



WATER DISTRIBUTION SYSTEM DESIGN CRITERIA MANUAL

EAST LARIMER COUNTY WATER DISTRICT

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Water Distribution System Design Criteria Manual– Version History

Version Number (Date)	Purpose/Change	Author
05/01/2025	Overhaul/reissue/reformat from previous version (March 17, 2020), made consistent with overhauled Specifications and Standard Construction Detail Drawings.	DKM
08/15/2025	Revised Section 3.05.B pertaining to ADD & MDD. Changed to “fire <i>service</i> lines” throughout. Minor format changes.	DKM



SECTION 1 — GENERAL PROVISIONS

1.01. INTENT

- A. These Design Criteria, hereinafter referred to as the “Criteria”, shall be known as the East Larimer County Water District (District) Water Distribution System Design Criteria (Criteria) and shall be the governing Criteria for the public water distribution improvements that are designed and installed within the District water service area.
- B. These Criteria, with all future amendments, establish minimum design standards for providing and maintaining the District water distribution system. Whenever the requirements of these Criteria are found to be inconsistent with any other adopted standards, regulations or codes, the more restrictive criteria, standards, regulations or codes shall control.
- C. The Design Engineer is responsible for compliance with these Criteria as well as other applicable design and construction standards in the preparation of engineering and construction documents for review and acceptance by the District. The provisions of these Criteria are minimum requirements that do not preclude the use of more restrictive standards by the Design Engineer.
- D. The design of all public improvements shall be by or under the direction of a Professional Engineer duly registered and licensed by the State of Colorado.
- E. Adherence to these Criteria does not remove the Developer’s responsibility to investigate and obtain any other regulatory permits or approvals from local, regional, state or federal agencies that may be required for a particular project.

1.02. REVISIONS AND UPDATED CRITERIA

- A. The Criteria may be amended as new technology is developed or as a need for revision is demonstrated and proven through experience and use. The District will maintain these Criteria and any amendments thereto and will post these Criteria and amendments on the District’s website. The District does not keep a database of holders of these Criteria. It shall be the responsibility of each holder to verify the most current Criteria are being used for any project.

1.03. OTHER RELATED STANDARDS

- A. All public water improvements shall comply with the District’s latest Water Distribution System Master Plans.
- B. Materials and installation of the water, wastewater and stormwater improvements shall comply with the District’s Standard Construction Specifications for Water Mains.

1.04. DEFINITIONS AND ABBREVIATIONS

- A. AASHTO – American Association of State Highway and Transportation Officials.
- B. AWWA – American Water Works Association.



- C. As-Built Drawings – As-Built Drawings are compiled and maintained during construction by the Contractor and identify, in red ink, on-site changes to the approved plans. As-Built Drawings shall be delivered to the District (electronically in PDF format or otherwise as requested by the District) for acceptance and to the Design Engineer for the creation of Record Drawings.
- D. Contractor – A person, partnership or corporation duly licensed and bonded to work in the area of the proposed water system improvements.
- E. CP – Cathodic Protection or Cathodically Protected.
- F. Design Engineer – The partnership, corporation or individual who is registered as a Professional Engineer according to Colorado Statutes, who is hired by the Developer/Owner to conduct engineering design services and who may be empowered by the Developer/Owner to act as his/her agent for the project.
- G. District – East Larimer County Water District
- H. District Engineer – The engineer at the District responsible for review of all Utility Plans associated with design and construction of proposed water lines and water line improvements within the District.
- I. Developer or Developer/Owner – This includes the person or persons, public or private, legally responsible for construction of improvements within a specific development.
- J. DI or DIP – Ductile iron / ductile iron pipe.
- K. Distribution Main – The portion of the water system that conveys water to or from the transmission mains for use at a neighborhood scale.
- L. Easement – A right granted by a property owner permitting a designated part or interest of the property to be used by others for a specific use or purpose.
- M. General Manager – The General Manager of the District.
- N. GPM or gpm – Gallons per minute.
- O. HDPE – High density polyethylene.
- P. Inspector – The authorized representative of the District assigned to make detailed inspections for contract performance, standards and contract compliance.
- Q. LCUASS – Larimer County Urban Area Street Standards.
- R. MJ – Mechanical joint.
- S. May – A permissive condition. No requirement for design or application is intended.
- T. Maximum (Max.) Day Demand – Maximum Day Demand (MDD) refers to the highest volume of water used by a system in a single 24-hour period throughout the year.
- U. Non-Potable – Water that is not treated to drinking water standards and is not suitable or intended for human consumption.



- V. Owner – Any person having title or rights of ownership in the surface of real property or leasehold interest therein.
- W. Peak Hour Demand – Peak Hour Demand (PHD) is the maximum average water flow rate experienced in a one-hour period.
- X. Professional Engineer – A registered engineer licensed by the State of Colorado with expertise and qualifications in the areas covering the scope of work.
- Y. PSI – Pounds per square inch of pressure.
- Z. PVC – Polyvinyl chloride.
- AA. Record Drawings – Record Drawings are prepared by the Design Engineer and shall accurately reflect any change made in the field which varies from the accepted Utility Plans, as noted in the As-Built Drawings, including at a minimum, field dimensions and elevations, horizontal and vertical locations of underground utilities and appurtenances. The Record Drawings shall be reviewed and accepted by the District prior to preliminary acceptance of the project. Record Drawings are to be delivered to the District in electronic format such as Adobe (PDF), AutoCAD and ArcView shape files (release version to be confirmed with District at time of submittal). The Record Drawings shall be prepared and stamped by a Professional Engineer registered and licensed by the State of Colorado.
- BB. R.O.W. or Right-of-Way – A general term denoting land, property, or interest therein, usually in a strip acquired for or devoted to a street or utility.
- CC. Shall – A mandatory condition. Where certain requirements in the design or application are described with the “shall” stipulation, it is mandatory that these requirements be met.
- DD. Should – An advisory condition. Where the word “should” is used, it is considered to be advisable usage, recommended but not mandatory. Deviations may be allowed when reasons are given which show that the intent of the standard is met.
- EE. Street – A general term denoting a public way for purposes of vehicular travel, including the entire area within the R.O.W. (including alleyways).
- FF. Transmission Main – Typically, a water line whose nominal diameter is 12 inches or larger and is used to convey water to the distribution system.
- GG. Utility Plans – Drawing and details of the project’s water lines that include a plan, profile and detail sheets of proposed water line improvements for development projects.

