

**Disinfection Plan  
Newly Constructed Potable Water Mains  
Continuous Feed Method  
(Up to 16" Diameter)  
Dublin San Ramon Services District**

**NOTE: DISINFECTION PROCESS REQUIRES A MINIMUM OF SIX WORK DAYS.**

<b>Project Name/Tract Number:</b>	
<b>Permit Number:</b>	
<b>Developer:</b>	
<b>Engineer of Record:</b>	
<b>Contractor:</b>	
<b>DSRSD Inspector:</b>	
<b>Prepared By:</b>	
<b>Email Address of Preparer:</b>	
<b>Preparer's Telephone No.:</b>	
<b>Estimated Start Date:</b>	

With the submittal of this plan, include a copy of affected waterline sheets. Make sure sheets include the waterline stationing and show callouts for appurtenances. Please include all backup documentation (See Section 11-B) to support the chlorination and de-chlorination chemicals. Inspections will not begin until entire Disinfection Plan has been approved by DSRSD.

If the total length of the connection from the end of the new main to the existing main is equal to or less than 20ft, see section 10A.

**Estimated Capacities** (Include all pipe, including fire hydrant laterals)

\_\_\_\_\_ LF    \_\_\_\_\_ Inch Waterline    Capacity \_\_\_\_\_ gallons  
 \_\_\_\_\_ LF    \_\_\_\_\_ Inch Waterline    Capacity \_\_\_\_\_ gallons  
 \_\_\_\_\_ LF    \_\_\_\_\_ Inch Waterline    Capacity \_\_\_\_\_ gallons  
 \_\_\_\_\_ LF    \_\_\_\_\_ Inch Waterline    Capacity \_\_\_\_\_ gallons

**Section 1  
Preparation**

**Section 1-A - Preventative and Corrective Measures during Construction**

Proper precautions shall be taken to ensure the pipe remains clean and dry during construction including but not limited to those preventative and corrective measures indicated in section 4.8 of AWWA C651-14.

**Section 1-B - Measurement of Water used in Disinfection Process**

All water used in the process shall be measured. Measurement shall be accomplished by utilizing a temporary construction meter. The contractor shall follow DSRSD Standard I-D1-7 Construction Water Supply where applicable to their project location.

**Section 1-C - Water Supply**

Water shall be supplied through a temporary construction meter equipped with an approved and tested backflow device.

**Section 2  
Discharge**

Discharge shall be within 20 feet of end of new main at the following location(s)  
Attach additional sheets as required to show discharge location.

- Existing or new fire hydrant Station \_\_\_\_\_
- Existing or new Service Station \_\_\_\_\_ Size \_\_\_\_\_
- Blow-off Assembly at Station \_\_\_\_\_

**Section 3  
Hydrostatic Testing**

Hydrostatic testing shall be completed prior to preliminary flushing and disinfection of the main. Testing must be witnessed by DSRSD designee.

**Witnessed by: DSRSD Inspector** \_\_\_\_\_ **Date** \_\_\_\_\_

**Section 4  
Preliminary Flushing**

Preliminary flushing shall be performed after installation and before disinfection to remove particulates. The flushing velocity goal is 5.0 fps but shall be no less than 3.0 fps. Flow rate must be demonstrated to DSRSD designee.

Flow rate to achieve 3.0 fps \_\_\_\_\_ gpm  
 Flow rate to achieve 5.0 fps \_\_\_\_\_ gpm  
 Capacity of new water mains \_\_\_\_\_ gallons  
 Estimated Water Volume to be flushed \_\_\_\_\_ gallon  
 Estimated time for preliminary flushing \_\_\_\_\_ Hours/minutes

Witnessed By: DSRSD Inspector \_\_\_\_\_

Date \_\_\_\_\_

**Section 5  
Continuous Feed Disinfection**

**Section 5-A - Chlorine**

**Table 1.** Amounts of chemicals required to neutralize various residual chlorine concentrations in 100,000 gallons of water. User should confirm required dosage with chemical supplier.

