SECTION DS-5

POTABLE WATER SYSTEM DESIGN STANDARDS

DS5-01 GENERAL:

A. INTENT: The intent of these Design Standards is to provide minimum standards for the design of a water system that will dependably and safely convey the required amount of high quality water throughout the City.

B. GOVERNING CRITERIA: These Design Standards, in conjunction with the most current edition of the City of Vacaville Water System Master Plan, hereafter referred to as the Master Plan, shall govern the engineering design of all potable water systems within the City of Vacaville. In the event that there is a conflict with the criteria between these two documents or with other "Current Standards", listed herein, the Director of Public Works shall determine which document governs. Additionally, if there are issues not addressed in these documents the Director of Public Works will determine the criteria to be utilized in the design.

C. CURRENT STANDARDS: Water system design shall be completed in accordance with all current applicable laws, standards, and regulations, including but not limited to, the California Safe Drinking Water Act and Related Laws (commonly referred to as the "Drinking Water Law Book"), the California Plumbing Code, the National Board of Fire Underwriters, California Department of Health Services, the California Fire Code, American Water Works Association Standards, the City of Vacaville Water System Master Plan, Municipal Code, Standard Drawings, and Standard Specifications which include the Construction Standards and these Design Standards.

D. WATER MASTER PLANNING: Potable water demand for planning purposes shall be estimated using the water demand factors outlined in the Master Plan. The City of Vacaville, Department of Public Works, is responsible for all master planning of the water system. Where any proposed development is different from the current master plan (land use or density), and/or if required by the Director of Public Works, the specific project shall be analyzed by the Department of Public Works using the City's water system model and the demand developed for the project. The project developer shall coordinate the analysis through the Department of Public Works and pay for the cost of any required modeling.

E. WATER SUPPLY, TREATMENT, AND STORAGE: The City of Vacaville water system consists of surface water treatment facilities, wells, pumping facilities, distribution and transmission pipelines, and storage reservoirs. These existing facilities are described in the Master Plan and improvement projects for increased demand are identified. Refer to the Master Plan for criteria and requirements for wells, reservoirs, and pumping facilities.

F. WATER SUPPLY PRESSURES AND FIRE FLOWS: The design for water system improvements shall accommodate normal operating pressures which shall conform to the performance guidelines presented in the Master Plan. Fire flow and peak hour demand requirements shall conform to the Master Plan. Periods of maximum day domestic demand occurring in conjunction with the appropriate fire flow demand shall be considered in establishing the design water demand.

G. ADDITIONS TO THE WATER SYSTEM: Additions to the water system shall be contingent on submission of hydraulic calculations (based on fire flow test results) to the City confirming that all the design criteria outlined in the Master Plan are met. The City's water system model shall be used except in simple, non-looped conditions such as a residential cul-de-sac where manual calculations will be sufficient.

H. CATEGORIES OF WATER SYSTEM PIPING: There are three categories of water system piping as follows:

1. Service Lateral; piping connecting the distribution main to the private property onsite water meter or fire protection backflow prevention device. The service lateral shall be considered as a component of the distribution system.

2. Distribution Main; piping solely located within the public right of way connecting the Transmission Main to Service Lateral.

3. Transmission Main; connects the City water system to the Distribution Main. No services are allowed to be connected to this main.

DS5-02 SYSTEM DESIGN:

A. PIPE SIZING REQUIREMENTS: Pipeline sizing in the transmission and distribution system shall be based on anticipated water demands, fire flow requirements, and hydraulic characteristics of the distribution system. In single family residential subdivisions, the distribution main pipelines shall not be less than 8 inches in diameter. In medium and high density residential areas, school locations, and commercial and industrial areas, pipelines shall not be less than 12 inches in diameter. Minimum pipeline sizes in the public water system are contingent upon meeting the fire flow criteria and performance guidelines specified in the Master Plan. In all cases, minimum sizes shall be subject to approval by the Director of Public Works, and larger sizes may be required at the City's discretion. The privately owned and maintained fire service lateral shall be sized to the fire code requirements and is subject to approval by the Fire Marshall.

