

**ARTICLE 2**

**WATER AND FIRE REGULATIONS**

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## ARTICLE 2

### WATER AND FIRE REGULATIONS

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#### SECTION 2-100 WATER DISTRIBUTION SYSTEMS

##### 2-110 Public System Extensions

1. All extensions of waterworks for the purpose of serving users located within or outside the Town limits shall be authorized by the Council. Any person desiring such an extension shall make application to the Council for approval thereof. *Refer to the Town Code Section 34-25, for permit procedures when requesting a connection. Also refer to the Town Code Section 34-28.*
2. The Subdivider or Developer shall install a complete water system for the subdivision or development. This complete watermain system shall be connected to a water supply which is approved by the Director of Utilities and the Virginia Department of Health as required by state law.
3. Any person proposing the construction of an extension of a public water supply system shall, at the time of submitting plans, profiles and specifications, agree by written contract approved by the Director of Utilities that, upon completion of the construction of the extension of such water system and the approval and acceptance thereof by the Director of Utilities, the water system so constructed shall become the property of the Town of Leesburg.
4. Virginia Department of Health (VDH) approval is required for all waterline extensions serving 15 or more equivalent residential connections or 6,000 gpd. If the proposed waterline extension involves pipe lines of 12" diameter or less, the waterlines can be reviewed by the Town of Leesburg under the Local Review Program which VDH has approved. The review comments under water and fire regulations constitute comments mandated by the Local Review Program. A Local Review Program Waterline Project Report will be completed by the Town and filed with VDH when these comments are satisfied, and the Town approves the waterline extension.
5. Contact the Department of Utilities for procedures that apply to projects ineligible for Local Review.

## **2-120 TOWN OF LEESBURG DESIGN & CONSTRUCTION STANDARDS**

### **2-120 Design Criteria**

All watermains, their sizes, valves and fire hydrants, and their relationship to gas lines shall be designed as indicated below:

### **2-121 General Location Requirements**

1. In subdivision streets on tangent sections, watermains shall be located ten feet north or east of the street centerline, or outside the edge of the sanitary sewer line if applicable, and gas mains shall be located eight feet south or west of the centerline.
2. On streets with curved alignment, watermains shall be located to the north or east of the predominant centerline of the street such that 10 feet horizontal separation is provided from outside the edge of sanitary sewer lines and manholes if applicable. Gas mains shall be located eight feet south or west of the predominant centerline of the street. The watermains and gas mains shall then continue on their respective sides of the centerline as determined above for the entire lengths of the streets to avoid crossing of the centerline.
3. Separation of watermains and sewers
  - A. The horizontal and vertical separation between sanitary sewers and waterlines shall be in accordance with the requirements of the Virginia Waterworks Regulations.
  - B. Horizontal Separation. Sanitary sewers shall be laid at least 10' horizontally from a watermain. The distance shall be measured edge-to-edge. The 10' separation must also be observed at sanitary sewer manholes from the widest part (diameter) of manhole. This means that when a 4' manhole is proposed, the waterline must be laid at least 12' edge to edge from the sewer line. Variations to this requirement may be granted where existing conditions prevent such provisions. *Refer to Drawing WS-33 in Appendix A.*
  - C. Crossings. Sanitary sewers shall cross under watermains such that the top of the sanitary sewer is at least 18" below the bottom of the watermain. When local conditions prohibit this vertical separation, the sanitary sewer shall be constructed of AWWA specified water pipe and pressure tested in place without leakage prior to backfilling. The hydrostatic test shall be conducted in accordance with the most recent edition of the AWWA

Standard with a minimum test pressure of 30 psi. Sanitary sewers crossing over watermains shall:

- (1) Be laid to provide a separation of at least 18" between the bottom of the sanitary sewer and the top of the watermain.
- (2) Be constructed of AWWA approved water pipe and pressure tested in place without leakage prior to backfilling, in accordance with the provisions of the most recent edition of the AWWA Standard, with a minimum test pressure of 30 psi.
- (3) Have adequate structural support to prevent damage to the watermain.
- (4) Have the sanitary sewer joints placed equidistant and as far as possible from the watermain joints.

**D. Manholes**

No water pipe shall pass through or come into contact with any part of a sanitary sewer manhole. Manholes shall be placed at least 10 feet horizontally from a watermain whenever possible. The distance shall be measured edge-to-edge of the pipes or structures. When local conditions prohibit this horizontal separation, the manhole shall be of watertight construction and tested in place.

**E. Nothing herein shall modify Virginia Department of Health requirements for waterlines and horizontal and vertical separation between waterlines and sanitary sewer manholes.**

- 4. Under normal conditions, the waterline shall be located within the travelway and egress and ingress easements of private/common parking courts. The Town, upon request, will assist Developers in determining a satisfactory location for water and other utilities.

## 2-121 TOWN OF LEESBURG DESIGN & CONSTRUCTION STANDARDS

5. All uses withdrawing water from the Town's water system shall make provisions for installation of a water meter.
  - A. In residential subdivisions, the water meter shall be located in a utility strip, which is adjacent to the curb and is two feet wide measured from the back of curb. Water meters shall not be located in driveways.
  - B. Except in commercial or industrial zones, the sidewalk must not encroach on the utility strip.
  - C. The installation must provide for connection of the building service line without disruption or undermining of the sidewalk.
  - D. Water meters larger than two-inches in diameter shall be installed in accordance with *Drawings WS-31 and WS-32 in Appendix A*. All appurtenances shall be supplied by the developer at no cost to the Town.
  - E. Water service lines shall be installed in a straight line from the street main to the meter location. Adjustments in alignment shall be accomplished within six feet of the connection to the street main.
  - F. Water meters installed outside of the public right-of-way must be in a waterline easement which extends five feet beyond the meter location.
  - G. The water service line shall be constructed to a minimum of one foot beyond the proposed sidewalk location and into the lot prior to the construction of the sidewalk.
  - H. Community and/or commercial pools selecting discharge to the sanitary sewer system shall install a single water meter to serve the pool and pool house. Those opting to discharge pool backwash water to State waters shall obtain a discharge permit from Virginia Department of Environmental Quality (DEQ) prior to plan approval by the Town. In those instances, the owner may elect to install separate meters to the pool and pool house. Method of discharge shall be indicated on plans.
  - I. Water sampling stations shall be provided in residential subdivision or commercial sites as requested by the Director of Utilities. In general, the requirements are as follows:

- (1) One sampling station shall be provided for the first 250 dwelling units or portion thereof or per commercial site.
- (2) One additional sampling station shall be provided for each additional 150 dwelling units or portion thereof beyond the initial 250.
- (3) Sampling stations shall be located as determined by the Director of Utilities, but in general shall be located in the utility strip and near a storm drain inlet. Sampling stations shall be located at the lot property line if a utility strip is not proposed.
- (4) *Refer to Drawings WD-13 and WD-14 of this Article.*

**2-122      General Design**

1. All watermain designs shall comply with the requirements of the standard specifications of this Manual, the Commonwealth of Virginia/State Board of Health Waterworks Regulations, and shall comply with the approved Water and Sewer Master Plan.
2. The capacity of a site's water system shall be determined by water use demand including both domestic and fire flow demands. *Refer to Drawing WD-1 of this Article.*
3. Minimum size of watermain shall be six inches. No more than one fire hydrant shall be located on any six-inch dead end main.
4. Detailed design calculations shall be submitted to substantiate line sizes. These designs shall comply with the approved Water and Sewer Master Plan recommendations, where applicable, and the design standards set forth herein.
  - A. The water system computations must be performed, demonstrating that the minimum pressure of 20 psi, as stated in the Virginia Waterworks Regulations, will be met under all conditions of flow. All conditions of flow shall mean average day demands, peak hour demands, maximum day demands, and maximum day demands plus fire flow.

The computations are to be performed for:

- (1) Average day demand.
- (2) Peak hour demand.
- (3) Maximum day demand.

**2-122 TOWN OF LEESBURG DESIGN & CONSTRUCTION STANDARDS**

- (4) Maximum day demand with fire flow applied simultaneously.
- (5) Hazen-Williams Coefficients to be used for the above computations are as follows:

<u>Pipe Diameter</u> <u>Inches</u>	<u>Hazen-Williams</u> <u>Coefficient</u>
6	100
8	110
10	115
12 & larger	120

- (6) In all cases, the hydraulic conditions at the points of connection to the existing Town water system shall be defined.
  - a. The Town will provide the hydraulic conditions, as computed by the water system computer model at the proposed point(s) of connection to the Town’s water system.
  - b. The designer of the proposed water system shall model the water system network (on-site and off-site as required, proposed and existing as required) starting from the node of the water system for which the Town has supplied the starting hydraulic conditions.
  - c. Requests for computer modeling shall be addressed to Director of Utilities, Town of Leesburg in Virginia. The request shall include the following:
    - 1. A map showing the point(s) of connection to the Town’s water system.
    - 2. The domestic average day demands and the required fire flow.
    - 3. A schematic of the onsite piping along with ground elevations of each node, hydrant location(s), the pipe sizes, and lengths between nodes.



- B. Plans must indicate if proposed buildings will be equipped with a fire sprinkler system.
  
- C. An overall map must be submitted showing the entire subdivision or development including all sections or phases accompanied by the computations demonstrating the adequacy of the proposed water system based on the following conditions:
  - (1) Overall computations showing that the system will meet the required criteria of the Virginia Waterworks Regulations and Town criteria with the entire subdivision build-out.
  
  - (2) An individual computation based on phasing of the construction showing each section meeting all required criteria independent of future sections, loops, or connections.
  
- D. The size of all domestic meter service connections and water meters shall be verified by calculations demonstrating adequate domestic flow and pressure, using International Plumbing Code (IPC), latest revision, at the highest plumbing fixture serviced by the connection. Domestic water demand within each building shall be determined by the methodology of IPC and based on the actual plumbing fixtures of the building. Street main pressure for this analysis shall be determined by water system computations for the peak hour or other condition, exclusive of fire flow or as provided by the Utilities Department. Worksheets WD-16, WD-17, and WD-19 of this Article are provided for water meter service sizing computations.
  - (1) Hazen-Williams Coefficient for copper or PVC water service tubing shall be 130.
  
  - (2) The Town Code Chapter 34, Division 3, requires that a backflow prevention device be installed on water service connections. Backflow prevention devices create additional head loss in the water service. Double check valve pressure loss shall be determined using Details WD-6, WD-7, WD-8, and WD-9 of this Article for meters up to 2". For meters larger than 2", consult the manufacturer of the proposed meter.
  
