

**DISTRICT OF COLUMBIA
WATER AND SEWER AUTHORITY
(DC Water)**



"SERVING THE PUBLIC - PROTECTING THE ENVIRONMENT"

**SUPPLEMENTAL
PROJECT DESIGN MANUAL
For
VOLUME 3
LINEAR INFRASTRUCTURE DESIGN**

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March 2020


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AUTHORIZATION FORM
Supplemental
Project Design Manual
For
Volume 3 Linear Infrastructure Design

LOG OF REVISIONS

Revision Number	Issue Date	Brief Description of Revision
A	November 2018	List of Tables – Added Reference to Table 6-1 Paragraph 4.2.1.1 Table 4-2 – Replaced Paragraph 4.3.5, 2 nd bullet - Replaced Paragraph 4.4.2 - Revised Safety Factor in Table 4.3 Section 4.8 – Replaced Section 6.1 – Replaced Appendix A, Pressure Zone Map – Replaced
B	January 2020	Paragraph 3.5.6 – Revised Table 3-5 – Added Easement Widths for Alleyways Paragraph 4.2.1.1 Table 4.2 – Corrected Table Number Assigned in Revision A Paragraph 4.2.6 – Added new paragraph 4.2.6 Water Main Redundancy Paragraph 4.3.1 – Added a subparagraph bullet item to define the required angle of the utility when utilities cross. Paragraph 4.3.4 – Revised a subparagraph to clarify the minimum clearance distance is four (4) feet. Paragraph 4.4.5 – Clarified when Concrete Thrust Blocks may be used. Section 4.12 – Added new Section 4.12 Distribution Mains in Alleyways Paragraph 5.3.1.2 – Revised minimum diameter of public gravity storm sewer. Paragraph 5.6.1.2 – Revised a subparagraph to clarify the minimum horizontal clearance distance is four (4) feet. Paragraph 5.7.1 – Revised subparagraph to clarify the minimum horizontal clearance distance is four (4) feet. Paragraph 5.7.6 – Added a subparagraph to define where catch basin can be located. Section 5.12 – Added new Section 5.12 Sewer Mains in Alleyways Paragraph 9.3.3 – Added new bulleted subparagraph with additional evaluation and protection requirements for utilities in the ZOI.
C	March 2020	Paragraph 5.6.3.3 – Revised the first sentence of the paragraph to clarify the acceptable use of PVC on storm drains.

This Supplemental Project Design Manual for Volume 3 – Linear Infrastructure Design is authorized by:


Craig A. Fricke, P.E., Director,
Department of Engineering and Technical Services
DC Water

3-26-2020
Date

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**SUPPLEMENTAL
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FOR**

VOLUME 3 – LINEAR INFRASTRUCTURE DESIGN

1. INTRODUCTION

This Supplemental Project Design Manual for Volume 3 – Linear Infrastructure Design contains revisions to the Project Design Manual – Volume 3 Linear Infrastructure Design issued July 2018. The revisions identified in this document are effective the date signed by the Director. Differences between the previous revision and this revision are shown with a sidebar in the margin. Formatting changes, including revision to paragraph numbers, are not marked.

2. LIST OF TABLES

2.1 *List of Tables* – Add Table 6-1 to List of Tables as follows:

Table 6-1: Soil Support Combining Factor (S).....3-6-1

3. CHAPTER 3 – SITE INVESTIGATION

3.1 *Paragraph 3.5.6* – Revise Table 3-5 to include easement widths for pipelines in alleyways and clarify the width of easement required for 16-inch diameter pipe. Revised table is shown below.

Table 3-5: Minimum Right Of Way / Easement Width For Pipelines

Pipeline Diameter	Width of Right-of-Way / Easement Centered over Pipeline	
	Water	Sewer
<16" to 16" in Alleyways	15 feet	15 feet
<16" to 16"	20 feet	20 feet
>16" to 24"	25 feet	30 feet
>24" to 36"	30 feet	40 feet
>36" to 42"	40 feet	50 feet
>42"	50 feet	50 feet

4. CHAPTER 4 – WATER MAINS

4.1 *Paragraph 4.2.1.1* – Delete Table 4-2 in Paragraph 4.2.1.1 and replace with the following:

Table 4-2: Overflow and Ground Elevations for Pressure Zones East of the Anacostia

Datum Point	Pressure Zone			
	Low	Anacostia 1st High	Anacostia 2nd High	Anacostia 3rd High
Overflow Elevation (ft.)	172	258	310	382
Ground Elevation (ft.)	0-70	70-170	170-Above	170-Above

4.2 **Paragraph 4.2.6** – Add new paragraph 4.2.6 as follows:

4.2.6 Water Main Redundancy

Water mains shall be looped, except when DC Water determines that there is no cost-effective alternative for looping the main, in which case, design the main with a flush-type hydrant at the dead end.