Desired Chlorine Concentration In Water mg/L	Liquid Chlorine Required lb	Sodium Hypochlorite Required				Calcium Hypochlorite Required
		5% Available Chlorine gal	10% Available Chlorine gal	15% Available Chlorine gal	65% Available Chlorine lb	
2	1.7	3.5	1.7	1.2	2.6	
10	8.3	17.1	8.5	5.7	12.8	
25	21.0	43.2	21.6	14.4	32.0	
50	42.0	86.0	43.0	28.7	64.0	

Sodium hypochlorite or calcium hypochlorite solution conforming to ANSI/AWWA B300 and NSF 61 containing approximately 5 to 15 percent available chlorine.

Type of Chemical to be used \_\_\_\_\_

Available chlorine by volume \_\_\_\_\_ %

Manufacturer \_\_\_\_\_ (provide SDS)

Pipe Capacity \_\_\_\_\_ gal

Quantity of Chlorine feed \_\_\_\_\_ gal or lb

**Section 5-B - Chlorine Injection**

A chlorine injection point shall be located not more than 10 feet downstream of the temporary flushing connection.

Chlorine Injection point shall be through, select one:

Temporary construction jumper at Station \_\_\_\_\_

OR

New Water Service at Station \_\_\_\_\_

Water entering the new main shall receive a dose of chlorine fed at a constant rate such that the water has been chlorinated to 25 mg/L (ppm) of free chlorine. Chlorine shall be measured at regular intervals in accordance with the procedures described in the current edition of *Standard Methods for the*

Examination of Water and Wastewater or AWWA Manual M12, or using appropriate chlorine test kits. Appropriate methods include DPD Drop Dilution Method or High-Range Chlorine Test Kits. Chlorine application shall not cease until the entire main is filled with chlorinated water to 25 mg/L of free chlorine. **If multiple discharge locations are being used, please provide a sequence of chlorination and dechlorination that describes when valves and end of line locations will be opened and closed so that all pipe sections receive the required amount of chlorine.**

**Sequence (if applicable)**

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**Section 5-C - Disinfection of Appurtenances**

Disinfection of appurtenances shall occur while new main is chlorinated (using water dosed as indicated in Section 5.B) by operating all valves, hydrants, and service connections to ensure contact with the chlorinated water.

**Appurtenances**

Sta	Description	Operated (Check when operated)
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**Section 5-D - Retain Super-Chlorinated Water**

Retain super chlorinated water in the main for 24 hours. At the end of holding period, the treated water in all portions of the main shall have a residual of not less than 10 mg/L (ppm) of free chlorine. Chlorine residuals must be verified by DSRSD designee.

**Witnessed by DSRSD Inspector:** \_\_\_\_\_ **Date** \_\_\_\_\_

**Section 6  
Final Flushing**

After the applicable retention period, chlorinated water must not remain in prolonged contact with pipe beyond 24-hours. Chlorinated water shall be flushed from the main, fittings, valves, and branches until chlorine measurements show that the concentration in the water leaving the main is no higher than that generally prevailing in the distribution system. A minimum of one times the volume of water in the new pipe shall be flushed.

**Flow rate for final flushing = \_\_\_\_\_ gpm \_\_\_\_\_ fps**  
**Amount of discharge water anticipated for final flushing = \_\_\_\_\_ gallons**  
**Estimated time for final flushing = \_\_\_\_\_ minutes**

**Section 7  
De-Chlorinating and Disposing of Background Chlorinated Water**

All background chlorinated water (3.0mg/L or less) discharged during this procedure shall be dechlorinated and disposed of properly as described below.

**Section 7-A – De-Chlorination Chemical**

Dechlorination chemicals of food grade quality shall be used to dechlorinate all water discharged from the system adequately to result in no detectable chlorine residual when measured by an appropriate low level chlorine test kit before the water reaches the curb inlet, wastewater manhole, receiving streams or wetlands.

User should confirm required dosage with chemical supplier, water leaving the new main shall receive a dose of the de-chlorination chemical fed at a constant rate.

**Table 2.** Amounts of chemicals required to neutralize various residual chlorine concentrations in 100,000 gallons of water (AWWA C655-09).

