

SECTION 8

DOMESTIC WATER SUPPLY SYSTEM DESIGN

- 8-1 INTRODUCTION** – These improvement standards shall govern the engineering design of all domestic water systems intended for operation and maintenance by the City of Roseville.
- 8-2 DESIGN CRITERIA** – These criteria shall apply to the engineering design of all water systems intended for operation and maintenance by the City of Roseville. The intent of these criteria is to provide a water system that will dependably and safely convey high quality water throughout the distribution system.
- 8-3 CURRENT STANDARDS** – Pertinent and current requirements of the following agencies or standards shall be complied with. In case of conflicting design criteria, standards set forth by the City of Roseville, as established herein, shall govern.
- A.** United States Environmental Protection Agency (EPA) Drinking Water Regulations.
 - B.** Laws and Standards of the State of California, Department of Public Health Services relating to Domestic Water Supply.
 - C.** City of Roseville Design Standards.
 - D.** City of Roseville Industrial Waste Regulations (Cited in Section 9.2E)
 - E.** Rules for installation of individual water services (Cited in Section 9.10C)
 - F.** City Code for taps to water system
 - G.** Title 17, Chapter V, Sections 7583-7622, California Administrative Code regarding cross-connections and backflow prevention
 - H.** Roseville Fire Code
 - I.** Latest Edition of the American Water Works Association (AWWA) Standards.
- 8-4 WATER SUPPLY QUALITY** – The quality of water supplied to the City's distribution system shall conform to the Environmental Protection Agency Drinking Water Act, and the State Department of Health Services Drinking Water Standards.

8-5 WATER SUPPLY PRESSURE – Normal-operating pressures of not less than 50 PSI nor more than 100 PSI shall be maintained at service connections to the distribution system, except that during periods of peak domestic and fire demand, the pressure shall not be less than 20 PSI.

8-6 FLOW DETERMINATION – Determination of flow volumes required for a specific land use category shall consider maximum day domestic demands occurring in conjunction with an emergency fire flow demand. For design of the distribution system, the following unit demand factors shall be assumed.

Land Use Category		Average Day Unit Water Demand Factors
Residential	LDR (<3.5 DU's/Ac)	728 gpd/DU
	LDR (3.5 to 5.0 DU's/Ac)	600 gpd/DU
	LMDR (>5.0 to 6.0 DU's/Ac)	521 gpd/DU
	LMDR (>6.0 to 8.0 DU's/Ac)	430 gpd/DU
	MDR (>8.0 to 12.0 DU's/Ac)	323 gpd/DU
	HDR (>12.0 to 16.0 DU's/Ac)	288 gpd/DU
	HDR (>16.0 DU's/Ac)	177 gpd/DU
Commercial/Other	Commercial/Retail	2,598 gpd/ac
	Business Professional	2,598 gpd/ac
	Light Industrial	2,598 gpd/ac
	Industrial	2,562 gpd/ac
	Railroad Yard	109 gpd/ac
	Elementary Schools	3,454 gpd/ac
	High Schools	4,068 gpd/ac
	Public (Fire Station, etc)	1,780 gpd/ac
	Park/Recreation	2,988 gpd/ac
	Open Space/Major ROW	-
	Vacant/Unassigned	-

8-7 PEAKING FACTORS – The average day demand to maximum day demand peaking factor shall be 2.0. The maximum day demand to peak hour demand peaking factor shall be 1.7 (3.4 average day to peak hour).

8-8 REQUIRED FIRE FLOWS – For areas of the general type noted below, the indicated water supply for fire flows shall be provided with the initial development. Expansion or change in zoning of the development shall be subject to the requirements of the California Fire Code (CFC hereafter) as adopted by the Roseville Fire Department (RFD hereafter). The RFD shall determine all fire flows.

A. Residential Areas – The fire flow demand for detached single family dwelling units shall be a minimum of 1,500 gallons per minute (gpm) in accordance with the CFC as adopted by the RFD. For fire flow greater than 1,500 gpm, each fire hydrant shall maintain 1,000 gpm or fraction thereof based on the provisions of the CFC.

Note: Automatic Fire Sprinklers – Single-family homes equipped with automatic fire sprinklers systems shall require a minimum 1-inch water service and meter as determined by the RFD. The minimum 1-inch water line shall start from the public main to the required water meter. Service size and meter size shall be as approved by the RFD.

B. Multi-Family Areas – For attached multi-family units, the fire flow shall be determined by the Roseville Fire Department. The maximum fire flow however shall not exceed 4,000 gpm provided the building is fully sprinklered in accordance with the CFC as adopted by the RFD. For buildings that are not sprinklered, contact the RFD. For fire flow demand greater than 1,500 gpm, each fire hydrant shall be 1,000 gpm or fraction thereof based on the provisions of the CFC.

C. Commercial, Business, Industrial or School District Areas – The maximum fire flow shall be determined by the Roseville Fire Department. The required fire flow however shall not exceed 4,000 gpm, provided all the buildings are fully sprinklered in accordance with the CFC as adopted by the RFD. For buildings that are not sprinklered, contact the RFD. For fire flow greater than 1,500 gpm, each fire hydrant shall be 1,000 gpm or fraction thereof based on the provisions of the CFC.

8-9 LOCATION IN EXISTING STREETS – Where water mains or services are to be located in an existing street, factors such as curbs, gutters, sidewalks, traffic conditions, traffic lane conditions, pavement conditions, future street improvement plans, and existing utilities shall be considered. The approval of the Environmental Utilities Director and City Engineer shall be obtained in every instance.

8-10 LOCATION IN UNPAVED AREAS – All mains in unpaved areas shall be ductile iron pipe and marked every 150 feet with a blue 5-foot 6-inch composite utility marker. A decal shall be placed on the marker stating “CAUTION WATER MAIN.” Utility markers shall be Carsonite or approved equal with anchor barb kit. The first utility marker shall be placed within 20 feet of the public roadway.

8-11 TRANSMISSION SYSTEM DESIGN – Transmission mains are 16 inches in diameter or larger. Standard transmission main sizes are 16-, 24-, 30-, 36-, 42-, 48- and 54- inches in diameter. Sizing and layout of transmission mains shall conform to the Master Water Supply Plans of the City of Roseville Environmental Utilities Department. Technical

specifications for water transmission mains shall be a requirement of the proposed improvements plans. Under no circumstances shall fire hydrants or water services be directly connected to a transmission main, with the exception of hydrants that are acting as blow-offs.

A. Transmission Main Location – All transmission mains shall be installed within public rights-of-way and easements.

1. Mains shall be located 3 feet from the lip of gutter on the northerly and westerly side of the street. If conflicts exist at this location, then the main may be installed within an easement immediately adjacent to and behind the property line fronting the public right-of-way, subject to approval of the Environmental Utilities Director.
2. A minimum horizontal separation of 10 feet shall be maintained between sanitary sewer and recycled water mains. A minimum cover of 48 inches shall be maintained at all locations.
3. Transmission mains shall maintain a minimum vertical clearance of 1 foot from all other utilities.

B. Transmission Main Appartenances

1. Valves shall be spaced no more than 2,000 feet apart.
2. Inspection manholes shall be placed every 1,500 feet. A minimum of one inspection manhole shall be located between two valves unless otherwise approved by the Environmental Utilities Director.

C. Corrosion Protection - A corrosion protection study shall be included with improvement plan submittals. Corrosion protection facilities shall be identified from the roadway with the curb stamp “CP-W”.

8-12 DISTRIBUTION SYSTEM DESIGN – Standard distribution main sizes are 6-, 8-, and 12- inches in diameter. Sizes of mains shall be such that the stated normal pressures, as specified in Section 8-5, and the minimum requirements for main spacing, specified below, are maintained. The distribution system shall be designed in grid form to provide equalized pressures throughout the system equalized under varying rates and location of demand. The minimum pressures and flows specified in these design standards shall govern the design. The following shall be considered during system design:

A. Hydraulic Analysis – A Hardy-Cross network hydraulic analysis shall be provided to the Environmental Utilities Department upon request.

