

PUBLIC WATER SYSTEM FIELD OBSERVATION GUIDELINES

***FOR PROJECTS WITHIN THE
PARK CITY WATER SERVICE DISTRICT***



YEAR 2024

REV. 1

FORWARD

This manual provides information to assist the field representative in his duties of observing the progress and quality of public water line construction within the Park City Water Service District, Park City, Utah, and determining if the work is proceeding in accordance with *Park City Design Standards, Construction Specifications and Standard Drawings*. The information, checklists and procedures included in the manual are not all inclusive, but are intended to serve as guidelines for the performance of periodic construction observations, required sampling and testing observation by the field representative. **It is important that field representatives contact the Project Manager or the Park City Engineer for clarification if there are any questions related to the requirements of the Park City Design Standards, Construction Specifications, and Standard Drawings.**

DISINFECTING

All new water mains, services, and appurtenances shall be disinfected in accordance with AWWA Standard C651-05.

The method typically employed by the Contractor to disinfect new water distribution systems is to place calcium hypochlorite granules in the pipeline as it is being installed. Reference *Park City Design Standards and Construction Specifications*, Appendix 703A. The field representative should pay special attention to the following items:

- Refer to Table No. 1 of the above referenced Appendix for the number of ounces to be used per pipe diameter and pipe interval to achieve the necessary disinfection concentration.
- **Active chlorine content of disinfecting solution within water service tubing (CTS) for water services shall not exceed 12%.**
- Water mains shall be filled slowly to prevent "pushing" the calcium hypochlorite granules to one end of the pipe line. If the new water lines are to be filled by introducing water from the existing water distribution system, via opening the isolation valve between the two systems, the field representative shall monitor the opening of the valve. The field representative shall pay special attention to the following during water system filling by the Contractor:
 1. Verify that the static water pressure of the distribution system (typically 40 psi) is capable of overcoming the static head required to fill the new water line.
 2. Be certain a means of releasing air at the high point of the water system to be filled is provided and is open.
 3. The isolation valve shall be opened only slightly (**existing water system valves are to be operated only by Water Operations staff**).
 4. Listen for water passing the valve. The valve shall be closed immediately if it appears that the water pressures begin to equalize on each side of the valve. Backflow of chlorinated water into the existing water distribution system must not occur.
- After the water mains and services have been filled by the Contractor, the field representative shall sample and test the water for chlorine concentration. Observe the following:
 1. Select sampling frequency and locations to achieve representative samples. Typical locations for samples at water meter services, taps or fire hydrants. The sampling frequency will depend on length of the water line being chlorinated, availability of sampling points, and results of chlorination concentration tests.
- The field representative should observe the disinfection of the interior of all pipe, fittings, valves, tapping sleeves, and other materials when existing water mains are cut into or repaired. The Contractor can accomplish this by swabbing the materials with a hypochlorite solution. Reference *Park City Design Standards and Construction Specifications*, Appendix A.
- **Remember: Good disinfection practices improve the opportunity for successful bacteriological test results.**

WATER SYSTEM FLUSHING

Flushing of the installed water system is to be completed in two steps. The initial flushing is to be performed following installation and disinfection of the water main but prior to hydrostatic testing. The final flushing is to be performed following hydrostatic testing and leakage testing.

INITIAL FLUSHING

The following items should be considered by the field representative and may need to be reviewed with the Park City Engineer:

1. When notified that the Contractor intends to begin the initial flushing but before the Contractor utilizes water contact the Park City Water Department to be certain that water is available from the City for flushing purposes. **Inform the Contractor not to begin flushing without authorization (existing water system valves are to be operated only by Water Operations staff).**
2. Review with the Contractor the proposed discharge location for flushing operations and the method by which the Contractor intends to control the discharge of chlorinated water from the water system. **Fire hydrants are not acceptable points for initial flushing operations.**
Typically, Contractors will discharge the water into a water truck or tank and haul the water offsite for disposal. Chlorinated water shall not be allowed to be discharged in a manner that it could now onto vegetation or into streams, waterways, storm drains or sanitary sewer systems.
3. Determine the required diameter of opening(s) for discharge from the water line. The opening must be sized to achieve velocities capable of moving dirt and rock through the pipe, approximately **6 to 8 feet per second**. Note that required flowrate and opening size(s) referenced in AWWA Table 3 Required Flow and Openings to Flush Pipelines, is based on only 2.5 feet per second velocity at 40 psi pressure. *Required opening size will be determined based on site specific available water system pressure to achieve the required velocity.*
4. Determine the total volume of water to be expelled from the section of water system being flushed. The entire contents of the water line must be discharged and replaced with new water. To determine the volume required, ensuring that the entire pipe line has been flushed, utilize the following formula:
$$V = (\pi d^2 / 4) (L) (7.481); \quad \text{where: } V = \text{volume (gallons)}$$
$$\pi / 4 = \text{area}$$
$$d = \text{pipe diameter (feet)}$$
$$\pi = 3.141$$
5. If the section of water line to be flushed is very long, making the transport of sediment and rock to the discharge location may be difficult, an intermediate discharge location for flushing should be considered. *The end of a fire service line, prior to setting the hydrant, or a properly sized service tap could be utilized.*
6. After initial flushing has been completed, perform sampling and testing for "low" chlorination concentration.