When the City requires the developer to oversize the water main beyond the size required to serve the development, the developer will be reimbursed by the City for the construction cost of oversizing the water main.

The following sizes in inches are allowed in the City Water system:

1. **Service Lateral:** 1, 1 ½ , 2, 3*, 4, 8, 12

2. **Distribution Main:** 8 and 12

3. **Transmission Main:** 18, 24, and larger

B. PIPE LAYOUT REQUIREMENTS: The distribution system layout shall conform to the Water System Master Plan and the following requirements:

1. **Water Main Location:** All pipelines shall be installed within public right-of-ways or, with approval by the Director of Public Works, in dedicated easements. Where the Water main is installed in an easement, the easement shall be 15 feet wide and be located on a single lot with the main centered in the easement. The preferable location water mains shall be six (6) feet from the centerline of the street, on the opposite side of the centerline from the sewer line. The alignment shall be parallel to the street centerline wherever possible. Curved water main alignments are preferred and allowed when the deflection at each pipe, coupling, and fitting joint conforms to the criteria specified in section CS-8, Potable Water Systems, of the Construction Standards. Major transmission pipelines (which are greater than 12 inches in diameter) shall be selected and aligned based on a hydraulic analysis of the distribution system, performed by the Department of Public Works, and paid for by the developer.

2. **Cross-country pipelines:** Pipelines located outside of the limits of a paved street, called "cross country pipelines" shall be avoided whenever possible. When approved by the Director of Public Works, they shall be constructed on slopes less than 20% and shall be provided with an all weather access road.

3. **Requirements for Water Main Separation from other utilities:**

   Water mains shall be installed as follows:

   a. At least ten feet horizontally from and one foot higher than sanitary sewers located parallel to the main (measured from the nearest edge of the facility).

   b. At least 5 feet horizontally from all other utilities.

   c. At least one foot higher than sanitary sewers crossing the main (measured from the nearest edge of the facility). The water pipeline shall be a minimum of 2 feet (clear dimension) when crossing a sanitary sewer force main. In either case, the crossing shall be as perpendicular as possible. A

* The 3 inch service consists of 4 inch connection to the main and service line which is reduced to a 3 inch line immediately before the meter.

full length section (minimum length of 18 feet) of the water pipelines shall be centered over the gravity sewer or sanitary force main.

d. With joints at least nine feet from sewer lines where the sewer crosses the main.

e. In a separate trench from the sanitary sewer.

f. Clearances are illustrated on the "Separation of Water and Sewer Lines" Standard Drawing. Exceptions to the above requirements must conform to criteria for the separation of water mains and sanitary sewers set forth in the California Waterworks Standards contained in the California Administrative Code.

4. Minimum Depth: The minimum depth of cover over water mains in areas of new construction is 42 inches below the final pavement elevation. If the water main is located in a location that will not be paved with the water main installation the depth of cover of 42 inches shall be measured from the top of the main to the top elevation of the backfill.

5. Dead End Lines: Single "dead-end" pipelines supplying a given area shall be avoided and "looped" systems shall be required whenever possible. A "dead-end line" shall not exceed 600 feet in length.

C. ALLOWABLE WATER PIPELINE MATERIAL: The pipe material used in the construction of water distribution main systems of 8 inch diameter up to 12 inch diameter shall be either ductile iron pipe (DIP) or polyvinyl chloride (PVC) pipe per Section CS-8 of these specifications, unless a particular pipe is specified by the City Engineer/Director of Public Works. PVC pipe shall not be used for transmission pipelines, reservoir tie-ins, and applications subject to high pressures and hydraulic surges.

DS5-03 WATER SYSTEM APPURTENANCES

A. VALVES: Valves shall be placed in the distribution system according to the following requirements:

1. at each leg of the distribution system.
2. at no more than 400 foot spacing in any direction, measured along water main.
3. so that no more than 2 fire hydrants will be removed from service at one time when any section of the distribution system is isolated.

