing of Flushing

Flushing activities are commonly completed during regular operating hours; however, customer constraints require many utilities to flush portions of their distribution system after hours. It is important to identify the critical customers during planning, as changes in the order of UDF sequences may delay or slow field activities. The relatively short duration of UDF, as compared to conventional flushing, may reduce the impact to critical customers and areas that are sensitive to utility activities.

## Tip 3: Electronic Planning Tools

Electronic tools and hydraulic modeling are not required to create a UDF plan; however, CAD, GIS, and hydraulic models can aid in the efficient creation and implementation of a UDF program. Commercial water distribution modeling software have created UDF-specific tools to aid in the setup of UDF sequences and produce “field-ready” output. This field-ready output can aid in implementing the program by providing expected flushing duration and flow rate, as well as a standard form to record field observations.

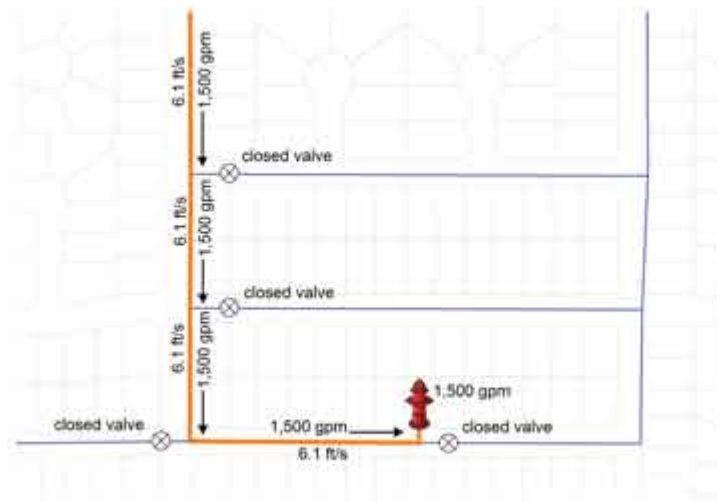


Figure 2: With unidirectional flushing, water flows through an isolated pipeline in a direction by closing valves and using specific hydrants.



Limited stormwater conveyance and subsequent ponding may require traffic control beyond that required for operator safety. Courtesy of Susan Fenhaus

## Implement A UDF Program: What Are You doing?

Public outreach may be the largest effort for many utilities, outside of the flushing itself. It is common for customers to be curious about flushing activities. Temporary unwanted discolorations, tastes and odors from water pipeline accumulations are conveyed during the cleaning, and this may alarm some customers. The duration and changing location of UDF activities can make outreach challenging. Unlike standard construction projects that have a defined location and duration, UDF activities move through many areas varying from a day to a week. This may impact individual customers for a day or just an hour. Given these challenges, utility staff will likely need to conduct public outreach, both before and during flushing activities.

Leading up to flushing activities, common outreach activities — such as website content, newspaper article and ads, and billing inserts — are excellent ways to educate customers on flushing activities and provide advanced notice of activities.

During flushing activities, flushing crews and customer service staff are likely to receive customer concerns and questions. It is important that they are prepared to answer questions or direct customers to appropriate staff. Targeted day or week of outreach can help reduce customer inquiries, which may include the use of door hangers, street placards or sandwich boards, press releases and electrical communication (i.e. email/text/radio call (reverse 911)). Utility staffs' experiences with customers are key to determining the best methods to reach customers.

In addition to outreach, direct communication with critical customers, and those with special needs, will likely be needed to make sure they are not adversely impacted by flushing.

## Flushing Activities

UDF field activities are very similar to conventional flushing, with the major difference being the opening and closing of valves after each flush. Industry standard and utility best practices should be followed to encourage safe and effective activities. Numerous publications are available to assist in developing or reviewing procedures before hydrant flushing, including the American Water Works Association (AWWA) Manual M17: Installation, Field Testing, and Maintenance of Fire Hydrants (AWWA, 2010) and National Fire Protection Association (NFPA) 291: Recommended Practice for Fire Flow Testing and Marking of Hydrants (NFPA, 2016).

### Activity 1: Mobilization and Setup Activities

UDF mobilization and setup activities are similar to conventional flushing. Opening and closing of valves to support UDF will likely require a longer setup period; however, this time may be offset by shorter flushing duration of flushes. Several key mobilization and setup activities to consider are:



Visual inspection or measurements, such as turbidity, should always be used to confirm that water quality has been restored before ending the flushing sequence. Courtesy of

Susan Fenhaus

Identifying stormwater and drainage that can be used to manage discharge of flushed water to avoid local flooding. De-chlorination may be required if discharge is entering a water body.

Establishing traffic control for the safety of operators and drivers. Limited stormwater conveyance and subsequent ponding may require traffic control beyond that required for operator safety. In addition, traffic control may be required at open/close valve locations.

Maintaining direct contact with critical customers sensitive to water quality or pressure changes.

Notifying the fire officials of UDF activities, which may limit available fire flow due to closed valves or active flushing.

Institutional knowledge of utility staff is often useful in identifying and mitigating major operational challenges before going out to the site. However, crews should be prepared to address a variety of conditions in the field. For example, a clogged storm drain may unexpectedly limit stormwater conveyance.

## **Activity 2: Flushing and System Impacts**

The increased cleaning power of UDF can result in temporary reductions in water quality and service pressure. Operators should expect:

- Initial water discoloration that clears during the flushing
- Sand and other particulates
- Temporary lower pressure
- Water on streets and/or parking lots

Visual inspection or measurements, such as turbidity, should always be used to confirm that adequate water quality has been restored before ending the flushing sequence.

## **Activity 3: Field Observations**

Field observations during flushing provides valuable information for future flushes. Records should include site requirements (traffic control, stormwater control, etc.), the flushing time, hydrant flow, velocity and pressure.

Documenting site requirements aid in planning and mobilization for future flushes. Comparison of system conditions in future flushes can help identify potential issues, such as open valves. Similarly, if hydraulic modeling was completed, this recorded field observation can be used to confirm the initial flush assumptions and planning considerations.

If changes or additional sequences are required, the updated field information will provide great value for future programs.

## **Activity 4: Site Restoration and Cleanup Activities**

UDF activities typically require additional site restoration and cleanup activities, as compared to conventional flushing. UDF may create a “dirtier” site than conventional flushing due to the discharge of sand and other particulates. In addition, flushing crews will need to open all valves at the completion of daily activities.

# Post Flushing Maintenance

During UDF activities, flushing crews will likely encounter infrastructure requiring maintenance, such as a valve. Crews should be prepared to make minor repairs and request a work order, if necessary.

The first time UDF is conducted, flushing crews will likely identify areas where existing records and mapping is inaccurate. The correct configuration of the distribution system should be recorded and used to update system maps, maintenance cards, and/or the Geographic Information System (GIS) data.

Unidirectional Water Main Flushing provides many benefits to water utilities. UDF provides greater cleaning uses less water than conventional flushing. It can remove unwanted tastes, odors, or discolorations of the water, and to improve chlorine residual, similar to standard flushing. Implementing a UDF program will enhance the system's performance while being a good steward and improving water use efficiency.

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