  - (3) Meter head loss shall be determined using Details WD-2, WD-3, WD-4, and WD-15 of this Article.

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- (4) For water meter sizes other than those listed above, head loss information shall be obtained from the manufacturer's literature.
  - (5) The typical tap and meter size for residential service line is a 1-inch tap and a 5/8-inch meter. *Refer to Drawings WS-1 and WS-2 in Appendix A.*
- E. All construction methods utilized on-site and interior to the building to provide adequate domestic pressure and flow, shall be listed on the plans.
- F. Valves shall be installed at the intersection of waterlines. Four valves shall be used at crosses and three valves used at tees. At fire hydrant leads, only one gate valve will be required on the hydrant lead. In all cases, the arrangement and location of the valves shall be such that no more than 600 linear feet of line is isolated when the valves are closed. Valves shall also be installed at a minimum of every 500 feet on transmission mains, (12 inches in diameter and larger), or as required by the Director of Utilities for special operational reasons. These valves shall be located adjacent to a fire hydrant. All valves on distribution lines and transmission mains which are located outside paved areas shall be provided with an 18" x 18" x 6" concrete collar at ground level around the valve box. The requirements of this section may be varied from time to time depending on the system layout.
- G. No underground electric, telephone, or fiber optic cables, gas lines, irrigation piping, or any other underground utility may be installed within the public water supply easement. The Director of Utilities may allow co-use of the public watermain easement if it can be demonstrated that excavation of the lower utility will not expose the upper utility. Irrigation plans must be submitted to the Town for review and approval prior to commencement of construction.
- H. The maximum length of any permanent dead end water distribution line shall be less than 600 feet. Water distribution lines which will be extended and looped with future phases or sections of the development as shown on an approved preliminary plat or plan for the subject property, and under legal control of the Developer, may exceed the 600-foot dead end limit temporarily. In all cases, the Developer must demonstrate that adequate domestic and fire flow demands and pressures can be achieved.

- I. The developer shall verify the location, type of pipe and size of the existing main prior to final submission of plans. The designer shall indicate test pits at these locations.
  
- J. The test pressure for watermains shall be shown on the plans and shall be 150 psi. A pressure-regulating valve shall be installed by the developer or property owner in the building plumbing system where the pressure exceeds 80 psi in order to eliminate water hammer and unnecessary water waste.
  
- K. Commercial development, office buildings, warehouses, churches, etc., that require a fire line to the building shall provide a combined tap for domestic and fire lines. *Refer to Drawings WS-6, WS-30, and WS-31 in Appendix A.*
  
- L. All waterlines shall provide blow-off provisions for the removal of sediment deposited in the line at strategic low points via the use of blow off fire hydrants. Terminus blow-offs shall be provided at the termination of all dead end lines. Locations of strategic low points/blow offs will be evaluated on a case-by-case basis dependent upon the waterline vertical profile. Blow-off provisions will not normally be required where waterlines are depressed to pass under other utilities. *Refer to Drawings WS-5, WS-21, WS-24, and WS-25 in Appendix A.*
  
- M. All waterlines shall provide provisions for release of entrapped air. Combination air release shall be provided at "strategic" high points on distribution and transmission lines and mains. Location of these "strategic" high points will be identified on a case-by-cases basis dependent upon the waterline vertical profile. Air releases will not normally be required at each rise in the waterline. Automatic air releases shall be provided on transmission mains (12 inches in diameter and larger). Note that installation of an automatic air release requires a waterline deflection so that the centerline of the pipe is 6 feet below finished grade. This deflection may influence the location of the automatic air release valve. Water distribution lines (less than 12 inches in diameter), shall be provided with fire hydrants or manual air release valves. Fire hydrants are the preferred option. *Refer to Drawings WS-7, WS-8, and WS-9 in Appendix A.*
  
- N. All watermain crossings installed under pavements of roads classified as limited access shall be steel cased. *Refer to Section 2-330, "Highway Crossings for Water and Sewer Mains" in this Article.* The casing shall extend from edge of pavement to edge of pavement. *Refer to Drawings WS-10 and WS-11 in Appendix A.*

## 2-122 TOWN OF LEESBURG DESIGN & CONSTRUCTION STANDARDS

- O. All attempts shall be made to locate the waterline outside the intersection of roads classified as minor arterial or higher to allow safe access during repair and maintenance.
  - P. All hydrants, fire lines, stub-out valves, bends, tees, crosses, wyes, plugs, and caps shall have poured-in-place concrete anchor thrust blocks against undisturbed earth. Thrust blocks shall be sized appropriately and strapped where applicable. Concrete shall be placed and allowed to cure a minimum of seven days prior to any watermain testing. No precast thrust blocks shall be accepted. *Refer to Drawings WS-12, WS-13 and WS-14 in Appendix A.*
  - Q. In instances where due to other excavation, thrust blocks cannot be placed against undisturbed earth, then restraint joint mechanical pipe shall be employed. The designer shall provide the contractor with the required length of pipe to be strapped on the plans. *Refer to Drawing WS-15 in Appendix A.*
  - R. All service lines or waterlines no longer in use must be disconnected at the active watermain.
5. Cover Requirements.
- A. All watermains shall have a minimum cover of four feet and a maximum cover of six feet, measured from the top of pipe to the proposed finished grade directly above the waterline except as defined in item B.
  - B. The depth of cover shall be no greater than eight feet and no less than 3.5 feet at utility crossings.
    - (1) If passing the waterline under other utilities would cause cover to exceed the eight-foot maximum, then the waterline should be routed over the conflicting utilities as long as the minimum cover at the highest relative point of the waterline is three feet. Three feet of cover is acceptable for a point on the line and not a run of pipe.
    - (2) The Director of Utilities may approve watermain depths deeper than eight feet due to other utility conflicts and/or unusual topographic conditions, provided the designer provides adequate pipe strength calculations and makes provisions for access to the waterline without undermining the overlying utility.

- (3) Requests for depth of cover greater than eight feet shall be recorded on the cover sheet for the project. Waterline installation in this condition requires specific approval of the Director of Utilities.
- (4) Plan and profiles of all utility crossings of watermains subject to change due to conflicts encountered in the field shall be submitted to the Utilities Department for approval prior to construction.
- (5) The minimum clearance between utilities at utility crossings shall be 1.5 feet, unless provisions to prevent damage to the underlying utility are detailed. The absolute minimum acceptable clearance will be 6” and must be backfilled with VDOT No. 21A stone. Clearances shall be based on outside edge of pipe.
- (6) All crossings shall be generally perpendicular, unless specific provisions to prevent undermining of the above utility and method to allow access to the lower utility are detailed.

**2-123      General Guidelines**

- 1. The developer shall agree to assume complete responsibility and all costs for the purchase, installation, and connection of the mains, meters, and appurtenances and for any adjustments in alignment and grade, location, repairs, and maintenance prior to final acceptance of the facilities. Final acceptance shall not be considered until after the streets have been hard surfaced or the easements recorded and the ground final graded and stabilized.
- 2. Development which proposes to:
  - A. Relocate existing waterlines;
  - B. Encroach upon existing waterline easements with physical improvements;
  - C. Reduce cover over existing waterlines to less than that specified by this manual; or
  - D. Increase cover over existing waterlines to more than that specified by this manual, shall be responsible for replacement of the waterline to a new location during development of the property. Such replacement shall be to the standards and specifications set forth in this manual, shall be approved by the Director of Utilities, and shall be at no cost to the Town.

## 2-123 TOWN OF LEESBURG DESIGN & CONSTRUCTION STANDARDS

3. The developer may request the Town allow connection to an existing watermain by use of a wet tap. In these instances, such permission may be granted on a case by case basis dependent upon available valving.
4. The developer shall request inspection by the Town of Leesburg three days prior to commencing construction or testing of any watermains. This inspection is to verify that other utilities have been marked and precautions for laying and resting of the pipe have been made.
5. All service line connections to the main shall be at least two feet apart and have a minimum horizontal separation of five feet from the lateral sewer line.
6. Prior to any water meter crock or vault installation, all required sanitary sewers (including laterals) and storm sewers must be installed, their ditches compacted for full depth according to current requirements, the sanitary sewer accepted for service by the Town and the streets and/or easements rough graded to meet current standards.
7. When utilities are proposed in close proximity to an existing watermain, or when grade changes are proposed above an existing watermain, test pits shall be required. Depending upon test pit results, sheeting, or bracing may be required when other utilities cross an existing watermain. Such test pits must be completed before approval of construction drawings.
8. Watermains may be installed on private property if a public easement is recorded. The width of the required easement is based on a one-to-one side slope measured outside edge of pipe extending from the invert of the pipe to the proposed finished grade with a minimum easement width of ten feet. The maximum easement width shall be 30 feet for single pipes or 15 feet each side for multiple pipes. Increased easement widths may be required by the Director of Utilities when necessary. *Refer to Drawing WS-16 in Appendix A.*
9. Easement instruments denoting waterline easements shall include a note granting the water purveyor the right of access to the water service connection and the water meter for the purpose of maintenance and operation.
10. No permanent structure shall be constructed within a public easement.
11. Watermains shall not be installed until cutsheets have been approved by the Director of Utilities.

12. No watermain valves are to be operated by anyone other than Town personnel.
13. The developer shall make provisions for the discharge of water as required by the Town of Leesburg for water system testing to the sanitary sewer system or to State waters with proper dechlorination.
14. When public improvements required herein are installed to such a size which is required for the benefit of other property owners in addition to the subdivider or developer, the Town may establish a pro-rata for recovery of expenses incurred for construction of such oversized facilities that will benefit other property owners.
15. All groundwater wells shown on the construction drawings to be abandoned must be abandoned in accordance to the Commonwealth of Virginia Water Works Regulations Section latest edition (VR 355-18-008.03.B.14). The Developer shall provide to the Town verification from the Health Department that the abandonment has been completed. This requirement shall be noted on the cover sheet.
16. All inactive fire hydrants in construction areas shall be clearly field identified or bagged in a manner acceptable to the Loudoun County Fire Marshal.

**2-124 Miscellaneous Notes**

1. Plan approval may be contingent upon the approval of construction drawings and bonding of watermains in other sections or subdivisions and connections thereto.
2. Judicious use of the public water supply as a source of water for temporary construction wash racks shall be allowed provided the developer has acquired a permit and met all applicable requirements.