B. FIRE HYDRANTS: Fire hydrants shall be placed at the end of cul-de-sacs and at street intersections wherever possible, and located to minimize the hazard of damage by traffic. They shall have a maximum normal spacing measured along the street frontage of 300 feet for commercial, hillside, and high density subdivisions and 400 feet for standard residential subdivisions. Hydrants located at intersections shall be installed outside the limits of the curb return at a

minimum distance of 2 feet beyond the point of tangent with the curb return. All other hydrants shall be located on property lines between lots.

Not more than two hydrants shall be placed on a dead end main. The details of this installation shall conform to the standard drawings and the minimum distance from the gate valve to the hydrant bury flange shall be 6 feet.

C. BLOW-OFFS AND AIR RELEASE ASSEMBLIES: A blow-off assembly shall only be installed on temporary dead end pipelines. A fire hydrant assembly shall be required and used as a blow-off on all permanent dead ends (cul-de-sacs) and at all system low points. See spacing requirements for fire hydrants in these Design Standards. A valve shall be installed at the upstream end of all dead-ends to isolate and drain the water main until it is placed in service.

When a blow-off is removed for extension of a water pipeline, it shall be replaced with a gate valve unless a valve exists past the last service.

Combination Air and Vacuum Release valves shall be installed at all system high points.

Locations and installations of blow-off and combination air and vacuum release assemblies shall be included on the Project Plans and be installed in accordance with the Standard Drawings.

D. WATER SERVICES: Water services from the water main to the back of walk or as shown on the plans shall normally be installed at the time the water main is constructed.

Water service installations shall conform to the following:

1. Location:

a. Water services shall be located a minimum of 5 feet from the edge of the onsite driveway and 2.5 feet from the property line.

b. The water meter and meter box shall be placed at the back of walk, in the right-of-way, as shown on the Standard Drawings.

c. Water services shall be placed a minimum of 5 feet measured horizontally from other parallel utility facilities, such as street lights, fire hydrants, sewer services, etc.

d. No services may be connected to transmission mains (pipes 18 inches and greater).

2. Size:

a. The standard residential water service pipeline size shall be 1 inch.

b. Other types of new buildings, including multiple residential, commercial, and industrial, shall have services commensurate with their water demand requirements.

c. Large vacant parcels with zoning other than R-1 shall have a minimum 8-inch service line. A blow off shall be provided at the end of the line to isolate and drain the line until the parcel is developed. A fire hydrant assembly may be substituted for the blow off assembly.

3. **Meter Requirements:** All water services shall be metered. Meter size (except for single family residential where a ¾ inch meter may be allowed) shall match service size. Meter size may be adjusted based on demand, system pressure, and other factors as approved by the Director of Public Works. A separate service and meter or manifold service and meter shall be installed for non residential irrigation systems.

4. **Materials:** Materials shall conform to Section CS 8-08.

Service Size	**Materials**
1", 1½", 2"	Polyethylene
3" and larger	Ductile iron pipe

5. **Valves and Boxes:** All water services 3 inch and larger shall be controlled by a valve rather than a corporation stop at the main. Valve boxes shall be provided for all valved water services in accordance with the Standard Drawings.

6. **City Taps:** The installation of water service taps to any size of transmission main shall not be permitted without prior approval of the Director of Public Works. The City of Vacaville shall have the option of making all individual water service taps for services 2 inch or less, when the taps are to be made in an accepted public street. The Contractor shall make all other taps.

E. BACKFLOW DEVICES: Backflow prevention assemblies shall be installed in accordance with the City of Vacaville Construction Standards, Standard Drawings, Chapter 13.14 of the Municipal Code (Municipal Code) and Title 17 of the California Code of Regulations. A complete list of building occupancies requiring backflow prevention assemblies as well as the particular type of assembly to be used is contained in the Municipal Code.