FINAL FLUSHING

1. Utilize the same procedure for final flushing as for initial flushing, except that concerns regarding the chlorine concentration of discharge water do not apply.
2. Fire hydrants are to be flushed and can be utilized as flushing locations.
3. Services are to be flushed at the meter vaults. *Proper flushing of the service lines is important since water samples for bacteriological testing are typically taken at the service lines.*

Pipe Diameter inches	Flow Required to produce 2.5 ft/s (approx) velocity in main gpm	1	Size of tap inches 1-1/2 Number of Taps on Pipe#	2	Number of 2-1/2 in. Hydrant Outlets*
4	100	1	–	–	1
6	200	–	1	–	1
8	400	–	2	1	1
10	600	–	3	2	1
12	900	–	–	2	2
16	1600	–	–	4	2

*With a 40 psi pressure in the main with the hydrant flowing to atmosphere, a 2-1/2 inch hydrant outlet will discharge approximately 100-0 gpm and a 4-1/2 inch hydrant outlet will discharge approximately 2500 gpm.

HYDROSTATIC TESTING

Hydrostatic testing is required for every section of water main (valve to valve). Testing every section is intended to test both sides of isolation valves to ensure proper functioning of the valve. Prior to hydrostatic testing and leakage testing the water system should be flushed and tested for proper disinfection.

HYDROSTATIC TESTING

The specified hydrostatic test pressure is to be met at the highest elevation in the section of water line being tested. The specified test pressure shall be achieved by means of a Contractor supplied pump/gauge system connected to the pipe. The gauge shall have sufficient increments to enable accurate readings to be taken.

To achieve proper hydrostatic test pressure at the highest elevation of the water line section being tested, consider the locations available for installing the testing apparatus. To determine the required test pressure at the test gauge, utilize the following formula:

$$P_g = P_r + (H_v - H_g) / 2.31;$$

where: P_g = required gauge pressure reading (psi)
 P_r = required test pressure (psi)
 H_v = elevation at highest valve (feet)
 H_g = elevation at gauge (psi)

Note: 1 psi = 2.31 feet of elevation, or 0.43 psi X elevation difference in feet.

The following items should be considered and may need to be reviewed with the Park City Engineer:

- The possibility of requiring/requesting a water valve to be installed in the water main to reduce the pressure difference in the water line to be tested. This may occur when there is a significant difference in elevation between water valves;
- The installation of an additional service tap to accommodate proper testing.
- In achieving the required hydrostatic pressure at the highest elevation of the water line section being tested, the hydrostatic pressures at the lowest elevation may exceed acceptable pressures for the pipe, valves or fittings. Typically, if the calculated pressure at the lowest elevation exceeds 300 psi, the City Engineer should be notified before testing is performed.

HYDROSTATIC TESTING

The field representative shall perform all sampling for bacteriological testing and deliver samples to the Summit County Health Department (or a pre-approved state certified laboratory) for analysis. To achieve consistent and representative sampling, the following procedures shall be observed by the field representative:

- Select the location and number of samples to be taken. Samples are typically taken at water meter services and ends of the water line. Intervals of 200 feet between sampling locations is preferred.
- Procedures for obtaining samples for bacteriological testing of the water system are as follows:
 1. Obtain sample bottles from the Public Works Water Department office or Summit County Health Department, if not available in the office.
 2. When sampling, first disinfect or sterilize the discharge area.
 3. Open the control valve slowly and allow water to flow for a short period.
 4. Close the valve slightly to reduce the flowrate and fill the sample bottle to the fill line. Place the lid on the sample bottle and seal shut. Note: Be sure to identify the location of the sample bottle before obtaining other samples.
- After all samples are taken, complete the identification form and add other pertinent information to each sample bottle. Reference the sample identification form contained in the Report Forms and Checklists section of this manual. *Note: Pay special attention to Item No. 2, "Investigative Sample (not included on official records)" on the identification form. Always check this box on the form.*

TABLE 1 ALLOWABLE LEAKAGE PER 1000 FEET OF PIPELINE									
(gph)	Nominal Pipe Diameter (inches)								
Avg. Test Pressure (psi)	3	4	6	8	10	12	14	16	18
250	.36	.47	.71	.95	1.19	1.42	1.66	1.90	2.14
225	.34	.45	.68	.90	1.13	1.58	1.58	1.80	2.03
220	.32	.43	.64	.85	1.06	1.28	1.48	1.70	1.91
175	.30	.40	.59	.80	.99	1.19	1.39	1.59	1.79
150	.28	.37	.55	.74	.92	1.10	1.29	1.47	1.66
125	.25	.34	.50	.67	.84	1.01	1.18	1.34	1.51
100	.23	.30	.45	.60	.75	.90	1.05	1.20	1.35

*EXCERPTED FROM AWWA C600

In inch-pound units,

$$L = \frac{SD\sqrt{P}}{133,200}$$

Where,

- L = testing allowance (makeup water), in gallons per hour
- S = length of pipe tested, in feet
- D = nominal diameter of the pipe, in inches
- P = average test pressure during the hydrostatic test, in pounds per square inch (gauge)

This formula is based on a testing allowance of 11.65 gpd/mi/in. of nominal diameter at a pressure of 150 psi.

FIELD OBSERVATION REPORT FORMS AND CHECKLISTS

This section includes typical forms checklists that are to be used as generalized guidelines to assist in the verification of the material and dimensional requirements of the Park City Design Standards and Construction Specifications. Field Representatives are to utilize the checklists during water system construction to assist the Contractor in understanding the requirements of the final product and during the final walk-through to verify consistency with the standards and specifications. Additionally, the fire hydrant inspection forms, illustrating the placement of a fire hydrant in three different terrain conditions, are to be completed during the Final Walk-through to provide the Park City Engineer with information regarding the hydrant's installed elevation and location relative to the curb and gutter and the auxiliary valve.

FIELD OBSERVATION QUICK CHECKLIST

WATER LINE INSTALLATION:

- Verify that marking tape and locator wire is installed above the water main in the trench

- Verify that water main is bedded with approved gravel-sand material

- Verify that water main is installed at proper horizontal location (within pavement and inside of curb & gutter limits) and depth. Require additional survey staking be provided if necessary to determine design grades and curb & gutter alignment

- Verify that correct polyethylene encasement is provided and properly installed

- Verify that wax tape coating system is provided and properly installed on all buried bolts & nuts. Verify the cathodic protection system (if required) is provided and properly installed.

- Verify that thrust blocking is of adequate size, extended to undisturbed soil and that the pipe is wrapped with polyethylene before concrete is placed

- Verify that service taps are at 45 degrees to the main with 2 feet minimum separation

- Verify that every service corporation stop is open. This can be verified during flushing procedures

- Verify that water valves are properly set, valve boxes are clear of debris, and that a valve key can be placed on the valve. This must be verified during the final walk-through

FIELD OBSERVATION QUICK CHECKLIST

FIRE HYDRANT INSTALLATION:

- Verify that adequate gravel is placed around the fire hydrant base
- Verify that thrust blocking is properly placed and fire hydrant drain ports are not covered by concrete.
- Flush fire hydrant drain ports. Close main hydrant valve to the position at which the drains open and allow flow through the drains under pressure for about ten seconds to flush the drains. Then close hydrant valve completely.
- Check fire hydrant barrels for drainage. Remove nozzle cap, open hydrant valve, allow hydrant to run briefly and close hydrant valve. Place palm of hand over nozzle outlet. Drainage should be sufficient to create a suction.
- Check fire hydrant nozzle caps for thread damage from impact or cross threading
- Verify that the auxiliary valve is in the wide open position.
- Verify that fire hydrant markers are installed
- Verify that fire hydrant is properly extended above grade and hydrant pad is properly constructed. See *Fire Hydrant Inspection Sheet*.

FIELD OBSERVATION QUICK CHECKLIST

WATER METER INSTALLATION:

- Verify that meter service assembly materials are in accordance with Checklist. *See checklists for specific size water meter.*

- Verify that water meter box is adjusted to grade. *See meter box adjustment detail sheet.*

- Verify that water meter box is located properly. Require additional staking as required for verification.

