

CHAPTER 8

WATER SUPPLY SYSTEM

- 8-1 INTRODUCTION – These improvement standards shall govern the engineering design of all domestic water systems intended for operation and maintenance by the County of Sutter or other agencies, such as Community Services Districts, where the Board of Supervisors is the agency board.
- 8-2 INTENT OF CRITERIA – The intent of these criteria is to provide a water system which will dependably and safely convey the required amount of high quality water throughout the distribution system at the least cost. In establishing the required amount of water, periods of peak domestic demand occurring in conjunction with an emergency fire flow demand shall be considered.
- 8-3 CURRENT STANDARDS – Pertinent and current requirements of the following agencies or standards shall be complied with:
- A. Environmental Protection Agency Drinking Water Regulations
 - B. Laws and Standards of the State of California, Department of Public Health Services relating to Domestic Water Supply
 - C. General Order No. 103 of the California Public Utilities Commission
 - D. Sutter County Code regulating the installation, operation, construction, reconstruction and repair of wells and pumps
 - E. State of California, Water Well Standards (Bulletin 74-81)
 - F. Title 17, Chapter V, Sections 7583-7622, California Administrative Code, regarding cross-connections and backflow prevention
 - G. Uniform Fire Code
 - H. Uniform Plumbing Code
 - I. Latest edition of the American Water Works Association (AWWA) Standards
- 8-4 CONNECTION PERMITS AND FEES – A permit shall be obtained for each connection to the water system.
- 8-5 WATER SUPPLY QUALITY – The quality of the water shall conform to the Environmental Protection Agency Drinking Water Act and the State Department of Public Health Drinking Water Standards.
- 8-6 WATER SUPPLY PRESSURE – Normal operating pressures of not less than 40 psi nor more than 80 psi shall be maintained at service connections to the distribution system, except during periods of peak domestic and fire demand the pressure shall not be less than 20 psi. Excessive water pressure greater than 80 psi must be regulated.
- 8-7 DESIGN CRITERIA – For design of the distribution system, the following criteria shall be used in designing and constructing the water systems. Water system design criteria and construction practices shall conform to the following criteria.

**OPERATING CONDITIONS
WATER SUPPLY PRESSURE**

	Pressure		Velocity
	Maximum	Minimum	Maximum
Maximum day	80 psi	40 psi	7 fps
Maximum day and Fire	80 psi	20 psi	10 fps
Peak hour	80 psi	40 psi	7 fps

RATE OF DOMESTIC WATER USE

Land Use	Average Day Demand Fire Flow ^{1 2}		Fire Flow Duration (hr)
	(gpd/ac)	(gpm)	
Low Density Residential	3,270	1,500	2
Medium Density Residential	3,720	1,500	2
High Density Residential	4,160	2,500	3
Commercial/Office	2,670	3,000	3
Light Industrial	2,670	3,000	3
Schools	3,270	4,000	4
Parks	3,640		
Environmental Corridor	530		
Open Space	530		
Maximum Day Demand	1.85 x Average Day		
Peak Hour Demand	1.9 x Maximum Day		

¹ Assumes all new residential construction over 6,200 ft² and all commercial, public and industrial land use will require fire sprinklers.

² Unique projects or projects with alternative materials may require higher fire flows and will be reviewed by the Fire Marshall on a case by case basis (e.g. proposed commercial/industrial areas and schools).

STORAGE AND PUMPING PLANT DESIGN

Minimum Storage Volume shall be the total of the following storage volumes

Operational Storage = 1/4 Maximum Day Demand

Fire Storage = Highest fire flow demand in service area multiplied by required duration

Emergency = Average Day Demand

8-8 WATER SUPPLY– All developments shall meet all applicable water supply reliability requirements of federal and state laws.