Residual Chlorine Concentration Mg/L	Calcium Thiosulfate (CaS2O3) gal	Sodium Thiosulfate (Na2S2O3-5H2O) lb	Ascorbic Acid (C6O8H6) lb	Sodium Bisulfite (NaHSO3) lb	Sodium Sulfite (Na2SO3) lb
1	0.34	1.2	2.1	1.2	1.4
2	0.67	2.4	4.2	2.5	2.9
10	3.36	12.0	20.9	12.5	14.6
25	8.4	30.0	52.0	31.3	36.5
50	16.8	60.0	104.0	62.6	73.0

The residual chlorine concentration in the water leaving the main shall be measured at regular intervals using appropriate chlorine test kits to ensure it does not exceed .01mg/L

Chlorine Concentration prior to Dechlorinating \_\_\_\_\_ mg/L  
Pipe Capacity \_\_\_\_\_ gallons  
Type of Chemical \_\_\_\_\_  
Brand/Manufacturer \_\_\_\_\_ (submit SDS)  
Chemical quantity required \_\_\_\_\_ lb

**Section 7-B - Discharge/Disposal**

Optional discharge methods are indicated below in order of preference: **Check one.**

- Wastewater Manhole – May be transported by hose to wastewater manhole subject to written approval from DSRSD/CCCSD. An air gap must be maintained between the discharge end of the hose and the manhole.
- Passive Storm Detention/Retention Pond – May be transported by hose to storm sewer inlet which discharges to a detention pond or retention pond with an isolation mechanism approved by DSRSD. An air gap shall be maintained between the discharge end of the hose and the inlet.
- Active storm drain connected directly to nearest waterway.

**NOTE: AIR GAP REQUIRED AT DISCHARGE POINT.**

Beneficial reuse:

Dechlorinated water shall be transported from discharge point at Station \_\_\_\_\_ to sanitary sewer manhole at Station \_\_\_\_\_ via \_\_\_\_\_ LF fire hose.

**Total Estimated** gallons to be discharged from disinfection and flushing operation \_\_\_\_\_.

**Flow Rate** into sanitary sewer manhole \_\_\_\_\_ gpm.

Storm drain disposal - Dechlorinated water shall be transported from discharge point at Station \_\_\_\_\_ to storm drain inlet at Station \_\_\_\_\_ via \_\_\_\_\_ LF fire hose.

**Total Estimated** gallons to be discharged from disinfection and flushing operation \_\_\_\_\_

**Flow Rate** into storm drain inlet \_\_\_\_\_ gpm.

Storm drain discharges into water quality pond located at (describe) \_\_\_\_\_.

**Total Estimated** gallons to be discharged from disinfection and flushing operation \_\_\_\_\_

**Flow Rate** into storm sewer inlet \_\_\_\_\_ gpm.

**Section 8**  
**Bacteriological Tests (Bac-Ts)**  
**(Presence/Absence and HPC Methods)**

After approved disinfection and final flushing is completed, bacteriological samples shall be collected by DSRSD no sooner than 24-hours after completion of the final flushing process. Before approving of a water main/system for release, both the initial Bac-T and confirming test results must pass. Sampling and analysis process takes a minimum of 48-hours for completion. **Loss of pressure or dewatering of any portion of the main at any time during the disinfection process can/will result in a cancellation of current sequence and restart back to the preliminary flushing phase.**

- **Sample Locations.** As a minimum, at least one set of samples shall be taken from the end of the line(s), from each branch greater than one pipe length, and at intervals not to exceed 1200 feet of the new main. If there is reason to believe that trench water has entered the new main during construction or if, in the opinion of DSRSD, excessive quantities of dirt or debris have entered the main, the DSRSD representative may require samples be taken at intervals of approximately 200 feet.

Sample Locations (List by Station and Description). Attach additional sheets if required.

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- **Procedure** - No hose shall be used in the collection of samples. Use of a combination blow-off assembly/sampling tap is recommended. Samples shall be collected by DSRSD personnel in sterile bottles treated with sodium thiosulfate.
- **Sample results** – If initial samples produce acceptable results, a confirming set of samples will be initiated no sooner than 24-hours after receipt of lab analysis results. **CAUTION:** NO flushing shall be allowed between sampling except as needed to flush the sampling port.  
 If sample results indicate a failed Presence/Absence or measured HPC greater than 500 colony-forming units (cfu) per mL, the water main/system shall be deemed to have failed the test. Additional flushing shall be conducted and a second set of samples will be taken for analysis.
- **Re-disinfection** – If two successive sets of passing samples cannot be achieved, the new main must be re-flushed, re-chlorinated and re-sampled. The main shall be rechlorinated by continuous feed method (As described in Section 5-B) until satisfactory results are obtained.