4.3 **Paragraph 4.3.1** – Add a new bullet to this paragraph as follows:

When a pipeline crosses or is crossed by other utilities, the angle of crossing shall be not less than 45 degrees until the pipeline is no longer within the required separation distances as defined in this Chapter.

Paragraph 4.3.4 – Delete the 5th subparagraph in its entirety and replace with the following:

The minimum horizontal clearance between the water lines and other utilities, including appurtenances, shall be four (4) feet.

Paragraph 4.3.5 – Delete 2nd bullet and replace with the following:

Profiles for all water mains eight (8) inches in diameter and greater. For permit submissions profiles are required for all water lines and services with pipe greater than 2” in diameter

4.4 **Paragraph 4.4.2** – Revise thrust restraining design criteria Safety Factor shown in Table 4-3 in Paragraph 4.4.2 from “Two (2)” to “1.5”

4.5 **Paragraph 4.4.5** – Delete the following text:

“Thrust blocks may only be used:

- On the existing pipe when connecting new pipe to existing pipe, and
- When the length of new pipe to be restrained exceeds the length of pipe to be installed.
- Approved otherwise by DC Water.

If the length of new pipe that needs to be restrained to resist the thrust exceeds the length of pipe to be installed, an in-line thrust block is required unless the existing pipe is fully restrained, and the new pipe is fully restrained against the existing pipe.

Refer to DC Water’s Standard Details for thrust blocks at connections to existing and inline thrust blocks. Refer to additional information in this Design Manual regarding connections to existing pipe.”

And replace with the following text:

“Thrust blocks may be used on new pipe when:

- Connecting to existing pipe and the restrained length of the new pipe is insufficient to counteract the thrust forces.
- Approved by DC Water for installation at other locations.

If the existing pipe is fully-restrained ductile-iron pipe, the connection to new pipe may be made with a mechanical-joint sleeve restrained by retainer glands. Retainer glands shall not be used on cast iron pipe.

Refer to DC Water’s Standard Details for thrust blocks on pipes 12 inches and smaller in diameter. Design thrust blocks for pipe greater than 12 inches diameter in accordance with the requirements of this manual. Submit calculations showing all thrust forces acting on the pipe and the lengths of restraint necessary to counteract such forces.”

4.6 **Section 4.8** – Delete Section 4.8 and replace with the following:

4.8 CUSTOMER SERVICE LINES

4.8.1 Service Lines

A customer service line (or “service line”) is the pipe from the water main to a house or similar building. The design and construction of customer service lines is governed by the DC Plumbing Code. The minimum size of service line is one (1) inch but shall be greater if water demand requires.

Service lines are installed by the developer or owner of the property, and they are owned by the property owner. However, in accordance with D.C. Law 1-98, “*Water and Sewer Repair and Compensation Act of 1976*”, DC Water is responsible for the maintenance and replacement, if necessary, of the service lines in public space, up to the property line or approved projection.

To distinguish between small and large water services, DC Water uses the following definitions:

- Water service line - When the size of the pipe between the public water main and the structure is two (2) inch or smaller diameter, the service is defined by DC Water as small and referred to as a water service line. These are copper tube and typically supply water to individual houses or townhouses.
- Water connection - When the size of the pipe between the water main and the structure is larger than two (2) inch diameter, the service is defined by DC Water as large and referred to as a water connection. Typically, these are ductile iron pipe and service properties requiring a large water supply, like commercial, industrial and apartment buildings for domestic and/or fire service.

Perform calculations to determine the size of service line in accordance with IPC sizing criteria and demonstrate that it will provide sufficient head and flow to meet the demands of the intended service. Small (water service lines) may be sized using Appendix E of the International Plumbing Code.

4.8.2 Service Line Replacement

When a water main is replaced, design shall include the replacement of all lead, galvanized, or undersized water service lines in public space. Undersized water service lines are any pipe smaller than one (1) inch.

During the preliminary design phase of a water main replacement project, identify the location and size, if possible, of all existing water service lines affected by the replacement by:

- Searching records at DC Water’s Permit Operations.
- Searching records at DC Water’s Technical Information Center (TIC).
- Searching GIS records.
- Performing a field survey and subsurface utility evaluation.

Large (water connections) shall be made with a Tee connection to a water main shall and shall have a side stop valve six (6) inches in diameter or greater. Large water connections smaller than six (6) inches in diameter, therefore, shall include a tee with a six (6) inch or greater branch, a six (6) inch or greater valve, and a reducer to downsize to the required water connection pipe size.