8-9 WELL AND PUMPING PLANT DESIGN – All phases of well and pumping plant design shall be coordinated with, and shall be under the direction of Sutter County. Particular attention shall be given, both in design and construction, to conformance with Bulletin 74-81, “Water Well Standards: State of California” of the State Department of Water Resources. Well production shall be based on the test wells drilled in the vicinity of the proposed well site and as approved by the Director of Public Works (Director). In general, all developments shall have a minimum of two (2) sources of water. Pump stations shall contain a minimum of two pumps and have the ability to meet all operating conditions efficiently and with largest pump out of service. Standby power may be required at the option of the Director. Standby power must be provided to be considered a reliable supply. Emergency storage for well supply systems may be waived if standby power is supplied for each well and the number of wells exceeds the minimum number by at least 20%.

Well site selection shall be approved by Sutter County and meet the requirements of the Environmental Health Division of the County Environmental Management Department, and the State Department of Public Health.

8-10 TRANSMISSION SYSTEM DESIGN (larger than 12 inch diameter) – Sizing and layout of transmission mains shall conform to Master Water Supply Plans for the proposed water system.

Technical specifications for water transmission mains shall be included in the proposed improvement plans.

Fire hydrants and water services shall not be directly connected to a transmission main over 12” in diameter, unless otherwise specified by the Director.

8-11 TRANSMISSION SYSTEM LAYOUT PLAN REQUIREMENT

- A. The transmission mains shall be shown in full on the plan and profile drawings, including valves, air relief devices, and blow off devices.
- B. Elevations shall be shown at all grade changes.
- C. Transmission mains shall maintain a minimum vertical clearance from all other utilities of 1’-0” or as approved by the Director.

- D. Transmission Main Location – All transmission mains shall be installed within public rights-of-way and easements.
- E. In general, the location shall be three (3) feet from the curb and gutter. The transmission main may be located in a landscape frontage if approved by the Director.
- F. The minimum horizontal separation between water mains and sanitary sewers shall be 10 feet.
- G. Minimum cover shall be 36” in all locations.

8-12 DISTRIBUTION SYSTEM DESIGN (12 inch diameter and smaller) – Sizing of mains shall be such that the stated normal pressures and the minimum requirements for main spacing and sizing are maintained.

The Hazen-Williams formula shall be used in the hydraulic study of the system, using a “C” value of 130 for cement-lined pipe, PVC C900, and ductile iron pipe. A hydraulic analysis of any proposed distribution system shall be submitted to the Director with the improvement plans. In design of the system, the maximum delivery from any hydrant shall be assumed to be limited to 1,500 gallons per minute. Hydraulic Model electronic files shall be provided to the Director.

8-13 DISTRIBUTION SYSTEM LAYOUT REQUIREMENTS – The water system layout requirements are as follows:

- A. Improvement Plan Criteria
 - 1. The distribution main shall be shown on plan and profile (top of pipe only). A water plan at 1” = 100’ scale shall be included as part of the improvement plans, showing locations of valves, fire hydrants, and water services.
 - 2. Details of water mains crossing other utilities or unusual alignments shall be provided if deemed necessary by the Director.
- B. Main Location.
 - 1. General – All water mains shall be placed within rights-of-way dedicated for public streets unless the use of easements is specifically approved by the Director. Easements shall be a minimum of 25 feet wide for mains up to 24 inches in diameter and as determined by the Director for larger diameter sewers. Temporary working easements of adequate dimensions shall be provided to allow the construction within the permanent easement

to be completed in a safe and reasonable manner. Easements shall be granted to the appropriate district or the County of Sutter.

2. The water main location shall be three (3) feet from the curb and gutter on the northerly or westerly side of the street. If it should be necessary because of existing improvements or possible conflict with other utilities, and with the approval of the Director, the mains shall be installed within an easement immediately adjacent to and behind the property line fronting on the public right-of-way.
3. The minimum horizontal distance between parallel water and sanitary sewer lines shall be 10 feet, and the water main shall be higher than the sewer. On crossings, the water line shall be at least 1 foot above the sewer line or as approved by the Director.
4. When crossing a sanitary sewer force main, the water line shall be a minimum of 3 feet above the sewer line. The water line shall be ductile iron.
5. In every instance where a water main is to be installed in public right-of-way or easement, the Director shall approve the specific location.