1.05. VARIANCES

- A. Any design that does not conform to these Criteria must be approved by the General Manager. Variances from these Criteria will be considered administratively on a case-by-case basis following a written request for a variance prepared by a Professional Engineer and submitted to the District Engineer. To



assist with plan preparation, designers may submit variance requests, along with documentation to support the variance, for informal advisory consideration prior to formal submittal of Utility Plans. Such advisory consideration shall not be binding on the District but may help guide the designer in the preparation of plans.

- B. Variances requested as part of the formal submittal of Utility Plans shall be shown on the plans and shall also be specifically substantiated and justified in a letter addressed to the District Engineer. A summary of all approved variances shall be listed in the general notes on the approved plans.
- C. The variance request shall include, at minimum, the following:
 - 1. Identifying Issue: Identification of the standard to be varied and the reason that the standard is not feasible or not in the public interest.
 - 2. Proposed Alternate Design: Identification of the proposed alternate design or construction criteria.
 - 3. Comparison to Criteria: A thorough description of the variance request including the impact on capital and maintenance requirements, costs and how the proposed design compares to the Criteria.
 - 4. Justification: The Professional Engineer must determine and state that the variance will not be detrimental to public health, safety and welfare and will not reduce the design life of the improvement nor cause the District additional maintenance costs. The proposed plan must advance the public purpose of the Criteria sought to be varied equally or better than would compliance with these Criteria.
- D. Approval or Denial of Variance: Based upon review of the Utility Plans and additional information submitted, and an analysis of the process set forth in this Subsection, the General Manger may approve or deny the variance request. If the request is approved, the plans will continue to be reviewed and approved within the typical review process. If the request is denied, the Developer shall subsequently submit revised plans in compliance with these Criteria. A written response outlining the basis for all approvals or denials of variance requests will be provided by the District Engineer.

1.06. ENFORCEMENT AND INSPECTION

- A. These Criteria are enforceable by the District at any point in the Development review and construction process, including installation, inspection and acceptance of the public improvements.
- B. Inspection services during construction are provided by the District.

1.07. PUBLIC WATER SYSTEM EXTENSION AND OVERSIZING

- A. Extensions: The Developer shall install water mains to the farthest point or points of the property.



- B. Oversizing: If the District requires a Developer to install water mains or other related infrastructure improvements at a size or capacity greater than would be necessary to serve the new development, the District will cooperate with the Developer and determine, through agreements or other means, an appropriate reimbursement for the additional cost for those improvements.

1.08. EASEMENTS

- A. All District-owned water lines and appurtenances associated with the water lines shall be located in a public Right-of-Way or an easement dedicated specifically to the District.
- B. Minimum easement widths are listed in Table 1. At the discretion of the District, wider easements may be required to provide adequate separation from buildings, structures or other adjacent improvements, or where the depth of a utility or the number of utilities occupying the easement necessitates additional width to satisfy standards for utility separations, trenching excavations, maintenance access and safety.
- C. Existing Easements: In some instances, for example during residential or commercial development of property through which an existing water main crosses, the District may determine that existing water main easements are of inadequate width. In these instances, additional easement must be granted to the District before the District provides service to the redeveloped property.

Table 1: Minimum Easement Requirements for Water Mains

Utility	Minimum Easement Width
Water Mains 12” Diameter and Less	30 feet
Water Mains Greater Than 12” Diameter	40 feet minimum

SECTION 2 — UTILITY PLAN AND RECORD DRAWING REQUIREMENTS

2.01. GENERAL

- A. Utility Plans and Record Drawings for District water system improvements shall be prepared and submitted in accordance with these Criteria. Final signed Utility Plans and Record Drawings must be stamped by a licensed Colorado Professional Engineer and delivered to the District in electronic format such as Adobe (PDF), AutoCAD and ArcView shape files if requested (release version to be confirmed with District at time of submittal).
- B. As a minimum, the Utility Plan set shall include the following:
 1. Cover sheet
 2. General and construction notes
 3. Overall utility plan
 4. Plan and profile sheets as required



5. Applicable standard construction details

2.02. UTILITY PLANS

- A. Utility Plans are plan view drawings that show all utilities to be installed for the development.
- B. The scale on the plan view drawings shall be 1 inch = 20 feet, 30 feet. or 40 feet. These sheets may also include details and designs for lowerings, crossings, or special items to clarify the intent of the information shown on that particular sheet.
- C. All projects must use the following coordinate systems:
 - 1. Horizontal Datum: Colorado State Plane North Zone NAD 83.
 - 2. Vertical Datum: NAVD 88.
- D. All construction or development phasing shall be clearly noted such that each phase is depicted in a “stand alone” manner. In some cases, water mains may be required to extend beyond a particular phase to provide acceptable redundancy for water service. In these cases, the plan sheets shall clearly show the applicable phase lines, design, details, R.O.W., easements, etc. to accommodate such extensions beyond a particular phase.
- E. On plan and profile drawings, longitudinal stationing based upon centerline of main shall be included for all water lines and related appurtenances (e.g. service connections, valves, fittings, fire hydrants, vaults, blow-offs, air release/vacuum valves, etc.). Stationing for water mains shall generally read in ascending order in the direction of the north arrow or from left to right.
- F. Horizontal locations for all proposed and existing water mains shall be dimensioned from the centerline of the R.O.W. or easement. In some cases, additional dimensioning may be required for purposes of clarity and future reference.
- G. Existing structures, wet and dry utilities, and ground surfaces shall be included on all plan views (shown as phantom lines and shapes). These existing items shall be dimensioned in a manner that clearly shows the relationship to the proposed water mains. This shall include but is not limited to the following:
 - 1. All water, wastewater, storm drainage, electric, cable television, communications lines, and any related appurtenances.
 - 2. Drainage and irrigation ditches or swales.
 - 3. Fence lines and gates.
 - 4. Bridges and culverts.
 - 5. Curb lines and other roadway features.
 - 6. Existing landscape features.
 - 7. Other items that may be required by the District, solely at the District’s discretion.