## **2-125 TOWN OF LEESBURG DESIGN & CONSTRUCTION STANDARDS**

### **2-125 Private System Requirements**

1. General
  - A. The Leesburg Town Code, Section 34, should be consulted to determine specific situations where private water systems are allowed. In most cases, private systems only apply to residential units meeting the established Town Code criteria.
  - B. No commercial establishment will be permitted to install a private system unless they meet the Town Code criteria.
2. Design and Installation

All private system design and construction shall conform to Section 2-120 of this Manual, and those outlined in the Virginia State Water Works Regulations, Part 3, "Manual of Practice for Community Water Works Design".

### **2-126 Cross Connections and Backflow Prevention**

1. Backflow prevention devices shall be installed where required by Section 34 of the Leesburg Town Code and Article 3 of the Virginia Waterworks Regulations. Town policy requires backflow prevention devices on all lines (domestic, fire sprinkler, and irrigation) withdrawing water from the Town's water system to reduce or eliminate health, pollution, or system hazard to the Town's water system. All testable devices shall be tested after installation, and a certificate of inspection shall be provided to the Town before the Utilities Department authorizes issuance of a building occupancy permit.
2. All water meters are purchased from the Town and installed by the Town's Utilities Department. The Town shall supply and install all meters at the owner's expense.
3. All Town supplied water meter setters up to two inch in size are provided with a dual check valve located within the meter crock. Meters larger than two inch in size shall have the required backflow prevention installed on the domestic service line within the mechanical room of the building served and must be accessible for inspections. Such devices shall be located horizontally and not more than 4' above finished grade.



4. Backflow prevention methods shall conform to the Virginia Department of Health Waterworks Regulations and local regulations where applicable. Contact the Town's Utilities Department for specifics in regards to the applicable regulations.
  
5. The Director of Utilities, under the direction of the Town Manager, shall administer and enforce the provisions of the Town Code, Section 34, Division 3 Cross-Connection and Backflow Prevention Control program. All Developers proposing development which will withdraw water from the Town's water system shall contact the Department of Utilities to coordinate the degree of protection and the devices required for water service line protection.

**2-127            Dead End Watermains**

Due to water quality concerns and regulations mandated by Commonwealth of Virginia, Virginia Department of Health, avoid long dead end water lines when there is little possibility of any usage and water turnover. All attempts shall be made to either loop dead end waterlines or eliminate them. Dead end waterlines may be accepted if a service connection is proposed near or at the terminus.

**2-128            Electronic Records**

To ensure accurate and updated Town water maps including the Town's water computerized model, the Developer's engineer is required to provide a computer-aided design (CAD) drawing, which shall contain the proposed watermains and appurtenances only. Profiles of the watermains shall also be required in hard copy, PDF format, or CAD file to ensure accurate elevations for the water model. The CAD files shall be submitted in the version of AutoCAD that the Utilities Department is running at the time of submission.

**2-129            Irrigation Systems**

If an irrigation system is proposed, a plan shall be prepared for review and approval (prior to installation) showing the location of the private system as it relates to all public utilities on site. This plan may be submitted with or after approval of the final site plan. All attempts must be made to eliminate conflicts with Town's utility easements. All irrigation systems when connected to the Town's system must be protected by a reduced pressure zone (RPZ) backflow preventer. All irrigation systems shall be metered separately and are subject to payment of availability and pro-rata fees. The meter must be appropriately sized for the proposed system and certified calculations provided to the Town as justification. Single-family residences and townhouse units are exempt from this section.

## **2-130 TOWN OF LEESBURG DESIGN & CONSTRUCTION STANDARDS**

### **2-130 Certificate to Operate**

No occupancy permit shall be issued for any building, which connects to a newly constructed water line until the meter cock and setter have undergone and successfully completed acceptance testing as required by this Manual and as required by State regulations. Acceptance testing shall insure that the water construction conforms to all applicable criteria and specifications.

### **2-140 General Utility Review**

The plans for water extensions will be reviewed not only for compliance to regulations but also for construction and maintenance related issues as well as safety concerns. These issues and concerns may not fall under a specific criteria but are in the judgment of the reviewer that should be addressed to consider construction, maintenance or safety issues. In these instances, we ask the designer's assistance in accommodating compliance with these requests in order for the water infrastructure to be designed and built with regard to maintenance while ensuring the safety of our employees and Town citizens.

### **2-150 Fire Meter Charges**

When regulations require installation of a fire service meter, the quarterly customer fixed charge will be based on the domestic meter size and not the fire meter size. Fire flow usage is free and in the event of excess usage of water due to a fire, the customer will be issued a credit for the excess usage.

### **2-160 Utility Crossing Application Process**

Proposed utilities crossing Town water and sanitary sewer lines within public right-of-way or public easement will require submission of a Town right-of-way permit application prior to commencement of activities. These applications are subject to review and approval prior to start up.

(End of Section)

**SECTION 2-200 FIRE PROTECTION REQUIREMENTS (DESIGN CRITERIA)**

**2-210 Adequate Fire Flow**

1. All projects within the Town of Leesburg must demonstrate adequate fire flow prior to construction plan approval. Demonstration of adequate fire flow shall be by water system computations, based upon fire hydrant flow tests as determined by computer modeling by the Town, utilizing the approved water system model from the Water and Sewer Master Plan, or in unusual circumstances (as determined by the Director of Utilities) by an actual flowing of the hydrant. The computations shall indicate:
  - A. Compliance with Town of Leesburg Required Fire Flows, or
  - B. Compliance with Town of Leesburg Interim Fire Flows, where applicable, or
  - C. Demonstration for other than single family detached dwellings that the available fire flow equals or exceeds the needed fire flow, as calculated using the methodology herein (developed from the Insurance Services Offices [ISO] methodology) with a maximum sprinkler protection credit of 50 percent reduction for a building with a fully automated sprinkler monitor system. Minimum needed fire flow shall be 750 gallons per minute (gpm). *Refer to Section 2-400 of this Article.*
2. Systems shall be designed to deliver fire flows listed below with a residual pressure of not less than 20 pounds per square inch with maximum day demands applied to the system.
  - A. To meet adequate fire flow, a computer model with one or more hydrants flowing shall be used. If more than one hydrant is used to meet fire flow requirements, then the model must flow all hydrants providing coverage flowing simultaneously.

**2-220 Required Fire Flows**

1. The required minimum fire flows are:
  - A. Residential dwellings, single-family detached, and duplexes:

**2-220 TOWN OF LEESBURG DESIGN & CONSTRUCTION STANDARDS**

<u>Separation Distance (feet)</u>	<u>Required Fire Flow</u>
0 - 20	1,500 gpm
20 - 30	1,250 gpm
30 and greater:	1,000 gpm

- B. Townhouses, apartments, and condominiums shall provide 2,500 gpm fire flow.
  - C. Hotels, motels, offices, schools, hospitals and nursing homes: 2,700 gpm.
  - D. Mercantile, retail sales, shopping centers, etc.: 2,700 gpm.
  - E. Industrial, storage buildings, repair garages, service stations: 2,700 gpm.
2. If the residences are continuous, the fire flow required shall be 2,500 gpm.
  3. The distance shall be determined by the minimum yard requirements for the zoning district.
  4. In mixed-use developments, the highest applicable fire flow shall apply to the whole development.
  5. Calculations shall use a Hazen-Williams Coefficient of:

<u>Pipe Diameter (inches)</u>	<u>Hazen-Williams Coefficient</u>
6	100
8	110
10	115
12 and larger	120

6. Required minimum fire flows are adjusted to 20 pounds per square inch (psi) at the street main.

**2-230      Interim Fire Flow Requirements**

1. In specific cases, where the required minimum fire flow cannot be provided, and where the conditions set forth below are satisfied, the Director of Utilities may authorize use of interim fire flow requirements. These interim fire flow requirements shall, when authorized, be substituted for the minimum required fire flows in the required computations.
  
  2. The interim fire flows are:
    - A. Residential dwellings: Single Family Detached and Duplexes:
 

(1) <u>Separation</u> <u>Distance (feet)</u>	<u>Interim</u> <u>Fire Flow</u>
0 - 10	1,500 gpm
10 - 20	1,250 gpm
20 - 30	1,000 gpm
30 & greater	750 gpm
  
    - (2) If the buildings are continuous, the interim fire flow shall be 2,000 gpm.
  
    - (3) Separation distance shall be determined by the minimum yard requirements for the zoning district.
  
  - B. Townhouses, apartments, and condominiums: 2,000 gpm.
  
  - C. Hotels, motels, offices, hospitals and nursing homes: 2,700 gpm.
  
  - D. Mercantile, retail sales, shopping centers, etc.: 2,700 gpm.
  
  - E. Industrial, storage buildings, repair garages, service stations: 2,700 gpm.
- 
3. Developments which propose a combination of land uses with varying interim fire flow requirements shall provide, as a minimum, the required interim fire flow for each land use. The required fire flow for each land use shall be provided at the specific fire hydrants which provide coverage to the land use.

## **2-230 TOWN OF LEESBURG DESIGN & CONSTRUCTION STANDARDS**

4. Calculations shall use a Hazen-Williams Coefficient of  $C = 130$  for all pipe – 1- and 2-year interim period
5. The aforementioned Interim Fire Flows will be authorized upon specific request for water system analysis for those subdivision and development plans which meet all of the following conditions:
  - A. Improvements to the Town's water system are imminent (expected completion in one to two years).
    - (1) A Town project is under design or construction or,
    - (2) A private project is approved and bonded.
  - B. Such improvements will provide the required fire flows listed in this Manual.
  - C. The interim period shall not exceed two years.
  - D. The specific request to utilize the interim fire flow must demonstrate that the items (A, B, and C above) apply. The request shall be on the cover sheet for the project or shall be requested in writing.

## **2-240 Fire Hydrant Locations**

1. Fire hydrants capable of providing the required fire flow as specified by this Article shall be located:
  - A. To provide hose stream coverage for all exterior faces of each building using no more than 300 feet of hose. Exceptions to this requirement will be granted if approved by Loudoun County Fire Marshal.
  - B. This will, in general, allow a hydrant spacing of 500 feet; however, the hose reach analysis shall determine hydrant location.
  - C. The hose reach distance shall be measured "as the hose lies" between and around obstructions, from the hydrant to the most remote exterior building face protected.

2. Fire hydrants shall be no closer than 50 feet from the buildings to be protected. In unusual circumstances where the 50-foot clearance is not possible, they shall be set where the chance of injury by falling walls is small and where the fire fighters are not likely to be driven away by smoke or heat. In unusual circumstances, the Loudoun County Fire Marshal must approve the location. Such approval shall be the responsibility of the developer.
3. Hydrants should be located as close to a street intersection as possible.
4. Fire hydrant locations are also subject to approval by the Loudoun County Fire Marshal. The Fire Marshal may require additional hydrants or relocation of hydrants required by this manual in order to provide effective fire protection.
5. For any structure incorporating a standpipe or sprinkler system requiring fire department connection, the maximum distance from the building to a fire hydrant shall be 100 feet.
6. For buildings, which employ sprinkler systems requiring a Siamese (FDC) connection, this connection is recommended to be placed in the front of the building and clearly labeled for easy identification by the Fire Department with approval for all cases by the Fire Marshal. When in use, an RPZ Backflow Preventer shall be used between the Town and the building systems.
7. In residential areas, fire hydrants shall be located at street intersections, at the end of cul-de-sacs and any intermediate locations specified by the Director of Utilities in conjunction with the Loudoun County Fire Marshal or as required to maintain coverage. *Refer to Drawing WS-17 in Appendix A.*
8. In no instance shall the distance between fire hydrants exceed 1,000 feet as measured along the centerline of accessible streets.
9. If hydrants are to be located in an area of possible guardrail construction, the design shall allow for fire hydrant access without obstruction.
10. Drainage shall be provided to prevent the ponding of water around hydrants.
11. Hydrants shall be placed one foot clear from the back edge of sidewalk in areas where the grass area is less than two feet wide.

## **2-240 TOWN OF LEESBURG DESIGN & CONSTRUCTION STANDARDS**

12. Hydrants shall be installed either five feet from the point of curvature of curb returns or on the property line in subdivisions. Hydrants must not be located farther than ten feet from face of curb or edge of pavement.
13. Steel bollards shall be installed around hydrants as needed for protection in industrial and commercial development areas where curbs are not available.
14. The installation of a fixed fire suppression system shall be subject to the applicable section of the Uniform Statewide Building Code. Connections for sprinkler systems, Siamese connectors, and post indicator valves need to be shown.
15. Private bridges must have a design satisfactory to the Director of Utilities to carry fire equipment where necessary. American Association of State Highway Transportation Officials "Standard Specifications for Highway Bridges" and the Virginia Department of Transportation Road and Bridge Standards shall be consulted for guidance.
16. Easements shall be required for hydrants located outside the right-of-way.

## **2-250 Fire Lanes**

1. Where required, paved, gravel or grass fire lanes shall have a minimum width of 20 feet and a maximum slope of five percent in all directions and must accommodate an AASHTO SU vehicle loading as a minimum.
2. The inner edge of the fire lane shall be no less than 15 feet or a maximum of 40 feet from the exterior building wall.
3. When buildings are more than five stories or 50 feet in height, access shall be provided to both the front and rear of the building. Access to the rear may be provided by either a street, parking lot aisle, or fire lane.
4. A 12-foot wide access shall be provided to within 50 feet of the edge of swimming pools with an 8-foot wide personnel gate in the required fence at the point of access, except for individually owned pools located on single-family lots.
5. Access shall be provided to within 100 feet of the main or principal entrance of any building by a public or private street or parking lot.



**2-260            Hydrant Design**

1. All fire waterlines shall have a minimum cover of four feet unless otherwise approved by the Director of Utilities.
2. Fire hydrants shall not be installed on lines less than six inches in diameter or on lines not adequately sized to convey fire flows. *Refer to Drawing WS-18 in Appendix A.*
3. No plantings or erection of other obstructions shall be made within five feet of any fire hydrant.
4. All hydrants and fire line valves shall be strapped or thrust blocked. *Refer to Drawings WS-12 and WS-15 in Appendix A.*
5. Hydrant and Siamese hose connections shall have a minimum clearance of five feet horizontally.
6. Where hydrant drains are not plugged, they shall drain to the ground surface or to dry wells provided exclusively for this purpose.
7. Hydrant drains shall not be connected to sanitary sewer or storm drainage system.

**2-270            Fire Suppression System**

1. When a facility requires installation of a fire sprinkler system, the combined (fire and domestic) water service to the building shall be provided with a service meter. The acceptable fire line sizes are 3", 4", 6", or 8". Larger sizes may be approved when necessary. A facility's fire line size and pump requirement shall be tabulated in a format similar to Drawing WS-6 and included on the approved construction drawings.
2. All combined fire and domestic meters shall be installed per drawings WS-3, WS-4, WS-30, WS-31, and/or WS-32.
4. The domestic service meter size could vary from 5/8" to 2" depending on results of the service line sizing calculations.

(End of Section)

## **2-300 TOWN OF LEESBURG DESIGN & CONSTRUCTION STANDARDS**

### **SECTION 2-300 CONSTRUCTION STANDARDS**

All installations shall be made in accordance with the American Water Works Association (AWWA) standards, Virginia Department of Transportation Road and Bridge Specifications, and in accordance with any special supplementary instructions issued by the manufacturers of the pipe or other equipment being installed.

#### **2-310 Materials Handling, Emplacement, and Testing**

1. Pipe, fittings, valves, hydrants, and accessories shall be loaded and unloaded by lifting with hoists or skidding to avoid shock or damage. Under no circumstances shall such material be dropped. Pipe shall be handled such that the coating and lining shall not be damaged.
2. The watermain shall be laid and maintained to the required lines and grades with fittings, valves, hydrants, and accessories set at the required locations as indicated on the approved plans for the project. All valve and hydrant stems shall be set vertically plumb.
3. Whenever obstructions not shown on the plans are encountered during progress of the work, and interfere to such an extent that alteration in plans is required, the Director of Utilities shall be advised and approval granted before such alterations are put into effect.
4. Trenches shall be dug so that the pipe can be laid to the alignment and depth required, and excavated not more than 500 feet in advance of the completed pipe laying operation. The width of the trench shall be ample to permit the pipe to be placed and backfill thoroughly compacted in accordance with the requirements of these specifications. When required, trenches shall be of such extra widths as will permit the convenient placing of timber supports, sheeting and bracing and handling of special fittings or appurtenances.
5. Pipe foundation and bedding shall conform to requirements set forth in Article 9 Section 700 "Excavation, Trenching and Backfilling for Utilities". Watermains constructed of PVC pipe shall be bedded using VDOT crushed stone #68, #78, or shall be bedded with other satisfactory material as defined in Section 9-700 and approved by the Director of Utilities on a case-by-case basis. *Refer to Drawings WD-12 and WD-20 of this article.*
6. Rock, boulders, large stones, or any other unyielding materials encountered shall be removed in accordance with Article 9 Section 700 Excavation, Trenching, and Backfilling for Utilities. *Refer to Drawings WD-12 and WD-20 of this article.*

7. Placement of Pipe and Backfill
  - A. No pipe shall be laid in water or when, in the opinion of the Town Utility Inspector, trench conditions are unsuitable.
  - B. Fill material placed under pipelines or appurtenances; initial backfill material placed over pipelines or appurtenances; and backfill material for filling of trenches shall meet the requirements of Article 9 Section 700 for material type, emplacement, compaction, and moisture content.
8. When installing pipe in the trench, proper implements, tools, and facilities satisfactory to the Town Utility Inspector and as recommended by the material manufacturer shall be provided and used by the contractor for the safe and convenient completion of the work. All pipe, valves, and fittings, hydrants and accessories shall be carefully lowered into the trench, piece by piece, by means of a derrick, ropes, slings or other suitable tools or equipment. Pipe and fittings shall be inspected for defects. All defective material will be rejected.
9. All lumps, blisters, and excess coal tar coatings shall be removed from and around ends of each pipe. The outside of the spigot and the inside of the bell shall be wire brushed and wiped clean and dry, and free from oil and greases before the pipe is laid. Ends of pipes while stored on site must be protected with covers.
10. Every precaution shall be taken to prevent foreign material, including non-potable water, from entering the pipe while it is being placed in the line. If the pipe laying crew cannot place the pipe in the trench without earth entering the pipe, a heavy, tightly woven canvas bag or cap of suitable size shall be placed over each end and left there until the connection is to be made to the adjacent pipe. During laying operations, no debris, tools, clothing, or other material shall be placed in the pipe. At the end of each day, a watertight plug shall be placed in any pipe openings.
11. Ductile iron pipe shall be laid with the bells facing the direction in which work is progressing. After placing a length of pipe in the trench, the spigot end shall be centered in the open bell of the pipeline and the pipe pushed home so that the face of the spigot is in close contact with the shoulder of the bell. Should mechanical joint pipe be used, the gasket should be pressed firmly and evenly around the entire socket and the bolts torqued in a crossing pattern starting with the bottom bolt, until they are all within the torque specifications.

## 2-310 TOWN OF LEESBURG DESIGN & CONSTRUCTION STANDARDS

12. No stub of any watermain shall terminate with a capped or plugged valve. Where a valve is required to be installed near a stub end, anchoring must be provided in the form of standard pipe anchor block, strapping of the valve, or no less than two standard lengths of pipe shall be installed between the valve and the plug stub end of pipe for adequate anchoring. *Refer to Drawing WS-19 in Appendix A.*
13. The cutting of pipe for inserting valves, fittings, or closure pieces shall be done in a neat and workmanlike manner without damage to the pipe cement lining, so as to leave a smooth end at right angles to the axis of the pipe. Flame cutting of pipe by means of oxyacetylene torch shall not be allowed.
14. Whenever it is necessary to deflect pipe from a straight line, either in the vertical or horizontal plane, to avoid obstructions or where long radius curves are permitted, the amount of deflection allowed shall not exceed that required for satisfactory joining of the pipes in accordance with AWWA, C-600.
15. All tees, bends, plugs, caps, and fire hydrants shall be braced, blocked, and/or strapped to prevent movement by providing reaction backing and/or tie rods. Strapping rods shall be stainless steel and field coated upon cutting. *Refer to Drawing WS-12, WS-13, WS-14, and WS-15 in Appendix A.*
16. All new watermains shall be tested in accordance with AWWA, C-600, after backfilling to a hydrostatic pressure of not less than 15 psi above the design water pressure for the system or 150 psi, which ever is greater. All high points in the portion of the system under test shall be vented and all air shall be expelled from the system prior to beginning the test. This is accomplished through the use of air release valves placed at the high points along the watermain. *Refer to Drawings WS-7, WS-8, and WS-9 in Appendix A.* Where concrete thrust blocks are used, they shall have attained their final set strength prior to testing. *Refer to Article 4 Section 4-150 Acceptance Tests.*
17. After the portion of the system being tested has reached the required pressure, the pressure shall be maintained for two hours. At the conclusion of the pressure test, volume of makeup water required to refill the pipeline shall be determined by measurement with a displacement meter or by pumping from a vessel of known volume. Any joints or fittings at which leakage occurs shall be repaired to ensure

tightness. Leakage shall not exceed the values for the appropriate size pipeline using the following equation:

$$L = \frac{SD\sqrt{P}}{148,000} \qquad \text{AWWA, C-600, Section 4.1}$$

*Refer to Drawing WD-5 of this Article for allowable leakage.*

- L = the allowable leakage, in gallons per hour
- S = the length of pipe tested in feet.
- D = the nominal diameter of the pipe, in inches
- P = the average test pressure during the leakage test, in psi gauge

These formulas are based on an allowable leakage of 11.65 gpd/mi/in. of nominal diameter at a pressure of 150 psi.

Leaks shall be repaired and watermain retested until the leakage is within the limit set. Methods of repair prior to retesting will be done with the Town Utility Inspector's approval and inspection.

**2-315      Pipe Restraints**

1. Restraint joints, such as Snap-Lok or approved equal shall be used when indicated on the drawings and as required by the Director. Use of mega-lug or approved equal in combination with thrust blocks will be acceptable in place of proprietary restraint. *Refer to Drawing WS-20 in Appendix A.*

Generally, 11-1/4° and 22-1/2° bends can be restrained by use of mega-lug or approved equal brands of restraining glands. All such materials shall be of DIP construction.

When 45° and 90° bends are required the restraints methods shall be by use of thrust blocks against undisturbed earth. When field conditions do not permit the use of thrust blocks, a combination of mega-lug and thrust blocks will be accepted when approved by the Director of Utilities.

Restraining devices must be installed in accordance with manufacturers' recommendations. All damaged coatings including twist-offs nuts must be recoated with the manufacturers approved coatings prior to backfilling or thrust block installation.

## 2-320 TOWN OF LEESBURG DESIGN & CONSTRUCTION STANDARDS

### 2-320 Watermain Pipe, Fittings, and Accessories

1. Pipe for watermain construction shall be Ductile Iron Pressure Pipe (DIP), Class 52. Use of Polyvinyl Chloride (PVC), C-900, DR-18, may be considered at major natural gas main crossings or when running parallel to or crossing major electric transmission lines. In all cases, for all pipe materials, pipe to be installed must be in a new and unused condition. Reuse of pipe will not be permitted. All plastic pipes shall be provided with warning tapes and tracing wires. *Refer to Drawing GN-2 in Appendix A.*
2. Ductile Iron Pipe shall be lined with cement mortar and have a protective exterior coating. The linings and protective coatings equal to "Enameline" with a two-mil bituminous coating on the exterior will be considered as a satisfactory lining and coating for the water pipe; however, any substitution in pipe lining and/or coating shall be specifically approved by the Director of Utilities. *Refer to AWWA Specification C-151, for Bituminous Coatings.*
3. High strength cast iron tee-head bolts, hex nuts, cast iron glands, and rubber gaskets shall be furnished as necessary by the pipe manufacturer. In making connections of ductile cast iron pipe using the standard mechanical joint, the gland followed by the rubber gasket shall be placed over the plain end of the pipe, which shall be carefully inserted and aligned into the socket end of the pipeline. The rubber gasket shall be lubricated with the approved lubricant so specified by the manufacturer. Lubricants shall be kept clean and free of water or other contaminants at all times. The gasket shall then be pushed into position so that it is evenly seated in the socket. The gland shall then be moved into position against the face of the gasket, bolts inserted and made finger tight. The bolts shall then be tightened by using a ratchet wrench not less than 14 inches in length.
4. All "push-on" or "slip" joint pipe shall conform to the requirements for a mechanical joint with regard to strength, class protective coating, gaskets, etc.
5. Fittings for ductile iron pipes shall be ductile iron or gray cast iron in accordance with AWWA specifications with a minimum pressure rating of 250 psi.
6. All gate valves shall be of superior quality ductile iron or cast iron body non-rising stem resilient wedge type. All gate valves shall withstand a working pressure of at least 150 psi and shall be in strict conformance to applicable AWWA standards. The valves shall be so arranged to fit into pipelines having standardized mechanical joints or slip joints. The gate valves shall be Mueller or approved equal. For watermains 16 inches or larger, butterfly valves conforming to AWWA, C-504, shall be used in lieu of gate valves.

7. All valve boxes, base extensions, heads, and covers shall be of cast iron. Valve boxes shall be of the Mueller sliding type, round head, marked "Water", or approved equal. The shaft diameter shall not be less than five inches. The valve boxes shall have a minimum range of extension to fit two-inch to 12-inch valves inclusive, placed on mains at depths of three feet to five feet of cover in order that the top cover of the valve box is set to finished grade. Valve boxes shall be a Mueller Company 10360, or approved equal. Valve boxes shall be centered over the valve screw and set vertically plumb. *Refer to Drawing WS-22 in Appendix A.*
8. All valves shall be opened by turning the valve operating stem nut in a counter clockwise direction (left open only).
9. The valve-operating nut shall not be deeper than 4' from the finished grade.

**2-330            Highway Crossings for Water and Sewer Mains**

**2-331            General**

1. The Contractor shall cooperate with the governmental authority or authorities having jurisdiction over the work in these crossings. Where the crossing is to be installed beneath a State highway, all operations and materials shall conform to the Virginia Department of Transportation's regulations governing such matters. The approval of the Virginia Department of Transportation of all materials and methods shall be obtained before work is begun. The Contractor shall be responsible for the location of all utilities in the area of the highway crossing.
2. In general, highway crossings shall be made utilizing steel casing pipe installed by boring and/or jacking techniques. Refer to Section 2-122-4.N for specific criteria.

**2-332 TOWN OF LEESBURG DESIGN & CONSTRUCTION STANDARDS**

**2-332 Boring and Jacking Materials**

1. Welded steel pipe for boring and jacking highway crossings shall be shop prime coated inside and out and shall have the following minimum wall thickness:

<u>Diameter</u>	<u>Thickness (minimum)</u>
42" & greater	1/2"
36" & less	3/8"

2. Pipe installations are to be cathodically protected if, in the Town's discretion, the field conditions require such protection. The casing joints shall be squared and continuously welded to create a waterproof enclosure. Edges of the welds shall be ground on the inside of the casing.

**2-333 Jacking Method**

1. The contractor shall submit to the Director of Utilities for approval, an outline of the methods and means proposed to be used in completing the work.
2. Hydraulic jacks shall be used in the jacking operation and extreme care shall be taken to hold the pipe to exact line and grade. Deviation at any point along the casing pipe from line and grade shall not exceed three inches in any direction. Excavation at the heading shall not exceed one foot ahead of the lead pipe.
3. The jacking pit shall be of adequate length to provide room for the jacking frame, the jacking head, the reaction blocks, the jacks and one section of casing pipe. The pit shall be sufficiently wide to allow ample working space on each side of the jacking frame. The depth of the pit shall be such that the invert of the pipe when placed on the guide frame will be at the elevation desired for the completed line. The pit shall be tightly sheeted and kept dry at all times.
4. The reaction blocks shall be adequately designed to carry the thrust of the jacks to the soil without excessive soil deflection and in such a manner as to avoid any disturbance of adjacent structures or utilities. Adequate protective railings shall be provided at the top of the pit at all times.



**2-334            Boring Method**

1.     When utilized, the drilling machine shall be securely supported and braced so that the casing pipe can be set to the proper line and grade and will not deflect therefrom during the boring operation. Deviation from the specified line and grade shall not exceed three inches in any direction at any point along the casing pipe.
  
2.     The Contractor shall submit to the Director of Utilities for approval, an outline of the methods and means proposed to be used in completing the work.
  
3.     Boring machines shall afford adequate protection against loss of ground and permit ground support adjacent to the tunnel face, as required by ground conditions.
  
4.     The method used to advance the boring machine shall ensure its correct alignment at all times, without binding or imposing excessive loads on the initial tunnel supports or upon the surrounding ground.
  
5.     The boring pit shall be of adequate length to provide room for the boring machine and appurtenances and one section of casing pipe. The pit shall be sufficiently wide to allow ample working space on each side of the boring machine. The depth of the pit shall be such that the invert of the pipe when placed on the guide frame will be at the elevation desired for the completed line. The pit shall be tightly sheeted and kept dry at all times. Adequate protective railings shall be installed at the top of the pit.

**2-335            Tunneling Materials**

1.     Encasing conduits shall be galvanized steel tunnel liner plate. Encasing conduits shall be of sufficient strength to support all superimposed loads including an AASHTO H-20 loading for conduits installed under highways. The thickness of the tunnel liner plate shall not be less than that required by the submitted load computations, except for the crossing of Interstate Highways, where the minimum shall be eight-gauge. The thickness gauge shall be marked on each liner plate in an approved manner by the liner plate manufacturer. The tunnel liner plate shall be hot-dipped galvanized in accordance with the requirements of the ASTM Specification Designation A-123, and the inside and outside surfaces of the tunnel liner plate shall be factory coated with asphaltic material to a minimum thickness of 0.05 inches. Bolts and nuts shall be the diameter and length recommended by the manufacturer. Bolts and nuts shall conform to ASTM A-307, Grade A, and shall be hot-dipped galvanized in accordance with ASTM A-153. Sufficient plates shall be provided with grout holes to provide four grout holes for each ring of plates. Grout holes shall be two-inch half couplings provided with two-inch cast iron plugs. The

## **2-335 TOWN OF LEESBURG DESIGN & CONSTRUCTION STANDARDS**

contractor shall furnish shop drawings of the liner plate to the Director of Utilities for approval. The shop drawings shall show the cross section dimensions, diameter, thickness gauge, and grout hole locations in the liner plate. No liner plate will be permitted to be used until shop drawings therefore, have been approved by the Director of Utilities. Tunnel liner plates shall be sectional steel liner plates as manufactured by Armco, Inc., Metal Products Division, Republic Steel Corporation, or approved equal.

2. Grout for filling voids caused by the installation of the tunnel liner plates shall consist of one part Portland cement, one part sand with 100 percent passing U.S. Standard sieve Number 16. Grout shall have a minimum compressive strength of not less than 100 psi attained within 24 hours.