The nominal depth of cover required for customer service lines is four (4) feet. When the water main is designed with over four (4) feet of cover, special considerations (*i.e.*, raising the water connection and providing elevations on the drawings), may be required.

Customer service lines shall not be located in driveways, building entrances, or under projections.

4.8.3 Combination Customer Service Lines

A small single water service line branching into a fire and a domestic service is permitted by the D.C. Fire Code. The combined service shall be capable of supplying the simultaneous domestic demand and

sprinkler demand for the facility. The combined service line must be approved by DC Water and a backflow preventer assembly/ device must be installed in accordance with DC codes.

The size of the small water service line can be determined using the IPC Appendix E. Small diameter combined service lines, two (2) inch diameter and smaller, serving residential properties may be sized for the service with the greatest demand if it is approved by the District Department of Regulatory Affairs (DCRA).

4.8.4 Water Meters

Water meters two (2) inch and smaller are classified as small water meters and shall be positive displacement type. Locate small water meters in the sidewalk or tree space and house them in a meter pit in accordance with DC Water's standard details. Meter yoke or meter pit fittings shall include an ASSE 1024 backflow prevention device.

Water meters larger than two (2) inches are classified as large water meters and shall be type II compound meters unless otherwise determined by DC Water. Large meters shall be located outside the building in a meter vault (in public space where possible).

When no sidewalk or tree space is available, locate the meter pit or vault in an accessible location in public space. Meter pits and vaults shall not be located behind any retaining walls or similar obstructions. Install water meters away from existing trees.

Meter housings and lids installed in traffic areas shall be rated for H-20 loading.

During installation of a new or replacement water main, water meters located inside a building or in private property shall be relocated to public space. No premise (address) shall have more than one (1) meter monitoring/tracking water consumption.

4.8.5 Temporary Water Services

When shutdown of a water main is required for replacement or rehabilitation, the design shall require temporary water service, including fire protection, be provided to all customers.

4.7 **Section 4.12** – Add Section 4.12 Distribution Mains in Alleyways as follows:

4.12 DISTRIBUTION MAINS IN ALLEYWAYS

This section provides additional requirements or amendments to the standard requirements for distribution mains described elsewhere in this manual. Design the distribution mains in alleyways with:

- Flush-type hydrants that are installed at dead ends or other locations as determined by DC Water, are below grade, and are self-draining.
- A minimum diameter of four (4)-inches.
- Valves installed on the branch line near the tee.
- A minimum branch size tee of six (6)-inches. If the branch line is less than six (6)-inches in diameter, require the reducer to be installed on the alleyway side of the valve.
- Fire hydrants installed on the street near the alleyway entrance and connected to the distribution main that is installed in the street. Fire hydrants are not allowed to be installed in alleyways or off of distribution mains installed in alleyways.

5. CHAPTER 5 – SEWERS

5.1 *Paragraph 5.3.1.2* – Revise the 4th bullet as follows:

Minimum pipe diameter of 15 inches for any public gravity storm sewer.

5.2 *Paragraph 5.6.1.2* – Delete bullet 3 in its entirety and replace with the following:

The minimum horizontal clearance between a sewer line and other utilities, including appurtenances, shall be (4) feet.

5.3 *Paragraph 5.7.1* – Delete subparagraph 3 in its entirety and replace with the following:

The minimum horizontal clearance between a storm sewer and water lines, including appurtenances, shall be (4) feet.

5.4 *Paragraph 5.7.6* – Add a new subparagraph as follows:

Design catch basins at low points and other locations as necessary to allow design flows to enter the stormwater sewer without backing up into the streets. Do not locate catch basins at street corners where they will be exposed to vehicle loading from large trucks turning corners too sharply.

5.5 *Section 5.12* – Add Section 5.12 Sewer Mains in Alleyways as follows:

5.12 SEWER MAINS IN ALLEYWAYS

This section provides additional requirements or amendments to the standard requirements for sewer mains described elsewhere in this manual. Design the sewer mains in alleyways to have:

- Gravity flow.
- The transition from pressure sewer laterals to the gravity main at or before the property line.
- A minimum vertical separation below water distribution mains of 1.5 feet and a minimum depth below grade of 5.5 feet, whichever is deeper.
- A pipe size with capacity for the maximum development potential of the alleyway but not less than 8 inches in diameter for sanitary sewers and 15 inches in diameter for storm sewers.
- A maximum pipe size equal to or less than the downstream sewer infrastructure.
- Manhole covers located outside stormwater flow channels.