C. Main Layout and Sizing – The distribution system, whenever possible, shall be in grid form so pressures throughout the system tend to become equalized under varying rates and locations of maximum demand. The required minimum pressures and flows shall govern design of the system. The following conditions are to be considered for the distribution system design:

1. In general, the minimum pipe size shall be 8 inches inside diameter for looped systems and for dead end runs more than 50 feet long that have a hydrant at the end. Dead end runs less than 50 feet and dead end runs without a hydrant may be 6 inches in inside diameter.
2. Where water mains are installed in a major thoroughfare (86 feet right-of-way or greater), dual mains (one pipeline on each side of the street) may be required.
3. Mains shall maintain a minimum cover of 30" (36" in rights-of-way 54' and greater) and a maximum depth of 60", both measured from gutter flow-line, unless otherwise specified by the Director.
4. Mains shall maintain a minimum 1'-0" vertical clearance from all utilities.
5. Mains shall be installed in a roadway right-of-way or within a water easement.

6. In privately owned, multiple ownership developments, water mains that are to be maintained by County/District forces shall be contained in a public water system easement.

D. Valves, Hydrants and Blow-Offs – The distribution system shall be equipped with a sufficient number of valves (clock-wise turn to close) so no single shut-down will result in shutting down a transmission main. Valves will also be spaced no greater than 500 feet in school, commercial, industrial, or multiple-family dwelling areas. In other residential areas, valves shall be spaced so no single shutdown will result in shutting down more than 15 services or 800 feet. In no case shall more than two fire hydrants be removed from service. The valves shall be located so any section of main can be shut down without going to more than two locations to close valves. Valves at intersections shall be located within the curb returns, and set as close to minimum pipe depth (30” to 36”) as possible. Four valves shall be placed where mains cross and three valves where mains tee. If it is necessary to install valves between street intersections, they shall be located on property lines between lots.

Fire hydrants of a type conforming to current County Fire Department Specifications and blow-off assemblies shall be located as follows:

1. Fire hydrants shall be placed at street intersections wherever possible, and located to minimize the hazard of damage by traffic. They shall have a maximum normal spacing of 500 feet in single family residential areas and 300 feet in duplex and multi-family areas, commercial areas, or industrial areas, measured along the street frontage. Hydrants located at intersections shall be installed at the curb return. All others shall be located on property lines between lots.
2. Not more than two hydrants shall be placed on a six inch main between intersecting lines. The minimum size main serving a fire hydrant shall be six inches in diameter. The pipeline connecting the hydrant and the main shall be a minimum of six inches, with a gate valve flange connected to the main. On long runs a second valve may be required near the hydrant location by the fire protection district having jurisdiction. The pipe reducer shall be placed at the fire hydrant.
3. A fire hydrant assembly shall be installed on all permanent dead end runs. Blow-off valves may be used with the approval of the Director if dead end runs are temporary and less than standard spacing will result if a fire hydrant is used. Wherever possible the blow-off shall be installed in the street right-of-way three feet from the curb and gutter. In no case shall the location be such that there is a possibility of back-siphonage into the distribution system.