1. The hydraulic analysis submitted shall include two copies of the following items:

- a. The data input files, as well as the analysis results in electronic format.
 - b. Information on the proposed development (e.g. type of development, number of acres, number of units, fire flow requirements, etc.).
 - c. Data sheets outlining all assumptions (e.g. method used to assign demands to corresponding junction nodes and source HGL's used).
 - d. Map identifying pipe and node numbers and their locations.
 - e. Fire hydrant locations.
 - f. The name and version of software used for the analysis.
 - g. Elevations of junction and source nodes. The elevations used in the network hydraulic analysis shall be based on a project grading plan or the anticipated final elevations. If the final grading plan deviates significantly from the elevations used in the analysis, a revised analysis will be required.
 - h. Staging or phasing of the development.
 - i. Appropriate off-site demands.
2. The Hazen-Williams formula shall be used in the analysis of the system. The roughness factor shall be as follows:
 - a. $C=130$ for all new cement-line, PVC C-900, and ductile iron pipes
 - b. $C=130$ for all existing pipes greater or equal to 16 inches in diameter
 - c. $C=120$ for all existing pipes less than or equal to 12 inches in diameter
 3. When identifying the fire flow available in a network analysis, use the hydrant located at the development's weakest point (highest point in the development and/or last hydrant on a dead-end main). Also verify the hydrant is located at a junction node. The maximum delivery from any hydrant of the type conforming to current City Standards shall be limited to 1,500 gallons per minute.
- B. Pipe Sizes** – The minimum pipe size for residential development shall be 6 inches in diameter. For commercial developments, the minimum pipe size shall be 8 inches in diameter.

- C. Stubs** – Stubs for future developments shall be fully restrained ductile iron pipe originating from the water main.
- 8-13 WATER MAIN LOCATION** – Water mains shall be installed in public rights-of-way or easements granted to the City.
- A. Location** – The following horizontal and vertical criteria shall be used to locate water mains:
- 1.** Mains shall be located 3 feet from the lip of gutter on the northerly or westerly side of the street. If conflicts exist, then the main may be installed immediately adjacent to and behind the property line fronting on the public right-of-way, subject to approval of the Environmental Utilities Director. Arterial streets may require dual mains, one on each side of the street, as approved by the Environmental Utilities Director.
 - 2.** If it is necessary to install a water main outside of the public right-of-way, an easement dedication to the City shall be required. Water mains shall be centered within their easement. Easements shall be located completely on one side of a property line or fence. Dedicated easements shall be clear of all permanent structures, building eaves, roof lines and the future trunks of large tree species. Temporary construction easements of adequate size shall also be provided. The easement width shall be the greater of the following:
 - a.** Minimum width of easement shall be 15 feet.
 - b.** All easements shall have a minimum width equal to the required trench width according to the standard detail for trench backfill plus 2 additional feet of width for every foot of depth of the pipe as measured from the bottom of the pipe to finished grade. All water mains shall be centered within their easement.
 - c.** Water mains located outside of paved area shall be ductile iron.
 - 3.** Water mains located between lots shall require an access easement or pedestrian walkway as determined by the Environmental Utilities Director.
 - 4.** Water mains shall maintain a minimum horizontal separation of 10 feet between sanitary sewer mains and recycled water mains. All other utilities shall maintain a minimum 5-foot separation sidewall of pipe to sidewall of pipe. The water main shall be a minimum of 12 inches higher than sewer and recycled water systems. In cases where the water main must cross under a recycled water or sanitary sewer main or service, and with the permission of the Environmental Utilities Director, the water main shall be ductile iron to a distance of 5 feet on each side of the crossing and be concrete-encased. When

crossing sanitary sewer force mains, the water main shall be installed a minimum of 3 feet above and be ductile iron a minimum of 5 feet on each side of the force main.