## **2-336 Tunnel Construction Methods**

1. The tunnels shall be constructed by personnel fully qualified by experience for such work to the lines and grades shown on the Drawings.
2. The Contractor shall submit to the Director of Utilities for approval an outline of the methods and means proposed to be used in completing the work.
3. The Contractor shall be responsible for the adequate support and protection of the highway being crossed and damage for disturbance to adjacent property and facilities affected by the work. If loose material is encountered and cave-ins occur or are anticipated, all operations shall be discontinued; shoring approved by the Virginia Department of Transportation shall be installed; and all voids filled by pressure grouting or other approved methods before work is continued.
4. During the tunneling operation, care shall be exercised in trimming the surface of the excavated section such that the steel liner plates fit snugly against undisturbed material. Excavation shall not be advanced ahead of the previous installed liner plates any more than is necessary for the installation of the succeeding liner plate. The vertical face of the excavation shall be supported as necessary to prevent sloughing. Rock excavation encountered in the work shall be removed by means of air hammers and in such a manner as to minimize the occurrence of voids outside the liner plates. At any interruption of the tunneling operation, the heading shall be completely bulk headed. If required by the Virginia Department of Transportation, the tunneling shall be conducted continuously, on a 24-hour basis, at no additional cost to the Owner. A uniform mixture of Portland cement grout shall be placed under pressure behind the liner plates to fill any voids existing between the liner plate and the undisturbed material. Grouting shall start at the lowest hole in each grout panel and proceed upward simultaneously on both sides of the tunnel. A threaded plug shall be installed in

each grout hole as the grouting is completed at that hole. Grouting shall be kept as close to the heading as possible, using grout stops behind the liner plates if necessary. Grouting shall proceed as directed by the representative of the Virginia Department of Transportation or the Director of Utilities, but in no event shall more than four linear feet of tunnel be progressed beyond the grouting nor shall any length of tunnel be allowed to stand un-grouted overnight. The tunnel liner plate encasing conduits may require a shield when soil or other conditions indicate its need.

5. After the tunnel is installed, Class D concrete shall be placed on the bottom of the tunnel as shown on the drawings. The surface of the concrete shall receive a hand-troweled finish until a smooth surface is achieved. *Refer to Drawing WS-11 in Appendix A.*

**2-337      Pipe Installation - Insulated Casing Installation**

1. Crossings of railroads, gas or petroleum pipelines protected by impressed current and where designated shall include cathodic protection measures as specified herein.
2. Casing insulators shall be affixed to the pipe around the polyethylene encasement as it is installed in the encasing conduit. Insulators shall be Model A-12-G2, as manufactured by Pipeline Seal & Insulator, Inc., or an approved equal, and shall be properly sized for the encasing conduit and carrier pipe diameters, and shall include offsets as necessary for the carrier pipe bell. Insulators shall be spaced on six-foot centers or as otherwise recommended by the manufacturer.
3. Encasing conduit ends shall be closed with a heat shrink sleeve "Caseal" as manufactured by Raychem, Menlo Park, California, or approved equal, sized for the specific outside diameters of carrier and encasing conduit.

**2-338      Pipe Installation - Standard Casing Installation**

1. Pipe shall be installed in the encasing conduit by use of cascade spacers at 6-foot intervals to the pipe and sliding the pipe into place. Care shall be taken to protect the exterior coating of pipeline when attaching the spacers and during installation of the pipe. *Refer to Drawing WS-10 in Appendix A.*
2. The ends of encasing conduits shall be sealed with a combination of link seal and casing end sealer per manufacturer's recommendation. The acceptable manufacturers are Cascade, PSI Casing Spacers, or approved equal. *Refer to Drawing WS-10 in Appendix A.*

## **2-339 TOWN OF LEESBURG DESIGN & CONSTRUCTION STANDARDS**

### **2-339 Test Pits**

1. Test pits shall be called out at all utility crossings and at the points of connection to existing watermains. The test pit data must be collected prior to submission of final construction plans.

### **2-340 Water Service Connections**

1. Water meter boxes and accessories necessary for meter installation shall be installed as public water service connections for townhouses, condominiums, and single-family homes at the front of the building served. For commercial and industrial buildings, water meters shall be banked and installed at the rear of buildings if possible. *Refer to Drawings WS-1, WS-2, WS-3, WS-4, WS-23, WS-30, WS-31, and WS-32 in Appendix A.*
2. The Town will supply and install at the developer's cost, any and all size water meters for installation within service areas. All water service pipe from main connections to the meter box assembly, shall be type "K" seamless copper. All connections shall use compressive or flared fittings. The minimum size service connection shall be type "K" seamless copper, one-inch, I.D, and maximum size service connection shall be type "K" seamless copper two-inch I.D. Larger sizes shall be of ductile iron, Class 52. A project's meter and line sizes shall be tabulated in a format similar to Drawing WS-6 and included on the approved construction drawings. *Refer to Drawings WD-10 and WD-11 of this Article.*
3. All private water service connections from the meter to the building, except when within a dedicated easement, are regulated by the IPC's, latest edition.
4. All wet taps require the approval of the Director of Utilities and will only be permitted under very special circumstances. Sleeve and valve assemblies shall be tested at 150 psi for ten minutes before the actual tap is made. Wet taps shall employ a Mueller No. H-615, cast iron mechanical joint sleeve, and a fabricated steel tap valve with epoxy coating as manufactured by Rockwell International, or approved equal. Tapped fittings shall be used for 1" and 2" taps.

5. The alignment from the meter to the main shall be as straight as possible. Meters shall not be installed within five feet of other utilities. Where storm sewer is placed parallel to the utility strip and conflicts with the meter location in the utility strip, meters shall be placed directly behind the sidewalk and enclosed in a watermain easement extending five feet beyond the meter. In locations where the meter is located behind the sidewalk because of its proximity to proposed storm sewer, the minimum separation of five feet shall be deemed to have been met.
  - A. For 1.5-inch and two-inch water meter installations, the Director of Utilities may specify the use of appropriately sized vaults in lieu of meter crocks. Water meters larger than two inches shall be installed with a bypass valve. *Refer to Drawing WS-3 and WS-4 in Appendix A.*
  - B. Plans for the installations of meters greater than two-inch shall be submitted for approval.
6. All meters for residential and commercial buildings shall be located outside of the structure. The Director of Utilities may permit installation of a water meter inside a utility room on a case-by-case basis. Such authorization must be approved prior to approval of plans and requires a signed agreement with the Town.
7. The method of metering for commercial, retail, and industrial uses with multiple tenants is to provide individual water meters for each individual tenant space. Master metering for these uses utilizing a single meter will not be acceptable.
8. All newly installed water meters shall be protected during construction by posting 3-2" x 2" x 4' posts wrapped with orange fencing.
9. When booster pumps are required on the domestic service, the type of meter to be utilized is a compound meter. This information must be conveyed to the Town's Utility Department on the construction plans via completion of Drawing WS-6 or equivalent.

## **2-350 TOWN OF LEESBURG DESIGN & CONSTRUCTION STANDARDS**

### **2-350 Separation and Crossings of Watermains and Other Utilities**

1. The following factors shall be considered in providing adequate separation of watermains and sanitary sewer:
  - A. Materials and types of joints for water and sewer pipes
  - B. Soil conditions
  - C. Service branch connections into the waterline and sewer lines
  - D. Compensating variations in the horizontal and vertical separations
  - E. Space for future repairs and/or alterations of water and sewer pipes.
2. No water pipes shall pass through or come in contact with any part of a storm or sewer manhole.
3. Waterlines shall be designed such that they do not create skewed crossings with other utilities with an acute angle of less than 45 degrees. Ninety degrees is preferred; however, where skewed crossings are unavoidable due to existing utilities and/or where the skewed crossing is greater than a 45-degree angle and involves a pipe larger than 48 inches in diameter, the crossing must be specifically designed and construction details provided. Crossings with an acute angle of less than 45 degrees will not be approved regardless of the size of the utilities.

### **2-360 Air Relief and Blow-Off Provisions**

1. Air accumulations shall be removed through a standard fire hydrant, manual air release valve assembly or automatic air release valves, where permitted by this manual. *Refer to Drawings WS-7, WS-8, WS-9 and WS-18 in Appendix A.* Sediment accumulations shall be removed through a blow-off fire hydrant. Compressed air and pumping may be used for dewatering mains through hydrants. *Refer to Drawing WS-5 in Appendix A.*
2. Chambers or pits containing valves, blow-offs, meters, or other such appurtenances to a distribution system shall not be connected directly to any storm drain or sanitary sewer, nor shall blow-offs or air relief valves be connected directly to any sewer. Such chambers or pits shall be drained to the surface of the ground where they are not subject to flooding by surface water, or to absorption pits located above the seasonal groundwater table elevation. Sump pumps may be used where other means are not practicable.

3. When subject to flooding, the open end of an air relief pipe should be extended from the manhole or enclosing chamber to a point at least one foot above finished grade and provided with a screened, downward-facing elbow.
4. A temporary blow-off may be installed at the end of a watermain, which is to be extended during future construction. Use of permanent blow offs will be assessed on a case-by-case basis. Use of a blow off fire hydrant is preferred. *Refer to Drawings WS-24 and WS-25 in Appendix A.*

**2-370      Stream Crossings**

1. Watermain crossings under a stormwater conveyance channel or natural watercourse, whether it contains a continuous flow or intermittent flow, presents special design and construction problems and shall require the approval of the Director of Utilities and/or the Virginia Department of Health as required.
  - A. Above water crossings are not permitted within the Town of Leesburg.
  - B. Underwater Crossing
    - (1) The pipe shall be ductile iron pipe meeting the DCSM requirements for water pipe, with rubber seal or gasket joint approved for water pipe, and with sufficient protection to prevent erosion of the backfill material. A minimum of one foot of cover where the stream is located in rock and three feet minimum cover where the stream is located in other materials shall be provided. The cover requirements may be lessened with the approval of the Director of Utilities where the pipe is encased in concrete and located in an area, which will not interfere with future improvements to the channel bottom. All joints shall be mega-lug joint restraint or approved equal for a minimum of 3 pipe sections on either side of the crossing measured from high water level. *Refer to Drawing SS-10 in Appendix A for concrete encasement.*
    - (2) Valves shall be provided at both ends of the water crossing so that the section can be isolated for tests or repair; the valves shall be easily accessible and not subject to flooding.
    - (3) Sample taps including, but not limited to hydrants, shall be available at each end of the crossing and at a reasonable distance from each side of the crossing and placed such that they are not subject to flooding.