- E. Service Lines – Service lines from the water main to the property line or edge of easement shall normally be installed at the time the main is constructed. Services from mains installed in private roads shall extend one foot beyond the edge of the pavement. Service line criteria shall be as follows:
1. In all new subdivisions the service line shall preferably be located within 9 inches to 30 inches from the side property line.
 2. Normal residential size of a service line shall be one inch. Schools, commercial, industrial, or multiple-family units with higher demand shall be provided with larger service lines, subject to approval of the Director. All services shall be installed with a corporation stop at the main and an angle meter stop or gate valve at the property line. The gate valve shall be used only when the service is 1-1/2 inches or larger. Installation of a concrete meter box is required for all services.
 3. Water service taps into existing mains shall only be accomplished by licensed contractors upon application for a permit and payment of the required fees. A note to this effect shall be placed on the plan sheet which details the area requiring such tapping. Application should be made to the Public Works Department and the required fees paid at least five (5) working days in advance of the time the tap is desired. All excavation and backfill, and the installation of the remainder of the water service shall be done by the Contractor.
- F. Water Meters – Water meters shall be installed on all residential, commercial, industrial, multi-family, and irrigation services. All water services shall be metered with Sensus (formerly Rockwell) SRII Touch Read, pit lid meters, reading in 100 cubic feet increments installed within a meter box.
- G. Water Pipe – Pipe used in the construction of water distribution systems shall be either ductile iron or polyvinyl chloride pipe. The pipe and the method of placement shall conform to the Standard Specifications.
- H. Detector-Check Valves – A detector-check valve and bypass meter is required on each fire service line into a building or fire line. See Standard Drawing W-8 for specifications and typical installation details.
- I. Backflow Devices – Backflow devices are required in accordance with Title 17, Chapter V, Sections 7583-7622 of the California Administrative Code.
- J. Locating Wire - Locating wire, consisting of 10 AWG with blue colored PVC insulation, shall be installed on all water mains in accordance with Drawing W-4.

8-14 WATER MAIN MATERIALS

A. Material – Pipe material shall be as approved by the Director and shall conform to the requirements of the Standard Specifications. Pipe materials which will normally be considered are as follows:

1. Ductile Iron Pipe (DIP) – Ductile iron pipe shall conform to ANSI A21.51 (AWWA C151) for a minimum working pressure of 150 psi unless otherwise specified. Ductile iron castings shall conform to and be tested in accordance with ASTM A536. Casting grade for pipe shall be 60-42-10. Laying length shall be the manufacturer's standard length, normally 18 feet. Shorter lengths may be used when required for closures and proper location of special sections.

The interior surface of all ductile iron pipe shall be cement-mortar lined and seal coated in conformance with AWWA C104, and the exterior surface shall have a bituminous coating of either coal tar or asphalt base, approximately 1 mil thick. At a minimum, buried DIP shall be encased in an 8-mil polyethylene wrap in accordance with AWWA C105. Additional external corrosion protection such as sacrificial anodes and/or impressed current cathodic protection may be required to suit site specific soil corrosivity, as required by the Director.

Fittings shall be push-on, mechanical, or flanged-type ductile iron or cast iron and shall conform to ANSI 21.10 (AWWA C110) or ANSI 21.11 (AWWA C111) designed for a working pressure of 250 or 350 psi. Coating and lining requirements shall be the same as specified for pipe.

Joints shall be push-on or mechanical type and shall conform to ANSI 21.11 (AWWA C111) with rubber gasket unless otherwise specified.

2. Polyvinyl Chloride Pipe (PVC)
 - a) Polyvinyl chloride pipe shall have a maximum dimension ratio (DR) of 18 (minimum Pressure Class 150), unless otherwise specified, and shall conform to AWWA Standards C900. Outside diameter (OD) pipe dimension shall be manufactured to cast iron pipe (CIP) equivalent. Pipe shall be furnished in minimum standard lengths of 20 feet. Pipe 6- to 12-inch diameter shall conform to AWWA Standard C900 and pipe 14- to 48-inch diameter shall conform to AWWA Standard C905.
 - b) Joints – Polyvinyl chloride pipe shall have integral wall-thickened bell ends designed for joint assembly using elastomeric-gasket seals. The minimum wall thickness of the integral wall-thickened bell, at any point between the ring groove and the pipe barrel, shall conform with the DR requirements for the pipe barrel. The minimum wall thickness in the ring-groove and bell entry sections shall equal or exceed the

minimum wall thickness of the pipe barrel. The elastomeric-gasket seals shall conform to ASTM F477.