TYPICAL PROCESS FOR WATER SYSTEM CONSTRUCTION

1. INSTALL WATER MAIN AND FIRE HYDRANTS
If the Contractor elects to perform hydrostatic testing of water services independently of the water main, Items 3, 5, 7 and 9 will be performed on the water main prior to installation of the water services.

2. INSTALL WATER SERVICES
If water services are installed after water main testing, the each services must be disinfected separately.

3. INITIAL FLUSHING OF WATER MAIN
Sampling and testing for "high" chlorine concentration is performed prior to initial flushing.

4. INITIAL FLUSHING OF WATER SERVICES

5. PERFORM HYDROSTATIC AND LEAKAGE TESTING ON WATER MAIN

6. PERFORM HYDROSTATIC AND LEAKAGE TESTING ON FIRE HYDRANTS & WATER SERVICES

7. FINAL FLUSHING OF WATER MAIN
Sampling and testing for "low" chlorine concentration is performed following final flushing.

8. FINAL FLUSHING OF FIRE HYDRANTS & WATER SERVICES

9. PERFORM BACTERIOLOGICAL TESTING

10. ALLOW ACTIVATION OF WATER SYSTEM
Permanent opening of isolation valves upon receipt of successful bacteriological test results.



WATER SYSTEM TESTING SUMMARY REPORT

PROJECT NAME _____ PROJECT # _____

CONTRACTOR _____

WATER SYSTEM SECTION _____

DISINFECTION: 703.2.12C & J

TYPE OF CHLORINE: GRANULAR INJECTION, WHERE: _____

SAMPLE LOCATION: _____

DATE TIME CHLORINE, PPM

START: _____

END: _____

RESULT: PASS FAIL INITIALS _____

DISPOSAL OF CHLORINATED WATER: _____

FLUSHING: 703.2.12A

MAIN:

LENGTH OF SECTION: _____ feet PIPE MAT'L: _____ PIPE DIAMETER: _____ inches

CITY WATER USED OTHER

FLUSH ORIFICE SIZE: _____ inches STATION: _____

ESTIMATED TO BE FLUSHED: _____ gal. ESTIMATED DURATION: _____ min.

ACTUAL DURATION: _____ min.

DATE: _____ INITIAL _____ FINAL _____ INITIALS _____

SERVICES:

LOT No's: _____

DATE: _____ INITIAL _____ FINAL _____ INITIALS _____

HYDRANTS:

STATION: _____ INITIAL _____ FINAL _____ INITIALS _____

STATION: _____ INITIAL _____ FINAL _____ INITIALS _____

STATION: _____ INITIAL _____ FINAL _____ INITIALS _____

BACTERIOLOGICAL SAMPLING: 703.2.12M

DATE OF SAMPLE: _____

SAMPLE TAKEN BY: _____ P.O. No.: _____

SAMPLES DELIVERED TO: _____ DATE: _____ TIME: _____

SAMPLES ANALYZED BY: _____

SAMPLE NO. 1 TAKEN AT: _____ PASS FAIL

SAMPLE NO. 2 TAKEN AT: _____ PASS FAIL

SAMPLE NO. 3 TAKEN AT: _____ PASS FAIL

DATE OF RESULT: _____ (REFERENCE ATTACHED TESTING REPORT)



WATER SYSTEM TESTING SUMMARY REPORT (continued)

HYDROSTATIC TEST: 703.2.11

MAIN: INITIAL TEST DATE: RETEST DATE: TEST PRESSURE @ START: @ 30 min: @ 60 min: @ 90 min: @ FINISH: [] PASS [] FAIL INITIALS

COMMENTS

SERVICES:

LOTS SERVICED:

INITIAL TEST DATE: RETEST DATE: TEST PRESSURE @ START: @ 30 min: @ FINISH: [] PASS [] FAIL INITIALS

COMMENTS

HYDRANTS:

STREET & STATION: TEST DATE: @ START: @ 30 min.: @ FINISH: [] PASS [] FAIL INITIALS

COMMENTS

LEAKAGE TEST: 703.2.11

DATE LENGTH OF SECTION: PIPE MAT'L.: DIAMETER LENGTH OF TEST: ACCEPTABLE LOSS, per AWWA C600. TABLE 6: GALLONS USED: RESULT: [] PASS [] FAIL INITIALS