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**Date/Time 1<sup>st</sup> Samples Collected** \_\_\_\_\_ **Pass/Fail**  
**Date/Time 2<sup>nd</sup> Sample Collected** \_\_\_\_\_ **Pass/Fail**

## **Section 9 Removal of Temporary Connections**

After satisfactory bacteriological sample results have been received, all temporary connections installed for this procedure (temporary connections, temporary injection point, temporary flushing devices) must be appropriately cut and plugged at the water main in the presence of a DSRSD Inspector.

## **Section 10 Connection to Existing Mains**

After satisfactory bacteriological sample results have been received, permanent connections may be made in the presence of a DSRSD Inspector to the active distribution system. Existing customers affected by a shutdown for final connection to new water main/system must be notified 72-hours in advance.

Sanitary construction practices must be followed during the connection process to prevent contamination of the new or existing water main.

### **Section 10-A - Connection of pipe length less than or equal to 20 feet**

New pipe, fittings, and valves required for the connection must be spray-disinfected or swabbed with a minimum of 1 percent solution of chlorine just prior to being installed and in the presence of a DSRSD Inspector.

### **Section 10-B - Connection of pipe greater than 20 feet**

Pipe required for the connection must be set up above ground, disinfected, and bacteriological samples taken as described in Section 8. After satisfactory bacteriological sample results have been received, the pipe can be used in connecting the new main to the active distribution system. Between the time satisfactory sample results have been received and the time that the connection piping is installed, the ends of the pipe must be sealed with plastic wraps, watertight plugs, or caps.

## **Section 11 Scheduling**

### **Section 11-A – Plan Approval Timeline**

Completed flushing/disinfection plans in their entirety will be reviewed by DSRSD staff for completeness and workability within a two-week period after submittal. After all required information is received and approved, DSRSD staff will notify the contractor and a start date can be scheduled.

### **Section 11-B - Plan Submittal**



Prior to the start of the pressure testing process, the Disinfection Plan, including all attachments, must be submitted for review and approval a minimum of two weeks prior to the requested pressure testing date. At a minimum, the following four items must be included and described in written format.

1. Water main preliminary flushing process.
2. Disinfection process.
3. Final flushing plan.
4. Final connection process.

### **Section 11-C – Inspection Requests**

A completed DSRSD Inspection Request Form is required a minimum of two working days before proposed date of pressure testing. Inspection requests for preliminary flushing, disinfection, final flushing and tie-ins shall be submitted by e-mail at least one work day in advance.

### **Section 11-D - Overtime**

From time to time overtime may be required to complete the overall process and receive final clearance of the newly installed system. For overtime request see DSRSD Standard Procedures, Specifications and Drawings Section I-B7 -2 Cost of Inspection and Testing.

### **Section 11-E – DSRSD Bacteriological Sampling Timeframe**

The timeframe for DSRSD collection of samples at the work site is from 8:30am to 3pm, Monday through Friday. Samples requested to be taken on Saturdays are subject to provisions of Section 11-D – Overtime. Samples collected on Saturdays must be within the hours of 8:00am and 11:00am.

Sampling by DSRSD staff must be completed no later than 3:00pm Monday through Friday. Samples requested to be taken on Saturday's are subject to provisions of Section 11-D-Overtime and must be drawn no later than 11:00am.

**Table 1: Velocity (fps) Conversion to Flow Rate (gpm)(Q=VA)**

Pipe size (in)	Velocity (fps)	Q (gpm)
1.5	1	6
1.5	3	17
2	1	10
2	3	29
4	1	39
4	3	118
6	1	88
6	3	264
8	1	157
8	3	470
10	1	245
10	3	734
12	1	352
12	3	1058
16	1	627
16	3	1880
24	1	1410
24	3	4230

**Table 2: Pipe Capacity (gallons)**

Pipe Dia (in)	Area (sf)	Volume Per 100 LF (cf)	Capacity Per 100 lf (gallons)
1.5	0.012272	1.23	9
2	0.021817	2.18	16
4	0.087266	8.7	65
6	0.19625	20	147
8	0.348888889	35	261
10	0.545415391	55	408
12	0.785	79	587
16	1.395555556	140	1,044
24	3.14	314	2,349
30	4.9087385	491	3,672
36	7.06858	707	5,288
42	9.621127502	962	7,196
48	12.56637061	1,257	9,400
54	15.90431281	1,590	11,894
66	23.7582944	2,376	17,772