The property owner, when required by the Municipal Code or when required by the Director of Public Works, shall install reduced pressure backflow devices, double check backflow devices, double detector check valves, and air gap separations. The devices will be owned and maintained by the City upon acceptance.

Single detector check valves shall be installed on private fire lines that do not have a fire department connection and as required by the Director of Public Works. The device will be privately owned and maintained. Construction shall conform to the "Single Detector Check Valve" Standard Drawing.

Parallel backflow assemblies shall be installed on services that can not sustain a water shutdown during annual testing, and (scheduled or unscheduled) maintenance, repair, and replacement.

Backflow prevention device installations shall include screening in accordance with the Standard Drawings.

F. WATER QUALITY SAMPLING STATIONS: A water quality sampling station shall be installed within the public right of way at locations required by the Director of Public Works. The installation shall conform to the City Standard Drawings.

G. THRUST RESTRAINT: The design for all water system facilities shall include considerations for thrust restraint. Thrust restraint may include a concrete thrust block, locking gasket, or restrained joint fitting. The Project Plans shall reflect the method of thrust restraint. The fire hydrant bury installation requires both restrained joints and a thrust block. The Standard Drawings provide minimum requirements that will be allowed for thrust restraint. However the Design Engineer shall determine whether these minimum requirements are sufficient for the site conditions. When thrust blocks are not used the Design Engineer shall prepare and submit specific calculations to the City for the restrained joint design and its application for each location proposed. Water mains installed at a slope of 15% or greater shall be designed with restrained joints.

DS5-04 CONNECTIONS TO WATER SYSTEM

A. PLANNED FUTURE DEVELOPMENT: Where development will occur in phases or where future development is planned, a tee, valve, and blind flange shall be provided for each future connection.

B. TIE-IN CONNECTIONS: Only one tie-in connection whether "tap" or "cut-in" shall be made to the existing City water system before the newly constructed water distribution system has been flushed, disinfected and satisfactorily pressure tested if a new mainline valve is installed to pressure test against.

Tap connections are made while existing water main is in service. Tapping sleeves may be used only with the approval of the Director of Public Works.

Cut-in connections require isolation of a section of pipe and shutting down service in the existing water main. Determination of the type of tie-in connection shall be made by the Department of Public Works.

Drawings of the two types of tie-in connections are included in the Standard Drawings .

DS5-05 PROJECT PLANS REQUIREMENTS:

A. GENERAL: The Project Plans shall be drafted to present plan and profile views and shall show existing and proposed improvements. The type and size of pipe material and all fittings, valves and appurtenances shall be noted on the plans. The requirements for joint restraints for piping, valves, bends, and all other types of fittings shall be designated on the Project Plans. The locations of fittings, valves and appurtenances shall be tied into the control or center line stationing. The Project Plans shall also show the water main crossings with other utilities, including vertical clearances; horizontal distances to the roadway centerline, sanitary sewer and storm drain pipes, flow line of pipe elevations at all grade changes, points of direction change, water main connections, water main termination, sampling station, and service locations.

B. CONNECTION AND TESTING PLAN: The Project Plans shall include a Connection and Testing Plan for the new addition to the water system. This Connection and Testing Plan shall specifically address the requirements for connections to the existing system, including but not limited to identifying the point of loading (one physical connection to the existing system) chlorine feed location, minimum duration of flushing, possible points for disposal of water, and sampling locations in accordance with the City Standard Specifications. Calculations of the anticipated volume of water and the minimum duration of flushing required to perform the flushing and testing shall be submitted with the Project Plans. All valves, taps and appurtenances and duration of flushing needed to meet these requirements shall be indicated on the Project Plans.

C. EASEMENTS: If public water mains are to be located outside of the public street right of way, legal descriptions of the easement shall be submitted with the plans for review by the City. Easements executed by the appropriate property owners shall be submitted to the City prior to the approval of the Project Plans.