2.03. WATER SYSTEM PLAN AND PROFILE DRAWINGS

- A. Plan view scale on the plan and profile drawings shall be 1 inch = 20 feet, 30 feet, or 40 feet. Profile view scale shall be 1 inch = 5 feet or as directed by the District to provide clarity and adequate detail to the drawings. These sheets may also include details and designs for lowerings, crossings, or special items to clarify the intent of the information shown on that particular sheet.
- B. Plan and profile drawings are required for all water mains.
- C. The following shall be clearly shown and labeled on the plan view:
 - 1. Pipe material, diameter, lengths between fittings, valves, fire hydrants, appurtenances, radius of curvature (where pipe is to be deflected), etc.
 - 2. All fittings and water main appurtenances.
 - 3. Services with size and curb stop locations.
 - 4. Location and size of all water service lines, meter pits, and meter vaults.
 - 5. Casings, including material, diameter, thickness, and length.
 - 6. All lowerings and vertical sweeps.
 - 7. Match lines with sheet numbers.
 - 8. Phase lines.
 - 9. Hatching or labeling to indicate beginning and end of all portions of the water main being restrained with restrained lengths clearly shown and labeled.
 - 10. Stationing Along Water Lines: Longitudinal stationing based upon centerline of the water line shall be included for all water lines and related appurtenances (e.g. service connections, valves, fittings, fire hydrants, vaults, blow-offs, air release/vacuum valves, etc.). Stationing for water mains shall generally read in ascending order in the direction of the north arrow or from left to right.
- D. Water main profiles shall include the following:
 - 1. Existing ground profile shown as dashed line.
 - 2. Proposed ground profile shown as solid line.
 - 3. All items required in 2.03 C. of these Criteria with longitudinal stationing and design elevations for each item noted.
 - 4. Depths of water main relative to the proposed ground profile.
 - 5. All utility crossings (existing and proposed) with longitudinal stationing, elevations, and clearance from water line to the utility noted.
 - 6. Groundwater barriers (cut-off walls) based upon groundwater levels.

2.04. UTILITY STANDARD DETAILS



- A. Each applicable Standard Construction Detail Drawing shall be included on the Utility Plan detail sheet. All Standard Construction Detail Drawings shall be shown as originally prepared by the District and shall not be altered without first obtaining written approval from the District Engineer.
- B. If alteration is approved, the Standard Construction Detail Drawing must clearly show “Revised – Project Name” in bold letters near the title block of the drawing.
- C. All other non-standard details (e.g. lowerings, special construction items, crossings, etc.) shall be included on the appropriate plan or plan and profile sheet.
- D. The Standard Construction Detail Drawings are available on the District’s website.

2.05. FINAL UTILITY PLAN

- A. An electronic version, in a format acceptable to the District, of the final Utility Plans shall be provided to the District at the time that the final plans are signed. The electronic plans shall include all approval signatures and Design Engineer’s seal and signature.

2.06. RECORD DRAWINGS

- A. The Contractor’s surveyor shall survey the location of the water line and all appurtenances so that the Design Engineer has adequate information to create the Record Drawings. Record Drawings shall be prepared with a cooperative effort of the Design Engineer and the Contractor as follows:
 - 1. Record Drawings shall document dimensions, grades/slopes, lengths, elevations, and details that are different from the approved Utility Plans.
 - 2. Record Drawings shall include horizontal and vertical locations of underground utilities different from or not shown on the approved Utility Plans.
 - 3. Record Drawings shall be prepared in a manner that shows changes legibly and denotes the change by clouding, revision symbols, alternate line coloring, or similar means to clarify the change or revision that was made.
 - 4. Record Drawings shall be clearly labeled **RECORD DRAWING** in bold font and be signed and sealed by the Professional Engineer.
 - 5. Water main locations on the Utility Plans shall be redrawn in the AutoCAD version of the Record Drawings to accurately represent the as-built location of the water main, appurtenances, services lines, and meter pit locations (curb stops).
 - 6. Profile view of the water main locations on the Utility Plans shall be redrawn in AutoCAD if the vertical location of the water main changes more than 12 inches from the design location or there are changes that are determined by the District Engineer to require the profile to be redrawn to show the actual location.



7. The Design Engineer shall submit one copy (electronic or hard copy to be determined by District Engineer) to the District Engineer for review. The Design Engineer shall modify or edit the drawings and resubmit as appropriate until the District is satisfied that the Record Drawings accurately reflect the as-built condition of all water lines and appurtenances.
- B. After acceptance of the Record Drawings by the District, the Professional Engineer completing the Record Drawings shall provide the following to District:
1. AutoCAD drawings (in latest version or version as requested by the District) with horizontal coordinates, elevations, water utility linework, appurtenances (including water service curb stop locations), and other pertinent information for the purposes of the District revising and maintaining its utility mapping system.
 2. PDF version of the drawings.

SECTION 3 — WATER DISTRIBUTION DESIGN CRITERIA

3.01. GENERAL

- A. These Criteria typically apply to potable water mains 12-inch diameter and smaller. If a development project includes any construction of or modification to a water main larger than 12-inch diameter, the Design Engineer must contact the District Engineer for design and construction requirements.

3.02. WATER DEMAND ANALYSIS REPORT

- A. The District *may* require that the Design Engineer submit a Water Demand Analysis Report during the initial development project review process. If a Demand Analysis Report is required, it shall at minimum analyze and identify the proposed development's residential, commercial, and irrigation water use (average and peak demands), and demand projections over a buildout timeline.

3.03. WATER SYSTEM MODELING

- A. If during the development review process, the District determines that a dynamic water system analysis is needed for proper sizing of water mains or other appurtenances within the District water transmission and distribution system, the Developer will be required to cover the cost for the District, or a consultant as hired by the District, to perform the necessary modeling and reporting to evaluate the proposed project's impact to the District water system. The evaluation (and report as required) shall identify water system improvements required to serve the development and maintain service within the existing District service area.