The pipe shall have a pipe stop indicated on the barrel that will accurately position the pipe end within the joint. The pipe in place shall permit thermal expansion and contraction of the pipe ends.

- c) Fittings –Fittings for polyvinyl chloride water main pipe shall be those specified by the pipe manufacturer. All pressure pipe fittings for 12-inch diameter PVC and smaller shall be ductile iron compact fittings conforming to AWWA C153 Class 350. Fittings for PVC 14 inches in diameter and greater shall be standard mechanical joint connections conforming to AWWA Standard C110 or restrained to the satisfaction of the Engineer. Adapter “O” rings are not acceptable.

8-15 TRENCH LOADING CONDITIONS AND PIPE DESIGN – The loading condition and pipe design criteria for conduits are as follows:

- A. Marston’s formula shall be used to determine the load placed on the pipe by the backfill. In the absence of specific soils data, as determined by a Soils Engineer, a soil weight of 120 p.c.f. and a Ku factor of 0.110 shall be used.
- B. Bedding and Initial Backfill – Bedding types and factors shall be as per Standard Drawing No. S-8. Bedding and initial backfill type shall be as necessitated by height of cover over the pipe, trench width, pipe strength, and other factors used to determine safe pipe loading. Unless otherwise noted on the plans, bedding and initial backfill for ductile iron pipe shall be Type II; bedding and initial backfill for PVC pipe shall be Type II Alternate. The minimum trench width shall be pipe O.D. plus 12 inches.

8-16 PRESSURE TESTING WATER MAINS

- A. After disinfection of the system, and prior to making connections, the entire new installation shall be pressure tested in accordance with the Standard Construction Specifications. Water mains shall be tested and must successfully pass all tests prior to acceptance.
- B. In the case of pipelines that fail to pass the prescribed leakage test, Contractor shall determine the cause of the leakage, take corrective measures acceptable to the Director to repair the leaks, and again test the pipelines. Corrective measures shall be subject to the approval of the Director.
- C. Contractor shall keep records of each piping test including: description and identification of piping tested, description of test procedure, date of test, witnessing by Contractor and Engineer, test evaluation, remarks on leaks, and remarks on leak repairs.

8-17 DISINFECTING PIPELINES

- A. All potable water pipelines shall be disinfected as hereafter described and in accordance with AWWA C651. Handling of disinfection solution before and after the test shall be the responsibility of the contractor/developer. Discharge to storm drains is prohibited. Discharge to sanitary sewer is subject to the approval of the Director.

- B. Chlorination
 - 1. A chlorine-water mixture shall be uniformly applied by means of a solution-feed chlorinating device. The chlorine solution shall be applied at one end of the pipeline through a tap in such a manner that as the pipeline is filled with water, the dosage applied to the water entering the pipe shall be approximately 50 mg/1.
 - 2. Disinfection of Mains 12 inches or less in diameter may be accomplished using the Tablet Method as described in the Standard Construction Specifications.
 - 3. Care shall be taken to prevent the strong chlorine solution from flowing back into the line supplying the water. A reduced pressure backflow preventer or an air gap shall be used for this purpose.

- C. Retention Period
 - 1. Chlorinated water shall be retained in the pipeline long enough to destroy all non-spore-forming bacteria. This period shall be at least 24 hours.
 - 2. During the retention period, the free chlorine residual at the pipeline extremities and at other representative points shall be maintained at a value of at least 25 mg/1.

- D. During the process of chlorinating the pipeline, all valves and other appurtenances shall be operated while the pipeline is filled with the heavily-chlorinated water.

- E. Final Flushing and Bacteriological Testing. Final Flushing and Bacteriological Testing shall be performed as required in the Standard Construction Specifications.

- F. Connections to Existing System. Where connections are to be made to an existing potable water system, the interior surfaces of all pipe and fittings used to make the connections shall be swabbed or sprayed with a one percent

hypochlorite solution before they are installed. Thorough flushing shall be performed as soon as the connection is completed.