## 2-380 TOWN OF LEESBURG DESIGN & CONSTRUCTION STANDARDS

### 2-380 Disinfection of Watermains

1. All waterlines shall be disinfected prior to being placed in operation.
2. Prior to disinfection, all waterlines shall be flushed using 2" ID or greater hoses, unless the tablet method of disinfection is used. All valves and hydrants shall be operated during this operation. Flushing velocities should not be less than 2.5 ft/sec.
3. Methods of Chlorine Application:
  - A. Continuous feed method - Potable water shall be introduced into the pipeline at a constant flow rate. Chlorine shall be added at a constant rate to this flow so that the chlorine concentration in the water in the pipe is at least 50 mg/L. The chlorinated water shall remain in the pipeline at least 24 hours, after which, the chlorine concentration in the water shall be at least 10 mg/L.
  - B. Slug method - Potable water shall be introduced into the pipeline at a constant flow rate. This water shall receive a chlorine dosage, which will result in a chlorine concentration of 100 mg/L in a "slug" of the water. The chlorine shall be added long enough to insure that all portions of the pipe are exposed to the 100 mg/L chlorine solution for at least three hours. The chlorine residual shall be checked at regular intervals not to exceed 2,000 feet to insure that adequate residual is maintained.
  - C. Tablet method - this method shall not be used if non-potable water or foreign materials have entered the lines or if the water temperature is below five degrees C (41 degrees F).

The tablets shall be placed in each section and in all appurtenances. A sufficient number of tablets shall be used to ensure that a chlorine concentration of 25 mg/L is provided in the water. They shall be attached by an adhesive to the top of the pipe sections and crushed or rubbed in all appurtenances. The adhesive shall be acceptable to the Virginia Department of Health (VDH). The velocity of the potable water in the pipeline shall be less than one foot per second. The water shall then remain in contact with the pipe for 24 hours.

- D. During the chlorination process, all valves and appurtenances shall be operated while the chlorinated water is in the pipeline in order to cleanse them.



4. Final Flushing - after the required retention period, the heavily chlorinated water shall be flushed using 2" ID or greater hoses, from the pipe line using potable water. Heavily chlorinated water shall be flushed into the sanitary sewer system upon approval and coordination with the Town Utility Inspector. When flushing above ground an approved de-chlorination device shall be used.
5. Testing of water following disinfection
  - A. Samples shall be collected at regular intervals, not exceeding 2,000 feet throughout the length of pipeline.
  - B. All chlorine residual determinations shall be made using only those methods approved by the Town.
    - B. Two water samples for bacteriological analysis must be collected at least 24 hours apart and analyzed by a certified laboratory. The results of these samples must indicate no coliform contamination before the pipe, tanks, or equipment can be utilized as part of the waterworks. If contamination is indicated, then the disinfection procedure must be repeated.

**2-390                      Construction Standards of Fire Lines and Hydrants**

1. All fire line construction shall conform to the guidelines and standards established herein unless otherwise authorized by the Director of Utilities.
2. Hydrants shall be set to established finished grade as follows:
  - A. The bottom of the 4.5-inch nozzle shall be 18 inches above the elevation of the edge of the shoulder on streets without curb and gutter and 18 inches above the elevation of the curb on streets with curb and gutter. The horizontal setback distances from the flow line of gutter shall be 14 inches minimum and 24 inches maximum. *Refer to Drawing WS-18 in Appendix A.*
  - B. The 2.5-inch hose connections shall have a minimum of five feet clearance on both sides.
  - C. The maximum hydrant barrel height shall be 8 feet.

## 2-390 TOWN OF LEESBURG DESIGN & CONSTRUCTION STANDARDS

3. All fire hydrants shall be traffic model Mueller Centurion, Kennedy Guardian, or approval equal. Hydrants shall be of the compression type with main valve openings not less than 5.25 inches in diameter. Hydrants shall have a cast iron body with full bronze trim and shall withstand a hydrostatic test pressure of 300 psi. Fire hydrants shall have a minimum six-inch connection base. Hydrants shall be equipped with hose connections as follows:

Two each, 2.5-inch N.S.T. hose connections

One each, 4.5-inch N.S.T. pumper connection

4. Hydrants shall be operated by a National Standard 1.5-inch pentagon shaped operating nut, opening counterclockwise. The direction of opening shall be clearly marked by an arrow cast on the outside of the hydrant. Hydrants shall be additionally controlled by an independent six-inch gate valve, located as near to the tee at the watermain as practical.
5. All hydrant barrels shall be painted red. The bonnet of the hydrant shall be painted with reflective white paint.
6. The use of detector check valves on sprinkler lines will be evaluated on a case by case basis.
7. On curb returns, the hydrants shall be located at least 5' from the face of curb.

(End of Section)

**SECTION 2-400      COMPUTATION OF "NEEDED FIRE FLOW"**

**2-410              General Criteria**

This Section sets forth the Needed Fire Flows for selected locations throughout the Town, which are used in the review of plans. The calculation of a Needed Fire Flow (NFF<sub>i</sub>) for a subject building in gallons per minute (gpm) considers the Construction (C<sub>i</sub>), Occupancy (O<sub>i</sub>), Exposure (X<sub>i</sub>) and Communication (P<sub>i</sub>) of each selected building or fire division, as outlined below. This method shall not be applied to single family detached dwellings.

**2-420              Construction Factor (C<sub>i</sub>)**

1. That portion of the Needed Fire Flow attributed to the construction and square footage area of the selected building is determined by the following formula:

$$C_i = 18F (A_i)^{0.5}$$

F = Coefficient related to Class of Construction

F = 1.5 for Construction Class 1 (Frame)

    = 1.0 for Construction Class 2 (Joisted Masonry)

    = 0.8 for Construction Class 3 (Non-Combustible) and Construction Class 4 (Masonry, Non-combustible)

    = 0.6 for Construction Class 5 (Modified Fire Resistive) and Construction Class 6 (Fire Resistive)

A<sub>i</sub> = Area in square feet of the largest Fire Division of the building. In Fire Divisions with mixed construction, C<sub>i</sub> values are multiplied by their individual percentage of the total area. The C<sub>i</sub> applicable to the entire division is the sum of these values; however, the value of the C<sub>i</sub> shall not be less than the maximum value for any division of the building, based upon its own construction and area.

**A.              Determination of Effective Area**

After modification for Division Walls as provided above, the Effective Area shall be the total square foot area of the largest floor in the building plus the following percentage of the total area of the other floors:

- (1) Buildings classified as Construction Classes 1-4; 50 percent of all other floors.

## 2-420 TOWN OF LEESBURG DESIGN & CONSTRUCTION STANDARDS

- (2) Buildings classified as Construction Classes 5 or 6:
  - a. If all vertical openings in the building have V-1 or V-2 protection, 25 percent of the area not exceeding the two other largest floors.
  - b. If one or more vertical openings in the building have V-3 or V-4 type protection, 50 percent of the area not exceeding eight other floors with V-3 or V-4 type protection.

Note: The Effective Area determined under item (2)b. above shall not be less than the Effective Area that would be determined under item (2)a. above if all openings had V-1 or V-2 protection.

### B. Vertical Openings

- (1) General
  - a. The charge for vertical openings is applicable only in buildings of Construction Class 5 or 6.
  - b. The charge is applicable to floor openings for stairways, elevators, ramps, ventilating shafts and similar openings.
  - c. Openings into attics or roof spaces (areas suitable for storage but not for normal occupancy) shall be considered as floor openings, except where the attic or roof space has (1) a fire resistive or non-combustible roof and (2) is not occupied or contains only non-combustible contents.
  - d. Courts, light-wells, and similar interior shafts without roofs, which are enclosed on all sides by walls, shall be considered as floor openings, except that such shafts, which are 20 feet or more in both dimensions, shall be disregarded.
- (2) Protection Requirements
  - a. The type of protection for vertical openings shall be based on the construction of the enclosure walls and the kind of door or other device used for the protection of openings in the enclosure.

- b. The following materials are acceptable for one-hour construction in enclosure walls: four-inch brick, four-inch reinforced concrete, six-inch hollow block, six-inch tile, or masonry or non-combustible materials listed with a fire resistance rating of not less than one hour.
- c. The following materials are acceptable for two hours: five-inch reinforced concrete, six-inch brick, eight-inch hollow block, eight-inch tile, or masonry or noncombustible materials listed with a fire resistance rating of not less than two hours.

(3) V-1 Protection

- a. Enclosures shall have walls of masonry or fire resistive construction grading one hour or over, except that in Fire Resistive buildings of four or more stories, the enclosure walls shall have two hours or over fire resistance.
- b. Doors for Type V-1 Protection shall be automatic or self-closing and be labeled for Class B opening protection (one hour rating, except in Fire Resistive buildings of four or more stories where 1-1/2 hour doors are required).

(4) V-2 Protection

Enclosure walls shall be as in Type V-1. All doors shall be as in Type V-1, except that elevator doors shall be of metal or metal covered construction so arranged that the doors must be normally closed for operation of the elevator.

(5) V-3 Protection

- a. Enclosure walls constructed of noncombustible materials which grade less than one hour (such as metal lath and plaster, gypsum board on metal studs, etc.).

## 2-420 TOWN OF LEESBURG DESIGN & CONSTRUCTION STANDARDS

- b. Openings for Type V-3 shall be protected by automatic or self-closing doors, either labeled for Class C situation (3/4 hour rating) or of metal or metal covered construction (wired glass permitted). Elevator doors (metal or metal covered) shall be so arranged that the doors must normally be closed for operation of the elevator.
- c. Also included in Type V-3 are enclosures or doors which grade one hour in Fire Resistive buildings of four or more stories, and which therefore, do not qualify for Type V-1 or V-2 protection.

### (6) V-4 Protection

Unprotected floor openings. Type V-4 also includes doors or enclosures not meeting minimum requirements for V-1, V-2, or V-3.

Note: Where masonry or fire resistive floors have part combustible, non-combustible or slow burning construction, such floors shall be considered as having type V-4 vertical opening protection.