3.04. DISTRICT WATER SERVICE AREA

- A. The District provides water service to portions of the area inside the City of Fort Collins, Town of Timnath, and Larimer County, and has lands within its service area in Weld County.



- B. The District's water service area generally abuts the following water districts or municipal water utilities:

City of Fort Collins
222 Laporte Avenue
Fort Collins, CO 80521
Telephone: 970-212-2900

Fort Collins-Loveland Water District
5150 Snead Drive
Fort Collins, CO 80525
Telephone: 970-226-3104

Northern Colorado Water Association
4389 E Co Rd 70
Wellington, CO 80549
Telephone: 970-568-3975

Sunset Water District
Telephone: 970-491-3237

West Fort Collins Water District
2711 N Overland Trail
Laporte, CO 80535
Telephone: 970-484-4881

North Weld County Water District
23825 County Road 39
Lucerne, CO 80646
Telephone: 970-356-3020

- C. When designing water main extensions, it is important to avoid designing/constructing mains which would interconnect with these various utilities.

3.05. WATER DISTRIBUTION SYSTEM DESIGN AND LAYOUT

A. General

1. Redundancy: Each development shall have redundant sources of water supply to provide a combination of adequate fire flow, uninterrupted customer service, and acceptable water quality. Redundancy is typically achieved by making at least two separate and distinct connections to the existing District water system. Based upon the magnitude and water demands of a proposed development project, the District may require a greater number of connections.



2. System Interconnectivity: All distribution mains shall be looped into the existing and proposed distribution system to ensure at least two feed sources and to maintain system reliability except where allowed as follows:
 - a. Dead-ends: Permanent dead-end mains are discouraged and should be avoided when practical. The most common exceptions are cul-de-sacs. If a dead-end main is approved by the District (temporary or permanent), there must be a fire hydrant at the end for flushing. Where allowed, the length of permanent dead-ends shall be limited to a maximum of 500 feet. The District shall have full discretion to reject any proposed dead-end main.
3. Access: Development site layout shall be designed in a manner that accommodates acceptable access for operation, maintenance, repair and replacement of the water system. This includes but is not limited to adequately designed all-weather access surfaces for mains installed outside of a public roadway.

B. Hydraulic Parameters

1. Pressure: The distribution system shall be designed to provide a minimum pressure of 40 psi and a residual pressure of 20 psi at ground surface elevation, both either under Maximum Day Demand plus fire flow (as required by the fire authority), or Peak Hour Demand, whichever is greater.
2. Velocity: All water mains (except for fire hydrant laterals) shall be designed for a maximum velocity of 10 feet per second at Maximum Day Demand plus fire flow (as required by the fire authority), or Peak Hour Demand, whichever is greater.

C. Water Main Size

1. Allowable Water Main Sizes: 6, 8, 12, 16 and 24-inch diameters. Minimum size is typically 8-inch with the exception of short cul-de-sacs and fire hydrant laterals.
2. Section Lines and Quarter Section Lines: Section and quarter sections shall have a water main grid of minimum 12-inch diameter lines unless a larger main is included in the District Water System Master Plan.
3. All water main sizes shall comply with the District Water System Master Plan.

D. Pipe Material

1. Water mains shall be Polyvinyl Chloride (PVC).
2. All water mains 6-inch through 24-inch shall be DR 18 (pressure class 235 psi) and manufactured in accordance with AWWA Standard C900 (latest version), "Polyvinyl Chloride (PVC) Pressure Pipe, 4-inch through 60-inch, For Water Transmission and Distribution."



3. Water mains greater than 24-inch diameter shall be specified based on an engineered design.
4. All water lines shall be installed with tracer wire.

E. Alignment

1. Within a platted public right-of-way, the water main shall be a minimum of 5 feet from the edge of curb.
2. Straight Alignment: In general, water mains shall be laid with straight alignments with manufactured, ductile iron, mechanical joint bends.
3. Curved Alignment: If allowed per review by the District Engineer, water mains installed in curved portions of street R.O.W.s or easements may be designed utilizing pipe joint deflection.
 - a. Pipe joint deflection for PVC pipe shall not exceed 1 degree per section of pipe or the pipe manufacturer's recommended maximum joint deflection, whichever is less. Bending the pipe is not allowed.

F. Water Main Depth

1. Normal depth of cover for all water mains is a minimum 4.5 feet to a maximum of 5.5 feet measured from finished grade to top of water main. Depths of cover outside of this range require approval from the District Engineer with input from District field operations staff. If less than 4.5 feet of cover is allowed, the Design Engineer must design the thickness and extent of the insulation to be provided to mitigate the shallower depth of cover and include a detail showing the placement and dimensions of the insulation and the specifications for the insulation which is suitable for underground applications.

G. Lowerings

1. In cases where the normal water main depth results in a conflict with other utilities, the water main may be lowered to mitigate the conflict. Combination air release / vacuum valves shall be required at high points that are created by the lowering of 12-inch and larger water mains and may be required on smaller mains at the discretion of District Engineer.
2. When the lowering is crossing below another pipeline 8 inches or larger, a bank of multiple pipelines, or a box culvert, the water main may be required to be installed in a casing. See the District's Standard Construction Detail Drawings, "Water Main Lowering Detail," to determine if a casing is required. If a casing is required, the following shall apply unless otherwise accepted by the District Engineer:
 - a. Casing shall extend a minimum of 10 feet beyond each side of the pipeline or other utility above.
 - b. 18 inches of vertical separation is required between the top of the casing pipe and the bottom of the other utility.



- c. The water line shall be restrained through the casing utilizing restrained joint pipe or approved joint restraint devices. The use of tie-rods is not allowed.
 - d. Isolation valves are required at both ends of these lowerings, 40 feet back from the end of the casing, and shall be restrained to prevent the valve from “blowing off” when the piping in the lowering area is disassembled for repair or replacement.
 - e. No services, fire hydrants, fire service lines, or any other connection(s) are allowed in the lowering area or between the isolation valves.
3. All lowerings are subject to clearance standards contained in these Criteria or as required by the District Engineer.
 4. Lowerings may be designed utilizing manufactured bends or pipe joint deflections.
 - a. Manufactured bends shall be mechanical joint (MJ) fittings restrained by approved mechanical joint restraints with restrained lengths determined by the Design Engineer and reviewed and accepted by the District Engineer.
 - b. Pipe joint deflection for PVC pipe shall not exceed that stated elsewhere in these criteria. Bending the pipe is not allowed.
 5. All lowerings shall be labeled on the Utility Plans
 6. When fittings are used, a detail for each lowering is required on the Utility Plans showing size and elevation of both utilities, fittings, valves, distance between fittings, casing diameter and thickness (if applicable), and other pertinent information.
 7. When pipe joint deflection is used, indicate on the Utility Plan and Profile drawing(s) the water main station where the deflection starts and ends.
 8. Valves may be required at both ends of lowerings other than those noted elsewhere in this section and, if required, shall be restrained or located sufficiently back from the lowering to prevent the valve from “blowing off” when the piping in the lowering area is disassembled for repair or replacement.

H. Connections to Existing Distribution System

1. Water Service Interruptions: The District seeks to achieve a continuous, reliable, and redundant water supply for its customers and to minimize interruptions of service. A service interruption for the purpose of installing a new water main connection to the existing distribution system must be closely coordinated with and approved by the District. Each request for a service interruption will be evaluated from the standpoint of the impacts on customer water needs, water quality, fire protection requirements, and other pertinent factors that may arise for a particular development proposal.



2. Method of Connection: Connections to the existing system shall be made by cutting in a tee or swivel tee, as directed by the District. Wet taps will not be allowed unless conditions preclude cutting in a tee and must be approved by the District. The decision on the type of connection (tee or wet tap) shall be at the sole discretion of the District.
3. Isolation Valves at New Connections: At the discretion of the District, a valve may be required at each new connection point to allow for isolation from the existing system.

I. Valves

1. Gate valves shall be used on all mains up to and including 8 inches.
2. Butterfly valves shall be used on all mains 12 inches and larger.
3. Valves are required at all crosses and tees. The minimum number of valves at these locations is generally the number of connections minus one. For example, a cross fitting has four connections; therefore, the design should include a minimum of three valves. The number of valves and orientation shall be determined by the District Engineer.
4. No more than 600 feet of water main shall be located between isolation valves. On transmission water mains with no service connections, valve placement will be evaluated on a case-by-case basis.
5. No more than one fire hydrant shall be located between isolation valves unless directed by the District to add additional fire hydrants.
6. Valves are required on both sides of a stream, irrigation ditch or canal crossings, railroad crossings, and bored crossings. Valves shall be located back from the crossing or restrained in such a manner as to prevent the valve from “blowing off” when the pipe is disassembled between the valves for maintenance or replacement. No water services shall be connected to the water main between these valves.
7. Valves may be required on both sides of water main lowerings.
8. The District may require installation of additional valves not shown on the plans when determined necessary in the field by the District.
9. Valves shall be located to provide maximum accessibility and shall not be placed in areas subject to routine parking and storage operations.
10. Combination air release / vacuum valves are required at high points on all water mains and at all other locations as required by the District.

J. Fire Hydrants

1. All fire protection, fire flow, and fire hydrant requirements are subject to the approval of the local fire authority.
2. Private fire hydrants are not allowed to be connected to the District system.



3. Hydrant Spacing and Flow: Table 2 provides general guidelines for hydrant spacing and flow requirements. For new developments, the Design Engineer shall be responsible for designing and locating fire hydrants per the requirement of the local fire authority.

Table 2: Hydrant Spacing and Flow Requirements

Description	Maximum Distance Building to Hydrant ₁	Maximum Distance Between Hydrants ₁	Minimum Flow at 20 psi
Single-Family Resident	400 Feet	800 Feet	1,500 gpm
Multi-Family Resident & Commercial	300 Feet	600 Feet	2,500 gpm

1. Distance measured on path of vehicle travel.

4. Where water mains are extended along streets through areas that will not be developed (open space, parks, etc.), hydrants shall be provided at spacing not to exceed 1,000 feet.
5. Hydrants shall be located at intersections whenever possible. Mid-block hydrants shall be installed at the extension of a property line at a location that avoids conflicts with dry utility service lines.
6. Fire hydrants shall be placed at the end of all cul-de-sacs. The hydrant valve shall be located in the paved street a minimum of 5 feet from the curb and gutter.
7. Fire hydrant assemblies are required on all permanent or temporary dead-end water mains. The hydrant lateral shall be at a right angle to the distribution main installed with a swivel tee (see the District’s Standard Construction Detail Drawings, “Typical Fire Hydrant Installation”).
8. A 5-foot radius in all directions around the hydrant shall be free of all obstructions.
9. Where hydrants are vulnerable to vehicular damage, they shall be protected by traffic rated fire hydrant guard posts.
10. All fire hydrants shall have a minimum of 4.5-feet and maximum 5.5-foot depth of bury with fire hydrant flange above finished grade by 4 inches.
11. Hydrants shall be located within the public R.O.W. or utility easement.

K. Thrust Restraint

1. The preferred method of thrust restraint shall be accomplished by restraining pipe joints and fittings with approved mechanical joint restraint devices on all water main fittings and appurtenances.
2. The minimum required restrained joint lengths shall be in accordance with the District’s Standard Construction Detail Drawings, “Horizontal (and Vertical) Restraint Lengths.”



3. For specific joint restraint situations not covered by the District’s Standard Construction Detail Drawings, the Design Engineer shall calculate the required restrained joint length. The District accepts calculations prepared using the online EBAA Iron's Restraint Length Calculator, version 7.1.3 (<https://ebaa.com/calculator/>), or most current version, using the input parameters presented in Table 3.