5. Water mains shall maintain vertical separation of 12 inches between storm drains and other dry utilities. The vertical clearance may be reduced to 6 inches with the approval of the Environmental Utilities Director.
 6. Water mains under large structures such as culverts and large diameter storm drains shall be ductile iron and installed within a casing per these standards. The casing shall extend beyond the structure a minimum of 5 feet or the depth of the water main on each side.
- B. Vertical Elevation Change** – Mains designed with a vertical elevation change using angle fittings shall use a segment of ductile iron pipe with an approved restraint system between the two angle fittings.
- C. Cover** - A minimum cover of 36 inches and a maximum cover of 60 inches shall be maintained as measured from the outside bell of the pipe to gutter flow-line for distribution mains. A minimum cover of 48 inches as measured above shall be maintained for transmission mains.
- D. Dead-End Mains** – Dead-end mains shall be eliminated wherever possible by looping the system. Blow-offs conforming to the Construction Standard details shall be installed on all permanent or temporary dead-end mains. Removal of the blow-off at the end of cul-de-sacs and service connection to the end of the main is not permitted without prior approval by the Environmental Utilities Director.
- E. Warranty Inspection of Water Main Stubs** - As a requirement, water stubs are provided to subdivisions as a courtesy by developers during the construction of backbone infrastructures in streets to prevent cutting up the newly paved streets when the subdivisions are ready to develop. These stubs become an integral part of the water system and subsequently the responsibility of the developers of the subdivision and are therefore imperiled to both construction and warranty inspections. This practice saves future developers construction time and cost that would have otherwise been spent on tie-ins and street repairs and in some instances prevents delays in the event a street has a moratorium. Since these stubs are provided at no cost to future developers, it is our position, hence our policy, that it is the responsibility of the contractors to test and repair these stubs, if found damage, prior to tie-ins. A note to this effect shall be placed on the improvement plans.
- F. Public Lines in Commercial Developments** – Water mains shall be located within drive aisles unless otherwise approved by the Environmental Utilities Director. The Design Engineer shall minimize

the length of publicly-owned mains where on on-site water loop is required.

8-14 VALVES – Sufficient valves shall be provided on water mains to minimize customer service interruptions and sanitary hazards during repairs and future development.

A. Locations – Valves shall be generally located as follows:

1. No single shutdown will result in shutting down a transmission main.
2. At minimum intervals of 500 feet in school, commercial, industrial, or multi-family residential developments.
3. In residential areas, valves shall be spaced such that no single shutdown will result in shutting off water to more than 20 services or 800 feet of water main, whichever occurs first.
4. Valves shall be located such that any section of main can be shut down without going to more than three valves to shut down the section main.
5. All tees shall have a minimum of two valves. Commercial services 6 inches and greater shall have a valve on each leg of the tee for a total of three valves.
6. All crosses shall have a minimum of three valves.
7. Valves shall not be located in street gutters, valley gutters, or driveways.
8. A valve shall be installed on each side of a creek bridge, major highway, or as required by the Environmental Utilities Director.

B. Removal and Abandonment – Any valve outlet installed prior to lot development and subsequently not required shall be removed in its entirety. If removal is not practical, the valve shall be abandoned in the closed position and the lateral shall be cut, capped, and finished with an adequate thrust block. The lid shall be welded shut and painted red. The following note shall appear on the construction drawing:

The Contractor shall cut the existing pipe where shown on the drawing and install a restrained cap complete with thrust block. Where a joint or coupling in the existing pipe is uncovered at the cut and cap locations, the installation of a plug may be permitted with approval from the Environmental Utilities Director.

C. Valve Extension Stems – Valve extension stems are required where the distance from the top of the valve box to the top of the operation nut exceeds 40 inches. The valve extension stem shall be a minimum of 24 inches long and shall be within 24 inches of the surface.

D. Air Relief Valves – In the absence of services to relieve air trapped in high points of the water main, air relief or air vacuum relief valves are required on pipeline high points and changes in grade.

8-15 HYDRANTS AND BLOW-OFFS

A. Location – Hydrants and blow-offs shall adhere to the following criteria:

1. Fire hydrants shall be placed at street intersections wherever possible. Hydrants located at intersections shall be installed at the curb return on the same side of the water main connection.
2. Fire hydrants and blow-offs not located at intersections shall be installed on property lines between lots.
3. Not more than three hydrants shall be installed on an 8-inch main between intersecting 12-inch mains. The pipeline connecting the hydrant and the main shall be a minimum of 6 inches, with a gate valve flange connected to the main.
4. A blow-off assembly shall be installed on all permanent and temporary dead-end runs. A 2-inch blow-off shall be used on mains 12 inches and smaller. A 4-inch blow-off shall be used on mains 16 inches and larger. In no case shall the location be such that there is a possibility of back-siphonage into the distribution system.
5. Blow-off assemblies shall be located at low points along transmission mains.

B. Spacing – Fire hydrants and blow-offs shall have a maximum spacing of 500 feet measured along the street frontage in residential areas and a maximum spacing of 350 feet in all other areas. Where new water mains are extended along streets where hydrants are not needed for protection of buildings or similar fire problems, fire hydrants shall be provided at spacing not to exceed 1,000 feet to provide for transportation hazards. Refer to Roseville Fire Code for the number and distribution of fire hydrants served by private fire service water systems.

C. Cul-de-sacs and Dead-end Streets – Hydrants shall be required within a cul-de-sac or dead-end street measuring more than 250 feet as measured from the curb return of the intersecting street and the end of the bulb or street. A minimum 8-inch water main shall extend up to the hydrant tee.

- D. Valves** – Hydrant valves shall be placed with a minimum separation of 15 feet from the hydrant.
- 8-16 WATER SERVICE** – Water services shall be installed at the time the water main is constructed. Service stubs 2 inches and smaller shall be copper. Service stubs 3 inches and larger shall be fully restrained ductile iron pipes. Services from mains installed in private roads shall be extended 1-foot beyond the edge of pavement. Water services shall also conform to the following requirements:
- A. Location** – Water services for residential subdivisions shall be located 42 inches from the property line per these Construction Standards. The building service shall be located to provide the most direct connection to the main. Every effort shall be made to pair services.
- B. Curb Stamp** – The curb shall be stamped with a “W” at all service locations.
- C. Sizing** – The standard size of a single-family residential service line shall be a minimum 1- inch service or as determined by Roseville Fire Department. Schools, commercial, industrial, or a multi-family residential developments shall be provided with a larger service subject to approval by the Environmental Utilities Director.
- D. Spacing** – For service laterals 2 inches in diameter or smaller, service saddles shall be a minimum of 12 inches from the end of the main and 24 inches to any other service saddle or pipe joint.
- E. Service Taps** – The Environmental Utilities Department reserves the right to make all water service taps onto existing mains upon application for a service tap and authorization for payment. Work by the City shall be performed on a time and materials basis. A note to this effect shall be placed on the plan sheet which shows a detail of the area that requires such tapping. The service tap application shall be made to the Environmental Utilities Department a minimum of two weeks in advance of the time the tap is desired. All connection fees must be paid prior to the time of application. All excavation, backfill and the installation of the remainder of the water service shall be performed by the Contractor.
- F. Water Meters** – Water meters shall be installed on all water services. Meters shall be purchased through the City and installed by City forces upon plan approval and payment of the connection fees.
- 8-17 RESTRAINT** – Joint restraint shall be achieved by means of a mechanical joint restraint device. Full pipe restraint shall be required within bridges, casings, dead end runs, temporary dead end runs, and as determined by the Environmental Utilities Director. Restrained pipe within casings or bridges

shall be fully extended or “stretched out” to remove the slack between the joints the entire length of the structure. A note shall be placed on the plans. Thrust blocks shall not be used unless specifically called out on the plan set and approved by the Environmental Utilities Director. In the case of hydrant runs and dead-ends, thrust blocks shall be used in addition to mechanical restraints as a redundant feature. Restraint calculations shall be submitted with the plan review. Restraint calculation parameters are as follows: soil type ml, granular fill, 1.5 to 1 safety factor, trench type 4, and minimum test pressure of 150 psi.

8-18 WORK NEAR EXISTING WATER MAINS – Existing transmission water mains shall be clearly shown on the plans. The plans shall have a caution note on the cover sheet, plan/profile sheets, and grading sheets where the transmission main is shown as existing. The notes shall read as follows:

CAUTION EXISTING (name size) WATER MAIN.

No construction shall be permitted within the water main easement without the presence of the Environmental Utilities inspector. Prior to start of construction, 48-hour notice shall be given. Heavy equipment and vibratory equipment may cross designated segments of the water main with a minimum of 10 feet of cover or approved equivalent. The City shall inspect the condition of the existing main prior to paving. Request for inspection shall be made one week in advance.

A. Water Mains 16 Inches and Larger:

1. The Environmental Utilities Department shall inspect the interior of the existing water transmission main prior to paving. If damage to the pipe resulting from construction activities is discovered, the Contractor shall be billed for repairs. A minimum of one-week advance notice is required prior to inspection.
2. The Contractor shall provide the City with a construction schedule, and a list of equipment proposed to be used within the water main easement.
3. A plastic mesh fence shall be installed on both sides of the water main a minimum of 10 feet from the centerline prior to the start of construction and/or grading operations

8-19 WATER IMPROVEMENT PLAN REQUIREMENTS – Plans for the construction of water infrastructure, whether in conjunction with other improvements or for a water project only, shall conform to these standards, the Construction Standards, and meet the following requirements.

A. Water Study – A water study or water master plan as determined by the Environmental Utilities Director may be required prior to review of

the water design if there is a possibility that adjacent areas might require service through the subject property.

B. General Requirements – Plans for the water improvement project shall include a layout sheet, plan and profile of each public water line, and necessary detail drawings. Reference to the Construction Standards shall be made for all standard details.

C. Layout Sheet – Improvement plans shall include an overall map which shows the project boundaries, water mains, valves, services, and other important items of the work.

1. A parcel which benefits from and financially participates in a water construction project, but is not included within the project boundaries, shall have a note to this effect placed on the layout map and on the plan and profile sheet if the parcel appears thereon. Parcels which make use of those facilities may be subject to additional fees at the time of connection, if the participation has not been so noted.

D. Plan and Profile Sheets – Water lines to be maintained by the City of Roseville shall be shown on both plan and profile. The following standards, with respect to drafting and the information to be included on the plan and profile sheets, generally apply to project in developed areas.

1. Water lines to be constructed shall be indicated on profile by parallel lines spaced to show the pipe diameter to scale. The length, size, and type of pipe material shall be printed parallel to the horizontal grid lines and approximately halfway between the ground surface and pipe line. The profile shall note all proposed appurtenances. Existing facilities shown on the profile shall be dashed or distinguishable from proposed improvement. Manhole identification on the plan view may be oblique. Stationing shall appear at the lower edge of the profile grid directly under the appurtenance.

2. Proposed water services shall be indicated on the plans per the Construction Standards details.

3. Improvements or lots shown on a plan sheet but served to a line shown on another plan sheet shall have the direction of service shown by a small triangle and letter “W.”

4. Both permanent and working easements shall be shown to scale and dimensioned on the plans.

5. Proposed water lines shall be adequately dimensioned from street centerline. If the water line is to be located in an easement, sufficient

dimensions and bearings from physical features to locate the line in the field shall be shown on the plans.

6. Existing gas, sewer, storm drains, and all other utility lines above or below ground shall be shown on the plans.
7. Trees and other objects within 10 feet of the construction centerline shall be dimensioned on the plans relative to the construction centerline. The diameter of tree trunks and interfering heavy tree branches shall be noted. Removal of a tree or object, or other special handling shall be noted. Written documentation of any special arrangements regarding preservation of property shall be provided to the Environmental Utilities Director if no easement document is involved. If an easement is negotiated, all special arrangement shall be included in the easement document. Tree removal must be approved by the Planning Department.
8. Culverts shall be shown on both plan and profile when crossed by the construction or when parallel and within 20 feet of the construction line. Type, size, and invert elevation shall be called out.
9. No trees or permanent structures shall be placed within water easements without the approval of the Environmental Utilities Director.

E. Detail Drawings – Details not covered by the Construction Standard Detail sheets shall be shown on the plans.

8-20 RECORD (AS-BUILT) PLANS –The Contractor/Developer shall keep an accurate record of all approved deviations from plans and shall provide a PDF electronic, full size bond and 11 x 17 copy of the as-built plans prior to final acceptance of the completes improvements. Each sheet of the plans shall be marked “AS-BUILT” or “RECORD DRAWING”. “AS-BUILT” or “RECORD DRAWING” of signal plans, water, sewer and storm drain composite in plan view only, and parcel and final maps shall also be submitted on computer disk in DXF or DWG format.