### C. Area-Height

#### (1) Exempt Areas: Disregard the following in the determination of the Effective Area:

- a. Floor (including basement and sub-basement) areas where the entire floor is protected by an acceptable system of automatic sprinklers, provided that there are no Combustibility Class C-5 occupancies located on the floor.
- b. Basement and sub-basement areas which are vacant, or are used for building maintenance, or which are occupied by occupancies having C-1 or C-2 Contents Combustibility (regardless of the Combustibility Class applicable to the building.)

Note: A basement is a story of a building, which is 50 percent or more below grade, unless such story is accessible at grade level on one or more sides. A story which is less than 50 percent below grade shall also be considered a basement if such story is wholly enclosed by blank masonry foundation walls.

- c. Roof structures, sheds, or similar attachments charged under Item 360 (Combustible Exterior Attachments) of the 1980 version of the Insurance Services Offices, Fire Suppression Rating Schedule.
- d. Courts without roofs.
- e. Areas of mezzanines less than 25 percent of the square foot area of the floor immediately below.

(2) Modification for Division Walls.

An acceptable Division Wall shall be constructed entirely of noncombustible materials with a fire resistance rating of not less than one hour, or of masonry materials, and shall:

- a. Extend from one exterior wall to another (or form an enclosed area within the building).
- b. Extend from one masonry or fire resistive floor to another masonry or fire resistive floor or from a masonry or fire resistive floor to a roof of any construction.
- c. Have all openings through the wall protected by an automatic or self-closing labeled Class B (one hour) fire door.

Where Division Walls meet the above requirements, the maximum area on any floor used to determine the Effective Area shall be the largest undivided area plus 50 percent of the second largest undivided area on that floor.

2. The maximum value of  $C_i$  is limited by the following:

- |           |   |
|-----------|---|
| 8,000 gpm | for Construction Classes 1 and 2                      |
| 6,000 gpm | for Construction Classes 3, 4, 5 and 6                |
| 6,000 gpm | for a one story building of any class of construction |

3. The minimum value of  $C_i$  is 750 gpm. The calculated value of  $C_i$  shall be rounded to the nearest 250 gpm.

**2-420 TOWN OF LEESBURG DESIGN & CONSTRUCTION STANDARDS**

4. For the specific purpose of this Section, the following definitions may be used for determining the coefficient of class of construction "F":

<u>F</u>	<u>Description</u>	<u>Classification BOCA Building Type</u>
1.5	Frame Construction -- Any Structure in which the structural members are wholly or partly of wood or other combustible material and the construction does not qualify as ordinary construction	5A, 5B
1.0	Joisted Masonry -- Any structure having exterior walls of masonry or other noncombustible material in which the other structural members, including but not limited to columns, floors, roofs, beams, girders, and joists, are wholly or partly of wood or other combustible material.	2C 3A,3B
	Heavy timber type buildings which are required to satisfy a number of specific provisions (see building codes).	4
0.8	Noncombustible Construction -- Any structure having all structural members including walls, columns, piers, beams, girders, trusses, floors, and roofs of noncombustible material and not qualifying as fire-resistive construction.	2A, 2B
0.6	Fire-Resistive Construction -- Any structure that is considered fire-resistive by any of the BOCA building codes	1A, 1B



**2-430      Occupancy Factor ( $O_i$ )**

1. The factors below reflect the influence of the occupancy in the selected building on the Needed Fire Flow.

<u>Occupancy Combustibility Class</u>	<u>Occupancy Factor (<math>O_i</math>)</u>
C-1 (Noncombustible)	0.75
C-2 (Limited Combustible)	0.85
C-3 (Combustible)	1.00
C-4 (Free Burning)	1.15
C-5 (Rapid Burning)	1.25

2. For the specific purposes of this Section, the following definitions shall be used for determining the coefficient of Occupancy  $O_i$  above:

<u><math>O_i</math></u>	<u>Description</u>
0.75	Apartments, Churches Dormitories Dwellings
0.85	Clubs Colleges and Universities Hospitals Hotels Institutions Libraries, except Large Stack Room Areas Museums Nursing, Convalescent and Care Homes Office Buildings Prisons Public Buildings Rooming Houses Schools Tenements
1.00	All other Building uses not listed herein

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<u>O<sub>i</sub></u>	<u>Description</u>
1.15	All industrial uses which exceed those listed below.
1.25	Aircraft Hangars Cereal, Feed, Flour, and Grist Mills Chemical Works - High Hazard Textile Operations Explosives and Pyrotechnics Manufacturing Linseed Oil Mills Match Manufacturing Oil Refineries Paint Shops Pyroxylin Plastic Manufacturing and Processing Shade Cloth Manufacturing Solvent Extracting Varnish and Paint Works Wood Working with Flammable Finishing Other Occupancies Involving Processing, Mixing, Storage and Dispensing Flammable and/or Combustible Liquids.

3. When determining occupancies, good judgment should be used, and the percentage increase or decrease will not necessarily be the same for all buildings that are in the same general category -- for example, "Colleges and Universities:" this could range from a 15 percent decrease for buildings used only as dormitories to an increase for a chemical laboratory. Even when considering high schools, the decrease should be less, if they have extensive shops.
  - A. In commercial buildings, no percentage increase or decrease for occupancy shall be applied in most of the fire flow determinations. In general, percentage increase or decrease will not be at the limits of  $\pm 25$  percent.

**2-440      Exposures (X<sub>i</sub>) and Communication (P<sub>i</sub>) Factors (X + P)<sub>i</sub>**

1. The factors developed in this item reflect the influence of exposed and communicating buildings on the Needed Fire Flow. A value (X<sub>i</sub> = P<sub>i</sub>) shall be developed for each side of the subject building.

$$(X + P)_i = 1.0 + \sum_{i=1}^n (X_i + P_i),$$

Maximum 1.75. Where n = number of sides of subject building.

**2-450      Factors for Communications (P<sub>i</sub>)**

1. The factor for P<sub>i</sub> depends upon the protection for communicating party wall openings and the length and construction of communications between fire divisions and shall be selected from the following table. When more than one communication type exists in any one side wall, apply only the largest factor P<sub>i</sub> for that side. When there is no communication on a side, P<sub>i</sub> = zero.

**2-450 TOWN OF LEESBURG DESIGN & CONSTRUCTION STANDARDS**

**FACTOR FOR COMMUNICATION (P<sub>i</sub>)**

Description of Protection of Passageway Openings	Fire Resistive, Non-Combustible, or Slow Burning Communications (F Less than 0.8)				Communications With Combustible Construction (F Equal to or Greater than 0.8)					
	Open	Enclosed			Open			Enclosed		
	Any Length	10 ft or Less	11 ft to 21 ft	21 ft to 50 ft +	10 ft or Less	11 ft to 20 ft	21 ft to 50 ft +	10 ft or Less	11 ft to 20 ft	21 ft to 50 ft +
Unprotected	0	++	0.30	0.20	0.30	0.20	0.10	++	++	0.30
Single Class A Fire Door at One End of Passageway	0	0.20	0.10	0	0.20	0.15	0	0.30	0.20	0.10
Single Class B Fire Door at One End of Passageway	0	0.30	0	0.10	0.25	0.20	0.10	0.35	0.25	0.15
Single Class A Fire Door at Each End or Double Class A Fire Doors at One End of Passageway	0	0	0	0	0	0	0	0	0	0
Single Class B Fire Door at Each End or Double Class B Fire Doors at One End of Passageway	0	0	0	0	0	0	0	0	0	0

+ For over 50 feet, P<sub>i</sub> = 0

++ For unprotected passageways of this length, consider the 2 buildings as a single Fire Division.

NOTE: When a party wall has communicating openings protected by a single automatic or self-closing Class B fire door, it qualifies as a division wall for reduction of area.

NOTE: Where communications are protected by a recognized water curtain, the value of P<sub>i</sub> = 0

**2-460 Exposure Factor (X<sub>i</sub>)**

- The factor for X<sub>i</sub> depends upon the construction and length to height value (length of wall in feet, times height in stories) of the exposed building and the distance between facing walls of the subject building and the exposed building, and shall be selected from the following table.

**FACTOR FOR EXPOSURE (X<sub>i</sub>)**

			Construction of Facing Wall of Exposed Building Construction Coefficient F			
			Less than 1.5			
Construction of Facing Wall of Subject Building	Distance / Feet to the Exposed Building	Length / Height of Facing Wall of Exposed Building	1.5	Unprotected Openings	Semi-Protected Openings (Wired Glass or Outside Open Sprinklers)	Blank Wall
Frame, Metal or Masonry with Openings	0-10	1-100	0.22	0.21	0.16	0
		101-200	0.23	0.22	0.17	0
		201-300	0.24	0.23	0.18	0
		301-400	0.25	0.24	0.19	0
		Over 400	0.25	0.25	0.20	0
	11-30	1-100	0.17	0.15	0.11	0
		101-200	0.18	0.16	0.12	0
		201-300	0.19	0.18	0.14	0
		301-400	0.20	0.19	0.15	0
		Over 400	0.20	0.19	0.15	0
	31-60	1-100	0.12	0.10	0.07	0
		101-200	0.13	0.11	0.08	0
		201-300	0.14	0.13	0.10	0
		301-400	0.15	0.14	0.11	0
		Over 400	0.15	0.15	0.12	0
	61-100	1-100	0.08	0.06	0.04	0
		101-200	0.08	0.07	0.05	0
		201-300	0.09	0.08	0.06	0
		301-400	0.10	0.09	0.07	0
		Over 400	0.10	0.10	0.08	0

**Blank Masonry Wall**

Facing Wall of the Expose Building is Higher than Subject Building:

Use the above table EXCEPT use only the Length-Height of Facing Wall of the Exposed Building ABOVE the height of the Facing Wall of the Subject Building. Buildings five stories or over in height, consider as five stories.

When the Height of the Facing Wall of the exposed Building is the Same or Lower than the Height of the Facing Wall of the Subject Building, X<sub>i</sub> = 0.

## 2-470 TOWN OF LEESBURG DESIGN & CONSTRUCTION STANDARDS

### 2-470 Calculation of Needed Fire Flow (NFF<sub>i</sub>)

$$\text{NFF}_i = (C_i) (O_i) (X + P)_i$$

1. When a wood shingle roof covering on the building being considered, or on exposed buildings can contribute to spreading fires, add 500 gpm to the Needed Fire Flow.
2. The Needed Fire Flow shall not exceed 12,000 gpm nor be less than 750 gpm.
3. The Needed Fire Flow shall be rounded off to the nearest 250 gpm if less than 2,500 gpm and to the nearest 500 gpm if greater than 2,500.

(End of Section)