Table 3: Input Parameters for EBAA Iron's Restraint Length Calculator

Item	Input Parameter
Pipe Material	PVC
Soil Type	ML Granular Fill or CL Granular Fill
Safety Factor	2.0 to 1.0
Trench Type	#5
Depth of Bury	4.5 Feet
Test Pressure	200 psi
Length Along Run (for Tee Fitting)	5 Feet

4. Restrained pipe lengths shall be clearly shown and detailed on the development Utility Plans and final Record Drawings.
5. Approved joint restraint devices shall be used on all joints and fittings for fire hydrant installations from the connection at the water main to the connection of the hydrant to the fire hydrant lateral. (See the District’s Standard Construction Detail Drawings.)
6. Approved joint restraint devices shall be used on all pipe joints within a casing pipe.
7. Approved joint restraint devices are listed in the District’s Standard Construction Specifications for Water Mains.
8. With prior approval from the District, concrete thrust blocks may be used when conditions make it impractical to use restrained joints for thrust restraint or if requested by the Contractor, at the discretion of the District.
9. When a new connection is installed on the existing distribution system by cutting in a tee or installing a wet tap, a concrete thrust block may be used for thrust restraint behind the tee or tapping saddle. This applies to connections for fire service lines, distribution mains or large domestic services. Use of a concrete thrust block or mechanical joint restraint shall be at the discretion of the District. Any fire hydrant connected to an existing water main will require restrained joints and a thrust block.

L. Services

1. General



- a. The sizing of the water service line ('line' or 'service') and meter is the sole responsibility of the Design Engineer. This responsibility includes sizing the line and meter to accommodate any fire sprinkler system, irrigation, or other water use expected from the service line.
 - b. Water service lines shall not be installed in the same trench as other utilities.
 - c. All portions of service lines shall be installed with a minimum of 4.5 feet of cover and a maximum of 5.5 feet of cover from final finished grade.
 - d. Service taps shall be connected directly to District water system distribution mains and shall not be connected to any fire hydrant lateral or fire service line.
 - e. Service lines shall be perpendicular to the main from the location of connection to a point beyond the curb stop (and meter pit where applicable).
 - f. Service lines shall be the same size as the meter from the location of connection at the main to a point 5 feet beyond the meter unless otherwise approved by the District. At the point 5 feet beyond the meter, the size of the service line may be increased to reduce hydraulic losses.
 - g. All services 3/4 inch through 1 inch shall have a curb stop located within a R.O.W. or utility easement adjacent to the R.O.W.
 - h. The shut-off/control valve for all services larger than 1 inch shall be an approved gate valve at the point of connection to the distribution system water main.
 - i. The connection for a 3-inch service shall be a 4-inch tap with a 4-inch valve and a 4-inch by 3-inch reducer located at the point of connection at the water main.
 - j. Service lines to a property shall connect directly to a District water main without crossing another private property. This requirement does not apply to the common, private service lines serving single-family attached dwellings.
 - k. No service connections are allowed within a water main lowering or within 10 feet of a water main crossing of another utility.
 - l. Domestic water services and fire service lines for a given lot shall be connected to the water main within the confines of the property lines extended.
 - m. Domestic water services and fire service lines that are constructed but not used with a development shall be abandoned at the main in accordance with Section 3.10 of these Criteria.
2. Domestic, Multi-Family, and Non-Residential Services
- a. General
 - i. Curb stops shall be located within R.O.W. or utility easement as shown on the District's Standard Construction Detail Drawings or as approved by the District.



- ii. The sizing of water service lines for multi-family and non-residential buildings shall be performed by the Design Engineer. When requested, the sizing calculations shall be submitted to the District for review and approval.
- b. Single-Family
 - i. Each single-family lot shall have a separate 3/4-inch water service line connecting directly to the District distribution system water main without crossing another property.
 - ii. Dual Meter Pits: In some locations, dual meter pits (a single connection to the water main with two meters to service two single-family lots) are allowed. Use of dual meter pits must be shown on the development plans and be approved by the District. If one or more dual pit's service lines is not fully on the served property, that service line must be wholly within a utility easement until it enters the served property's boundary.
 - iii. Water service lines and meter pits shall be placed in a location acceptable to the District that will not be under a drive, fence, landscaping, structure, or impeded by other utilities.
- c. Single-Family with Carriage House
 - i. On a single-family lot, water service may be extended from the principal residence to a carriage house if approved by the District (in its sole discretion) if:
 - The buildings are on a single platted lot under single ownership.
- d. Duplex
 - i. Each dwelling unit in a duplex shall have a separate water service extending from the District water main unless a dual meter pit assembly is approved by the District.
- e. Multi-Family
 - i. Each multi-family building shall have a separate water service connecting directly to the District water main without crossing another property; however, the District may require a multi-family building to have more than one service.
 - ii. All multi-family developments shall have dedicated irrigation services (i.e., irrigation lines cannot connect to the water service and meter that provides water to the residential units) unless otherwise approved by the District.
- f. Single-Family Attached Dwellings
 - i. For single-family attached dwellings where each dwelling unit is on a separate platted lot, service and metering may be provided by:
 - A single meter and service line to each dwelling unit/platted lot, or



- e. The private property owner shall assume full responsibility of the fire service line downstream of the District-owned valve at the water main connection – that responsibility including but not being limited to installation, inspection, testing during installation, and compliance with all codes or other requirements.
- f. Fire service lines smaller than 2-inch diameter shall have a curb stop located within the R.O.W. or utility easement adjacent to the R.O.W.
- g. Fire service lines 2-inch diameter and larger shall have an approved gate valve at the point of connection to the water main.
- h. No domestic water service or irrigation taps are allowed to connect to a fire service line or a fire hydrant line.
- i. An approved backflow device in compliance with the District’s most recent Cross-Connection Control and Backflow Prevention Manual and all applicable regulations are required on all non-single family residential building fire service lines.

M. Meters

1. All domestic and irrigation water services connected to a water main shall be metered.
2. Water meter sizes allowed include 3/4-, 1-, 1-1/2-, 2-, 3-, 4-, and 6-inch.
3. Single family residences shall be limited to one 3/4-inch or 1-inch meter and service.
4. Meter locations:
 - a. Meters shall be installed outside (exterior to any building) in a water meter pit or vault (see the District’s Standard Construction Detail Drawings).
 - b. All meter pits and vaults shall be located in landscaped areas.
 - c. Modifications or deviations to the meter pit or vault locations must be approved by the District during the development review process.
5. Modification, alteration, or relocation of metering equipment must be approved by the District before any such modification, alteration, or relocation occurs.
6. The Design Engineer/Developer is responsible for determining the potential traffic loadings on meter pits/vaults and shall provide adequate structural strength for these loadings. The District may require AASHTO H-20 loadings.
7. Meter installations must be located to provide protection from freezing and frost damage.

N. Borings

1. Water mains across road, ditches, railroads, or other impediments may require a bored casing pipe to facilitate water main installation. The type



of bored casing material and its properties will be specified by the agency granting permission for the crossing or as determined necessary by the Design Engineer or the District. Such crossings are subject to the approval of the District to avoid conflicts between the requirements or standards between the District and the agency granting permission to cross.

- a. A letter, permit, or approved crossing application from the agency granting permission to cross must be provided to the District prior to the boring.
- b. The District will not accept any crossings or permits that require an annual user or crossing fee to be paid to the agency granting permission to cross.
- c. All bored crossing fees, if applicable, shall be paid by the Developer prior to boring.
- d. Valves are required at each end of the boring or as approved by the District.

2. Casing Pipe

- a. Casing pipe shall be steel unless otherwise approved or required by the District.
- b. Each casing pipe installation shall be specifically designed by the Design Engineer.
- c. If steel casing pipe is to be used, a soil resistivity analysis shall be performed and the need for cathodic protection shall be evaluated in accordance with Section 3.05.O.2. of this Criteria.
- d. A 20-pound anode and CP test station are required on both ends on a steel casing pipe. The anode wire and the test station wire shall be exothermically welded to the steel casing pipe.

O. Corrosion Control and Cathodic Protection

1. Certain other utility water mains or lines within the District water transmission and distribution system are equipped with cathodic protection (CP) systems.
 - a. All existing CP test stations shall be shown on the Utility Plans with notes to protect them in place.
2. If the use of steel casing (i.e., a boring) is proposed, the Design Engineer shall have a soil resistivity survey of the construction area performed by a certified Geotechnical Engineer to evaluate the corrosion potential of the soil and to make recommendations on any corrosion protection measures such as pipe type or cathodic protection to be used.
 - a. The distance between the soil sample locations for the survey shall be at the discretion of the District; however, testing frequency shall not be less than one test for every 400 feet of pipe.
3. Soil samples shall be taken at pipe depth.

P. Phased Installation and Stub-Outs



1. If phasing of the water distribution system improvements is proposed by the Developer, the phasing shall be clearly defined and shown in the Utility Plans.
2. The proposed phasing shall maintain looping integrity (redundancy) within the system.
3. The phased system design shall meet all water demands and fire flow requirements for the portion of the development being served.
4. An inline valve and fire hydrant (temporary or permanent) shall be required at the end of each phase or stub-out. The fire hydrant assembly shall be constructed with the hydrant off the side of the street (see the District's Standard Construction Detail Drawings, "Typical Fire Hydrant Installation").
5. Phased water mains/stub-outs shall be valved such that only one valve needs to be closed when the main is extended and no customers are without service. The valve must be appropriately restrained to prevent the valve from "blowing off" when the water line is exposed and the thrust blocking is removed for extension of the main.
6. Stub-outs not utilized shall be abandoned in accordance with these Criteria.

3.06. SEPARATION FROM OTHER UTILITIES AND BUILDINGS

A. Horizontal

1. Other Wet Utilities: Sanitary sewers, storm sewers, non-potable/reclaimed pipelines, or another water utility water main, etc. running parallel to any District line (water main, service line, fire service line, or any other District line) or related appurtenance shall not be closer than 10 feet.
 - a. Water service lines shall be located at a minimum of 5 feet from a fire service line.
2. Dry Utilities: Natural gas, electric, cable TV, telephone/communication, etc., running parallel to a District line (water main, service line, fire hydrant line, or any other District line) or related appurtenance shall be no closer than 10 feet. Other water system appurtenances, meter pits, and vaults shall be a minimum 5 feet from any dry utility line or appurtenance as measured from the outside edge of the water system appurtenance, meter pit, or vault to the edge of the dry utility or its appurtenance.
3. Buildings and Structures: Water mains shall be a minimum of 15 feet from all buildings and structures. Other water system appurtenances, meter pits, and vaults shall be a minimum 6 feet from any building, foundation, or structure such as a porch, concrete slab, post, or any other immovable object associated with an adjacent structure as measured from the outside edge of the water system appurtenance, meter pit, or vault to the edge of the structure, foundation, or object.



4. Driveways: Water services and meter pits shall not be installed under or within driveways. Service lines extending into a lot and parallel to driveways shall have a minimum 5 feet separation from the driveway. Meter pits shall be set a minimum 5 feet from any driveway edge (edge of meter pit to edge of driveway).
5. Sidewalks: Water service lines that run parallel to sidewalks shall have a minimum of 24 inches of separation between the sidewalk and the service line. Meter pit separation from all sidewalks shall be as shown on the District's Standard Construction Detail Drawings.
6. Fences: Fences shall not be installed such that meter pits or other District appurtenances are inaccessible to District staff. Fences shall be a minimum 5 feet from any meter pit, fire hydrant, or other District appurtenance.
7. Fire Hydrants: No fences, gates, fence posts, signs, or any other related appurtenance shall be located within 5 feet of a fire hydrant.

B. Vertical

1. When a water main crosses another public or private utility, irrigation, drainage ditch, or natural stream, the crossing design shall protect the water main and other utility's structural integrity, prevent contamination of the water main, and mitigate future system impacts and costs of repair. The entity responsible for the utility, ditch, railroad, or other structure that is crossed may also impose additional criteria.
2. All crossings shall be clearly identified and dimensioned on the plan and profile view on the Utility Plans.
3. Water Main Crossing over Wastewater/Stormwater/Other non-potable Systems: When a public water main crosses these types of systems, the water main shall cross above with a minimum of 18 inches vertical clearance from the system and maintain the minimum depth of cover required by these Criteria.
 - a. A vertical clearance of less than 18 inches may be allowed with prior District approval.
4. Water Main Crossing under Wastewater/Stormwater/Other Non-Potable Systems: When a public water main crosses under these types of systems, the water main should maintain 18 inches of vertical clearance from such systems.
 - a. If vertical clearance is less than 18 inches:
 - i. For crossing wastewater, stormwater, or other non-potable pipelines 24 inches and larger, the water main shall be installed in a steel casing pipe. The casing shall extend to a minimum of 10 feet beyond each side of the crossing.
5. For all crossings, the District may, based on site specific conditions and at its sole discretion, require the water main be installed in a steel casing which shall be designed by the Design Engineer



3.07. DITCH CROSSINGS

- A. When a water main is crossing an irrigation ditch owned and operated by an irrigation entity (Ditch Company), the Developer shall contact the Ditch Company and obtain all permits and approvals for each crossing. In addition to the requirements of these Criteria, the Ditch Company may add to or modify the requirements of these Criteria, provided the requirements are more stringent. All permit/crossing fees and costs shall be paid by the Developer.
1. Casing: As required per each crossing's specific need, the water main shall be installed in a casing of sufficient length so that the ends of the casing may be exposed without excavating in the ditch R.O.W. or easement and a minimum of 10 feet beyond any toe or top of slope to ditch. The casing pipe shall be in accordance with Section 3.5.G. of these Criteria.
 2. Cut-off Walls: A clay or concrete cut-off wall shall be placed on both ends of the casing pipe. The cut-off wall shall extend to 1 foot above the maximum free surface water elevation of the ditch (or as required by the Ditch Company). See the District's Standard Construction Detail Drawings.
 3. Cover: Cover over the casing shall be 2 feet or more from flowline of ditch to top of casing or as required by the Ditch Company or the District based on site specific conditions as may be determined at the sole discretion of the District.
 4. Ditch Repair: All ditches shall be restored according to the Ditch Company's requirements.
 5. Additional Easement: Additional easement must be granted to the District at each end of the casing pipe to facilitate future removal or replacement of the water main. The easement area required will be determined on a case-by-case basis.
- B. Valves are required on both sides of the ditch crossing. Valves shall be located back from the crossing or restrained in such a manner as to prevent the valve from "blowing off" when the pipe is disassembled between the valves for maintenance or replacement. No water services shall be connected to the water main between these valves.

3.08. ROUNDABOUT CROSSINGS

- A. Where an existing or proposed water main crosses a roundabout, the following design criteria shall apply:
1. All valves, fittings, fire hydrants, services, and appurtenances shall be located outside the center median of the roundabout unless approved by the District. It shall be the Developer's responsibility to relocate any of these existing facilities outside of the center median.
 - a. If there are no water mains connecting from a perpendicular alignment, the water main may be installed in a casing pipe



through the roundabout median. It shall be the Developer's responsibility to reconstruct and install any existing water main in a casing.

- i. If the water main is installed in a casing, isolation valves shall be installed on both sides of the roundabout 40 feet from each end of the casing and shall be restrained in accordance with the District's Standard Construction Detail Drawings, "Horizontal (and Vertical) Restraint Lengths" for dead ends to prevent the valve from "blowing off" when the piping in the roundabout area is disassembled for repair or replacement.
 - ii. Approved joint restraint devices shall be used on all pipe joints within a casing pipe.
 - iii. No services or connections are allowed between the isolation valves.
- b. If there are water mains connecting from a perpendicular alignment, all water mains shall be routed around the center median. It shall be the Developer's responsibility to relocate any existing water mains.
2. Water service taps shall be located outside the roundabout center median and roadway a minimum of 50 feet.
 3. The District, at its sole discretion, may require a water main to be located in the roundabout road or outside the road within an easement.

3.09. LANDSCAPE SEPARATION DISTANCES

- A. Trees: Trees shall be a minimum of 10 feet from all water mains, fire hydrants, fire service lines, water services (including curb stops and meter pits/vaults), or any other appurtenance attached to or associated with the District water main and distribution system. Separation distances from meter pits and vaults shall be measured from the edge of the meter pit or vault to the center of the tree.
- B. Shrubs: Shrubs shall be a minimum of 5 feet from water mains, fire hydrants, fire service lines, water services (including curb stops and meter pits/vaults), or any other appurtenance attached to or associated with the District water main and distribution system. Separation distances from meter pits and vaults shall be measured from the edge of the meter pit or vault and center of the shrub.
- C. Other Landscape Objects: Landscape objects such as sculptures, large rocks and boulders (any rock or boulder over 50 pounds), timbers, or other objects shall have a minimum 10 feet of horizontal separation from the edge of any District water line or appurtenance when in the public right-of-way or shall be located outside the District easement area when the water line is within a District easement.

3.10. ABANDONMENT OF MAINS AND SERVICES



- A. Any water main, connection, stub-out, appurtenance, or water services that were installed and will not be used (such as in the case of a replat or change in project layout) shall be abandoned.
 - 1. Services will be required to be abandoned at the water main. This shall include excavating at the main and disconnecting the line to be abandoned as directed by the District. Each situation will be evaluated on a case-by-case basis to determine if the valve at the connection point is to be removed.
 - 2. For a water main abandonment, the main shall be abandoned to the last water main connection point or to the last remaining in-service portion of the water main, as determined by the District. All tees, fire hydrants, valve boxes, curb stops, and meter pits/vaults associated with the main being abandoned shall be removed per direction of District. Each situation will be evaluated on a case-by-case basis to determine the specific method of connection removal and existing pipe repair.
- B. When a water main is to be abandoned, it shall be removed by the Developer at its cost unless otherwise approved by the District. If a water main is approved for abandonment in place, the abandoned main shall be drained and both ends shall be plugged with concrete or other method as determined by District. Mains 12 inches and larger shall be flash filled with a District accepted material as recommended by the Design Engineer.
- C. Any existing water services within or adjacent to a site being redeveloped that are not being used shall be disconnected from and abandoned at the water line as directed by the District. This shall include the removal of the curb stop box or valve box on the abandoned service and removal of any meter pits or vaults.



APPENDIX A: Water Utility Service Area

