

# Sample Flushing and Disinfection Plan

## General

Flushing and chlorination will be performed on the entire 10,200 feet of combined 24” and 30” water main. Of this total length, 7600 ft is 24” and 2600 feet is 30”. An 8” blow-off with a control valve will be used on the west end of the project for flushing and flow control during disinfection. Flushing will be performed by opening the valve on the tee at 14<sup>th</sup> and Fletcher. Chlorinated water will be introduced under pressure through a 2” welded flanged opening near this same tee fitting. Water for mixing the chlorine solution will be obtained from a nearby hydrant and mixing will occur in a 3500 gallon water tanker. All water will be metered or measured to obtain the correct chlorine concentration to be added to the water main. Chlorine shall be liquid sodium hypochlorite in a 12.5% chlorine solution.

## Flushing Procedure

See Figure 1 below. It has been determined that a flushing velocity of 2 ft/s combined with a volume of water equal to two (2) pipe lengths is sufficient for pre-flushing of the entire length of the water main. The discharge rate was calculated using an equivalent pipe diameter of 26” to account for the two pipe sizes that make up the total length of pipe. To obtain this velocity, the control valve should be opened so that water will discharge approximately 10 feet from the end of the 8” discharge pipe onto a steel plate or other surface to prevent erosion. The discharge pipe will be 4’ (48”) above the ground surface. The pipe will be flushed for a time period of 170 minutes (2 hours and 50 minutes) in order to flush two pipe volumes of water.

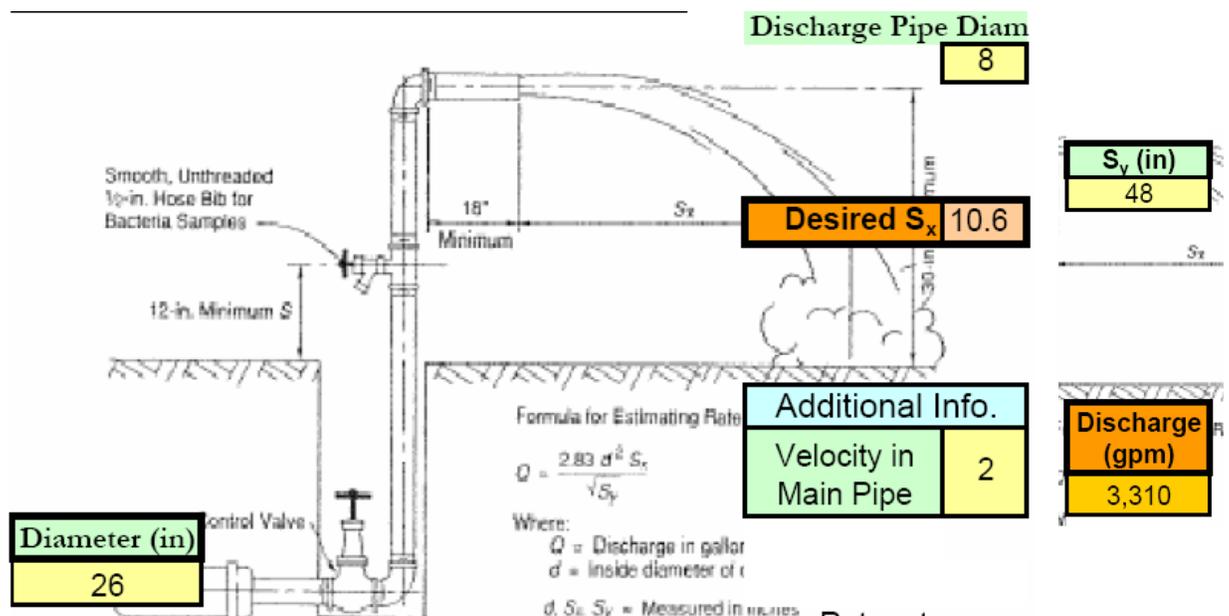


Figure 1.

## Chlorination Procedure

See Figure 2 and Figure 3. A chlorine slug with a length of 500 feet will be introduced into the 30” pipe at a concentration of 100 – 150 parts per million. To create this concentration, a total of 17.5 gallons of sodium hypochlorite with 12.5% available chlorine is to be mixed with 17,500 gallons of water. For this volume, a total of five (5), 3500 gallon tanker loads of chlorine solution will be required using 3.5 gallons of sodium hypochlorite per tanker load. The Contractor should sample each tank to confirm required chlorine concentration of 100 ppm – 150

ppm. To ensure that contact time is maintained during the initial filling of the chlorine slug, the cycle time for each tanker truck shall be no more than 35 minutes including discharge and refilling time.

To ensure that all parts of the water main will be exposed to the chlorinated water for a period of not less than 3 hours, a discharge rate of no more than 97 gpm (1.6 gallons per second) shall be maintained. At this rate, the time to complete disinfection of the entire pipe length will be 47 hours. The discharge rate shall be determined using volume over time measurements with a calibrated container.

## Slug Method

Measured Quantities	
Pipe Length (ft)	2600
Slug Length (ft)	477
Desired Concentration ppm	150
Contact Time (min)	180
Percent Chlorine of NaOCl	12.5%
Available Cl per tablet Ca(OCl) <sub>2</sub>	65%

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Main Pipe Diameter (in)	Maximum Blow off Discharge (gpm)	Maximum Blow off Discharge (gps)	Velocity of Slug (ft/s)	Volume of Tank/Slug (gallons)	*Time to Complete Disinfection (hrs)	Total Chlorine Needed for Desired Concentration (lb)	**NaOCl at % Chlorine (gallons)	Ca(OCl) <sub>2</sub> (lb)
30	97.3	1.62	0.044	17,515	16.4	21.93	17.53	33.73

Change Diameter to Desired Width

\*\*Assumes the specific gravity of Na

\*Note: Neutralization will need to begin 3 hours (or other desired contact time) before the time to complete the disinfection

Figure 2. Slug Method for 30 inch pipe.

## Slug Method

Measured Quantities	
Pipe Length (ft)	7600
Slug Length (ft)	745
Desired Concentration ppm	150
Contact Time (min)	180
Percent Chlorine of NaOCl	12.5%
Available Cl per tablet Ca(OCl) <sub>2</sub>	65%

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Main Pipe Diameter (in)	Maximum Blow off Discharge (gpm)	Maximum Blow off Discharge (gps)	Velocity of Slug (ft/s)	Volume of Tank/Slug (gallons)	*Time to Complete Disinfection (hrs)	Total Chlorine Needed for Desired Concentration (lb)	**NaOCl at % Chlorine (gallons)	Ca(OCl) <sub>2</sub> (lb)
24	97.3	1.62	0.089	17,508	30.6	21.92	17.52	33.72

Change Diameter to Desired Width

\*\*Assumes the specific gravity of Na

\*Note: Neutralization will need to begin 3 hours (or other desired contact time) before the time to complete the disinfection

*Figure 3. Slug Method for 24 inch pipe.*

### **Monitoring and De-chlorination**

The discharge will be monitored during the chlorination process. The heavily chlorinated water will be completely neutralized in a stock tank using ascorbic acid to allow for sufficient mixing time to reduce the toxicity of the water to a safe level for humans and wildlife.

Discharge will be continuously monitored using a suitable chlorine analyzer. Flow rate and chemical feed shall be adjusted to fully neutralize the chlorine. The inlet into the mixing tank shall be located at the bottom of the tank and directed to promote suitable mixing. If necessary, baffling shall be provided to ensure adequate mixing and contact time.

### **Sample Collection**

Contractor should take samples for bacteriological testing in accordance to proper collection, sampling and handling procedures and then deliver them to the Nebraska Health and Human Services Laboratory.

### **Erosion Control**

Erosion control measures will be in place to satisfy all parties. Ditch capacities and all private property in contact with the discharge flows should be investigated to ensure prevention of erosion and other harmful effects of the large quantities of water. Notification shall be made with Gary Lacey of the Public Works and Utilities Department for determining if other restrictions or requirements are necessary.