Properties that discharge to the sewer mains in alleyways are required to have cleanouts on the laterals and working grinder pumps. Grinder pumps, laterals (pressure or gravity), and cleanouts are required to be located within the property line and are owned, operated, and maintained by the property owner.

5.6 *Paragraph 5.6.3.3* – Delete the first sentence and insert new text as follows:

5.6.3.3 Polyvinyl Chloride Pipe

Delete “All buried sewers up to 36 inches in diameter shall be PVC unless otherwise approved by DC Water.”

Insert “All buried sanitary sewers up to 36 inches in diameter shall be PVC unless otherwise approved by DC Water. PVC may be used for storm sewers up to 36 inches in diameter when approved by DC Water on a case by case basis and is subject to considerations such as depth of bury, proximity to other utilities, and other considerations that DC Water believes may have an impact on the performance of the storm drain.”

6. CHAPTER 6 – EARTH BACKFILL AND LATERAL SUPPORT FOR BURIED PIPES

6.1 *Section 6.1* – Delete Section 6.1 and replace with the following:

6.1 MODULUS OF SOIL REACTION (E')

The E' of the in-situ material shall be estimated in the field by conducting standard penetration per ASTM D1586, cone penetrometer test per ASTM D3441 or D5778, or dilatometer tests per ASTM D6635. In the absence of field tested data to define E', assume the in-situ E' is 100 psi.

If the E' value of the in-situ soil is higher than the E' value of the backfill, use the E' value of the backfill.

If the E' value of the in-situ soil is lower than the E' value of the backfill, use the following methodology to calculate a composite E'.

- Step 1: Calculate ratio of $E'_{INSITU} / E'_{BACKFILL}$. Note: If E'_{INSITU} is greater than $E'_{BACKFILL}$, use $E'_{BACKFILL}$.
- Step 2: Calculate ratio of W / D ; where W is trench width at springline and D is nominal pipe diameter.
- Step 3: Identify appropriate value of the Soil Support Combining Factor, S from Table 6-1.
- Step 4: Calculate the composite E' using the formula: $E'_{COMPOSITE} = S * E'_{BACKFILL}$

Table 6-1: Soil Support Combining Factor (S)

E' _{INSITU} / E' _{BACKFILL}	W / D Trench Width at Springline / Nominal Pipe Diameter					
	1.5	2.0	2.5	3.0	4.0	5.0
0.1	0.15	0.30	0.60	0.80	0.90	1.00
0.2	0.30	0.45	0.70	0.85	0.92	1.00
0.4	0.50	0.60	0.80	0.90	0.95	1.00
0.6	0.70	0.80	0.90	0.95	1.00	1.00
0.8	0.85	0.90	0.95	0.98	1.00	1.00
1.0	1.00	1.00	1.00	1.00	1.00	1.00

Note: Table adapted from Pipeline Installation by Amster Howard, copyright 1996.

7. CHAPTER 9 – PROTECTION OF UTILITIES

7.1 *Paragraph 9.3.3* – Add the following bulleted subparagraph to paragraph 9.3.3.

- Evaluate existing water and sewer utilities to determine if any excavation may be within 1 foot of a water or sewer utility or if the horizontal clearances required in Chapters 4 and 5 will be violated. If either of these conditions exist, then include in the design, protection for the existing utility by incorporating the options listed below:
 - Option 1** – Where sufficient distance exists on the new construction side of the existing utility, revise the location of the new construction to achieve the clearances listed above.
 - Option 2** – If Option 1 cannot be performed, and where sufficient distance exists on the existing utility side of the new construction, include in the design the requirement to replace the existing utility at the location where the required clearances cannot be achieved with new piping to achieve the clearances listed above.
 - Option 3** – Where insufficient distance exists on either side of the existing utility to allow the use of Options 1, 2, or 1 and 2 together, include in the design the requirement for the Contractor to replace existing cast iron pipe with ductile iron pipe to the joint that is a distance of at least 10 feet beyond the excavation limits. Additionally, DC Water will

determine if additional design requirements are needed to provide protection for the existing utility regardless of the existing utility material.

Option 4 –If the bedding is disturbed by an excavation, the design shall require the Contractor to backfill beneath the pipe using CLSM as follows: Begin placing CLSM at a depth of 1 foot below the pipe or an elevation at which the Contractor can no longer properly perform compaction activities, whichever is lower. Install CLSM to an elevation of at least the top of the bedding but not higher than the springline of the pipe.

8. APPENDIX A – PRESSURE ZONE MAP

8.1 *Pressure Zone Map* – Delete Pressure Zone Map and replace with the following:

