

COLORADO SPRINGS FIRE DEPARTMENT, DIVISION OF THE FIRE MARSHAL

# WATER SUPPLIES FOR FIRE PROTECTION

General requirements per the Locally Amended 2015 International Fire Code



Fire Construction Services  
4/12/2019



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## PURPOSE

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This guidance document has been developed in an effort to provide the highest level of service to the customers of the Colorado Springs Fire Department. The Colorado Springs Fire Department and the Colorado Springs Utilities work closely together reviewing water plans to ensure that minimum design criteria are met. The major goal of the water system plan reviews is to ensure adequate fire flow, location of hydrants, and the number of hydrants meets the minimum requirements of the adopted codes and ordinances of the City of Colorado Springs.

## SCOPE

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This guidance document outlines the requirements set forth in the adopted International Fire Code, local amendments, departmental policies, and appropriate NFPA standards as they relate to the installation of fire hydrants and fire lines for commercial and residential occupancies having access to city water supplies. Also included in this guidance document is information covering items required to be included on the working drawings and supporting documents. This guidance document is not intended to provide an all-inclusive listing of submittal and inspection requirements, as it would be virtually impossible to cover all situations.

## DEFINITIONS

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|                 |  |
|-----------------|--|
| AHJ             | Authority Having Jurisdiction  |
| CSFD            | Colorado Springs Fire Department   |
| CSU             | Colorado Springs Utilities   |
| DFM             | Division of the Fire Marshal   |
| FDC             | Fire Department Connection   |
| Fire Area       | The Gross Square footage of all floors   |
| Fire Flow       | The rate of water in gpm measured at 20 psi residual pressure  |
| Fire Line       | That portion of underground pipe from water main to a building dedicated to the fire sprinkler system. |
| Ft <sup>2</sup> | Square Feet  |
| GPM             | Gallons per Minute   |
| IBC             | International Building Code  |
| IFC             | International Fire Code  |
| NFPA            | National Fire Protection Association   |
| PIV             | Post Indicator Valve   |
| PSI             | Pounds per square foot   |

## GUIDELINES

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### I. INTRODUCTION

#### A. APPLICABLE CODES AND STANDARDS.

1. 2015 International Fire Code and its local Amendments
2. 2019 NFPA 24 Installation of Private Fire Service Mains and Their Appurtenances
3. Colorado Springs City Ordinances
4. CSFD Administrative Rulings and Interpretations
5. CSU Water Line Extension and Service Standards (LESS)

**B. ADMINISTRATIVE REQUIREMENTS.**

1. **Approved Contractors.** All fire lines must be installed by contractors who are registered with the State of Colorado as a "Fire Suppression System Contractor – Underground." Please contact the Colorado Division of Fire Prevention and Control at 303-239-4600 for additional information on obtaining this license.
2. **Code/Standard Editions.** All water system designs shall meet the criteria of the adopted IFC as amended and all applicable requirements of the most recent edition of NFPA 24. NFPA standards are effective on the January 1<sup>st</sup> of the year following the effective date printed in the standard. All water system designs shall also meet the requirements set forth in adopted ordinances, CSFD administrative rulings and CSU standards.
3. **Plan Reviews/Inspections.** Required plans submittal with approvals and associated inspections must be secured through CSFD. This is in addition to the review and inspections conducted by CSU.
4. **Revisions.** All revisions shall be clouded and identified with a sequential numbering or lettering system, such as Revision A, B, etc or Revision 1, 2, etc. Revisions are date sensitive, thus each revised sheet must bear the date of the revision.

**II. SUBMITTAL INFORMATION**

Submittals shall be of sufficient clarity and quality to indicate the location, nature and extent of the work proposed and show in detail that it will conform to the provisions of the IFC, and other relevant laws, ordinances, rules and regulations adopted by Colorado Springs, as determined by the Fire Construction Services and CSU. You may refer to the attachments section of this guidance document for a more complete checklist of items required to be provided on the submitted plans. Please refer to CSU standards for their requirements on submittal information. Fire Construction Services and CSU conduct concurrent reviews of water plans involving new or relocated fire hydrants and new fire line service.

**A. MINIMUM REQUIREMENTS.**

1. **Drawing Size.** Drawings shall be submitted on sheets no less than 24x36 inches and shall be drawn to an engineering scale no less than 1/50.
2. **Number of Drawing Sets.** One set of plans may be submitted for the initial review. The plans shall include the items found in the checklist provided at the end of this guidance document. Please roll the plans, as opposed to folding them, as this method is more appropriate for our plan bins and easier to transport within the office. Please note: when we are signing plans, one extra set must be provided for our records.
3. **CSFD Plan Review Application.** Fill out the plan review application form and attach to all submittals.
4. **Fire Flow Report.** We will provide you with the required fire flow and number of hydrants to be met at the time of the first review. This process will reduce the number of requests for flow reports to CSU and thus reduce the amount of time it takes to get one back. Additionally, CSU will not run a fire flow report until CSU Development Services has reviewed the plans. Be advised that we will still deny the plans for lack of a fire flow report.

5. Tax Schedule Number. Drawings shall be provided with the Tax Schedule Number found on the approved development plan or through the El Paso County Tax Assessor.
6. Signature Block. When all requirements have been met, the water plans will be signed off by this office. The following must be included on plans:

**CSFD ACCEPTANCE**

*All Fire Hydrants shall be installed according to Colorado Springs Utilities water line extension and service standards.*

*The number of fire hydrants and hydrant locations as shown as shown on this water plan are correct and adequate to satisfy the fire protection requirements as specified by the City of Colorado Springs Fire Department.*

Signed: \_\_\_\_\_

*CSFD Division of the Fire Marshal*

CSFD Plan Review Number: \_\_\_\_\_

7. Building Data. At the very minimum, you must supply the gross square footage and the construction type of the building. The gross square footage is the total floor area of all floors within the exterior walls, and under the horizontal projections of the roof of the building (IFC Appendix B104.1). Before we approve the plans for signature, you must provide all of the following information on the plans:
  - a. Building Name
  - b. Address, if known
  - c. Gross Square Footage
  - d. Construction Type
  - e. Fire Sprinkler:  Y  N (If Yes, SHOW 50% REDUCTION DATA)
  - f. Required Fire Flow
  - g. Minimum # of hydrants required
  - h. Maximum Average Spacing
  - i. Maximum Hose Lay

**B. PRELIMINARY REVIEW ON THE DEVELOPMENT PLAN.**

CSFD will look at hydrant placement and number of required hydrants during the development plan review stage, if specifically requested. You must provide, at a minimum, the type of construction and square footage for this review to take place. Keep in mind; this is only a preliminary review. Installation of hydrant, FDC or water lines may not begin until the water plans have been signed by both CSFD and CSU.

**III. GENERAL INFORMATION AND REQUIREMENTS.**

- A. FIRE FLOW.** Fire flow requirements may be ascertained by applying Appendices B and C of the adopted IFC (See Appendixes) to the building in question. At a minimum you must know the construction type of the building and the gross square footage of the building.

Fire flow reports older than 1 year will not be accepted. Reports must be obtained from Colorado Springs Utilities. Requests can be made on line at <https://www.csu.org/Pages/construction-drawing-review.aspx>.

1. Type of Construction. The type of construction that the architect has assigned to the structure must be indicated on the plans.
2. Gross Square Footage. The fire area to be considered in determining the fire flow for these buildings shall be the the total floor area of all floors within the exterior walls, and under the horizontal projections of the roof of the building (IFC Appendix B104.1). . For

type IA and IB construction, it is the three largest consecutive floors. NOTE: Fire walls cannot have protected or unprotected openings in them to reduce the required fire flow per IFC B104.2.

3. Fire Sprinklers. A 50% reduction in fire flow is allowed with the use of a fire sprinkler system, whether they are required or not. For example, if your building requires 5000 gpm by the table, and the building is sprinklered, the required fire flow may be reduced to 2500 gpm. Your required number of hydrants and spacing will be determined by the reduced fire flow. The minimum flow accepted is 1500 gpm. When reducing the fire flows, you will occasionally end up with an odd number such as 1825, in these cases you must round up to the nearest 250 gpm.
  4. Simultaneous Fire Flows. If you do not meet the required fire flow, CSFD accepts the practice of using hydrants that are open simultaneously to determine available fire flow.
  5. Alternatives. If the required fire flow still cannot be met by any reasonable means (changing construction type, increasing pipe sizes, looping mains) there are alternatives that may be considered.
    - a. Fire sprinkler systems, if not already provided, may allow for a 50% reduction in required fire flow.
    - b. Request a simultaneous fire flow report.
    - c. Reduce the size of the building.
    - d. Fire walls constructed in accordance with the adopted IBC creates separate buildings. Note fire walls cannot have any openings in them.
    - e. On Site Stored Water with an automatic pump supply providing the required fire flow and duration.
    - f. Actual flow test of existing hydrants.
  6. Reminders.
    - a. 1,500 gallons per minute (gpm) @ 20 pounds per square inch (psi) is the minimum flow and pressure permitted for both residential and commercial sites when hydrants are flowing individually.
    - b. 750 gpm @ 20 pounds per square inch (psi) is the minimum flow and pressure permitted per hydrant for both residential and commercial sites when hydrants are flowing simultaneously.
    - c. "On Site/Actual" fire flows dated less than one year is an acceptable alternative to a theoretical report from CSU, at the time of plan review. These actual fire flows must be provided with the flow at 20 psi.
- B. HYDRANTS.** The primary purpose of fire hydrants is to supply water to firefighting apparatus. The proper location, operation and system capability is essential to the successful execution of fire department operations during an emergency.

Providing appropriate water flow is the responsibility of the developer or property owner. These systems must meet CSFD and CSU standards and gain approvals prior to installation.

1. Existing Hydrants. Label all existing hydrants with the CSU number.
2. Private Hydrants. Private hydrants become the ultimate responsibility of the property owner with regards to maintenance and repair. They must be flow tested and painted prior to issuance of a Certificate of Occupancy. Should the property owner not be willing to undertake this responsibility, it is strongly recommended they seek a solution with CSU to allow the installation of public hydrants. Use of a private hydrant owned by another property owner requires the use of a *Private Hydrant Agreement*, copies of which are available from the Fire Construction Services office. This is a legal document and must

be registered through the El Paso County Clerk and Recorder's Office. CSFD does not need to be involved in this process.

3. Placement.

- a. Hydrants should be placed at intersections for increased flexibility. Where this is not possible, it may be placed along a curb or in a parking lot island. Access and turning radius must always be in consideration.
- b. Hydrants must face the direction of water flow i.e. the lateral line they are connected to. Keep this in mind when laying the water mains, as the steamer connection on the hydrant must face the street.
- c. In most cases, fire hydrants should be on the same side of the street that the building is located on. Having to lay hose across streets or driveways could inhibit access for additional fire apparatus.
- d. Avoid putting hydrants at the end of dead end streets.
- e. Hydrants shall be located so that the center of the large diameter outlet is not less than 18-inches above final grade, and not more than 36-inches above grade.
- f. Hydrants shall not be located behind obstructions such as parked cars, fences, retaining walls, trash enclosures, etc.
- g. Fire hydrants are to be a minimum of 40 feet from any building to insure they are kept out of the "Collapse Zone."
- h. A 3 foot clearance is required around all hydrants.

4. Spacing. Hydrants shall be located with the following considerations in mind:

- a. Meet the requirements of Appendix C of the adopted IFC (See Appendixes) for location and distribution.
- b. For sprinkled buildings, the FDC shall be located within 100 feet of a fire hydrant, and be located on the address side of the building. If this cannot be accomplished due to unusual site configurations or existing infrastructure, please call Fire Construction Services to discuss potential solutions.

5. Protection from Vehicular Damage. Posts or concrete barriers may be used to protect hydrants from vehicular damage. Please refer to our guidance document titled "Protection of Equipment from Vehicular Damage" for additional requirements.

**C. FIRE LINES.**

1. Fire lines shall be installed by an underground contractor registered with the State of Colorado as a "Fire Suppression Contractor – Underground."
2. The minimum size of a fire line for a commercial building is typically 4-inches. If a smaller size is desired, it must be hydraulically proven to provide the necessary water supply for the fire sprinkler system.
3. Fire lines must be flushed and hydrostatically tested prior to the connection of any aboveground piping. Be advised the chlorination flush performed by Colorado Springs Utilities does not satisfy the requirements of the CSFD for flushing the fire lines, as it is not at the velocity or volume required by NFPA. Keep in mind if a fire pump is to be installed; the required flushing velocity is 20 feet per second.
4. Fire lines shall NOT be run underneath buildings!

- D. FIRE DEPARTMENT CONNECTIONS (FDC).** Fire department connections provide a means for CSFD to supplement the water supply to a fire sprinkler system. By considering the location of the FDC at the water plan stage, all parties involved can prepare for this requirement.
1. FDC's shall be located with the following considerations in mind:
    - a. On the main entrance and/or the street addressed side of the building.
    - b. Cannot be obstructed by parking, landscaping, planters, columns, fences, retaining walls, etc.
    - c. A 3-foot radius of clearance shall be provided around the FDC to provide for our hose connections.
    - d. Within 100-feet of a hydrant.
    - e. Within 40-feet of a fire department access road.
    - f. Away from and on a separate wall from any utility meters.
  2. FDC's shall be mounted not less than 18-inches and not more than 4-foot above the level of the adjacent grade or access level.
  3. FDC's shall have a listed horn/strobe indicating device within 20 feet, to notify fire crews of system flow and assist them in the location of the FDC. Proper signage shall be posted at all FDC locations per NFPA standards.
  4. If a remote FDC is installed, there must be indications on the submitted water plans that an outside horn/strobe unit will be provided in a highly visible and acceptable locations, and it must be within 20 feet of the FDC. NOTE: Remote FDC piping is not inspected by Colorado Springs Utilities. This piping must be inspected by CSFD prior to burial.
- E. FIRE WALLS.** In buildings utilizing fire walls, it is important that they be listed slightly differently in the building data block, than normally utilized.

1. Please use this format, and list each structure as follows:

Business Name  
 Business Address  
 Tax ID Number  
 Total Gross Square Footage of Building  
 Ratings of Fire Walls Being Installed

|                      |                      |
|----------------------|----------------------|
| Building A           | Building B           |
| Type of Construction | Type of Construction |
| Square Footage       | Square Footage       |
| Fire Sprinklers      | Fire Sprinklers      |
| Required Fire flow   | Required Fire Flow   |
| Min # Hydrants       | Min # Hydrants       |
| Max Average Spacing  | Max Average Spacing  |
| Max Hose Lay         | Max Hose Lay         |

2. Fire walls shall be not less than 2-hour fire-resistance rated. These walls are not allowed to have openings (including protected openings) in order to be considered for reducing the fire flow requirements. Most buildings need to have openings in these fire walls for their operations, making this a less than desirable method to reduce building size.



- F. DEAD END SERVICE LINES. Unless approved by the fire code official, dead end fire service mains shall not be used when there is not a reliable secondary or redundant means of water supply within 500 feet of a structure along an approved route.

## LINKS

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- a. Colorado Division of Fire Prevention and Control Web site.  
<http://dfpc.state.co.us/>
- b. CSU Water & Wastewater specifications.  
<http://www.csu.org/>
- c. Administrative Rulings and IFC Amendments can be found on the CSFD web site at.  
<https://coloradosprings.gov/fire-department/page/fire-code-amendments-and-administrative-rulings?mlid=9796>

## APPENDIXES

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1. CSFD Submittal Checklist
2. Appendices B and C of the Adopted IFC
3. How to Figure Fire Flow Required and # of Hydrants Needed
4. Supplemental Information
5. Flow Chart for Water Plan Submittals.

## APPENDIX A - CSFD SUBMITTAL CHECKLIST

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### HYDRANTS & WATER MAINS

*The following must be included on all plans to ensure a complete submittal. Specific details for each item are found in this packet:*

- Attach completed CSFD Plan Review Application
- Attach Fire Flow Report from CSU with map
- Attach all red-lined plans for re-reviews when requested
- Development Plan must be approved before water plans can be signed
- Provide CSFD Plan Review # on cover sheet
- Provide CSFD Signature Block on cover sheet
- Provide El Paso County Tax ID Number
- Provide Building Data, if required (not required for utility service plan only)
- Provide City Water Map Page Numbers
- Show Fire Department Connection (FDC) location, if applicable
- Show Water Supply Feeds for the sprinklers, standpipes, domestic water systems, all valves, including post indicator valves
- Show tie-ins to all existing water lines
- Label new and existing hydrants with CSU number and fire flow, ensure numbers match flow report
- Label all hydrants and water mains as public or private
- Label all streets with name and/or proposed name
- For gates, fences and walls: show how CSFD will gain access on fire lanes and around building
- Provide Service Line Integrity Statement on cover sheet, if applicable

## APPENDIX B

IFC TABLE B105.1 MINIMUM REQUIRED FIRE-FLOW AND FLOW DURATION FOR BUILDINGS

| FIRE-FLOW CALCULATION AREA (square feet) |                                |                              |                                |                       | FIRE-FLOW<br>(gallons per minute) <sup>b</sup> | FLOW DURATION<br>(hours) |
|--|--------------------------------|------------------------------|--------------------------------|-----------------------|--|--------------------------|
| Type IA and IB <sup>a</sup>              | Type IIA and IIIA <sup>a</sup> | Type IV and V-A <sup>a</sup> | Type IIB and IIIB <sup>a</sup> | Type V-B <sup>a</sup> |  |                          |
| 0-22,700                                 | 0-12,700                       | 0-8,200                      | 0-5,900                        | 0-3,600               | 1,500  | 2                        |
| 22,701-30,200                            | 12,701-17,000                  | 8,201-10,900                 | 5,901-7,900                    | 3,601-4,800           | 1,750  |                          |
| 30,201-38,700                            | 17,001-21,800                  | 10,901-12,900                | 7,901-9,800                    | 4,801-6,200           | 2,000  |                          |
| 38,701-48,300                            | 21,801-24,200                  | 12,901-17,400                | 9,801-12,600                   | 6,201-7,700           | 2,250  |                          |
| 48,301-59,000                            | 24,201-33,200                  | 17,401-21,300                | 12,601-15,400                  | 7,701-9,400           | 2,500  |                          |
| 59,001-70,900                            | 33,201-39,700                  | 21,301-25,500                | 15,401-18,400                  | 9,401-11,300          | 2,750  |                          |
| 70,901-83,700                            | 39,701-47,100                  | 25,501-30,100                | 18,401-21,800                  | 11,301-13,400         | 3,000  | 3                        |
| 83,701-97,700                            | 47,101-54,900                  | 30,101-35,200                | 21,801-25,900                  | 13,401-15,600         | 3,250  |                          |
| 97,701-112,700                           | 54,901-63,400                  | 35,201-40,600                | 25,901-29,300                  | 15,601-18,000         | 3,500  |                          |
| 112,701-128,700                          | 63,401-72,400                  | 40,601-46,400                | 29,301-33,500                  | 18,001-20,600         | 3,750  | 4                        |
| 128,701-145,900                          | 72,401-82,100                  | 46,401-52,500                | 33,501-37,900                  | 20,601-23,300         | 4,000  |                          |
| 145,901-164,200                          | 82,101-92,400                  | 52,501-59,100                | 37,901-42,700                  | 23,301-26,300         | 4,250  |                          |
| 164,201-183,400                          | 92,401-103,100                 | 59,101-66,000                | 42,701-47,700                  | 26,301-29,300         | 4,500  |                          |
| 183,401-203,700                          | 103,101-114,600                | 66,001-73,300                | 47,701-53,000                  | 29,301-32,600         | 4,750  |                          |
| 203,701-225,200                          | 114,601-126,700                | 73,301-81,100                | 53,001-58,600                  | 32,601-36,000         | 5,000  |                          |
| 225,201-247,700                          | 126,701-139,400                | 81,101-89,200                | 58,601-65,400                  | 36,001-39,600         | 5,250  |                          |
| 247,701-271,200                          | 139,401-152,600                | 89,201-97,700                | 65,401-70,600                  | 39,601-43,400         | 5,500  |                          |
| 271,201-295,900                          | 152,601-166,500                | 97,701-106,500               | 70,601-77,000                  | 43,401-47,400         | 5,750  |                          |
| 295,901-Greater                          | 166,501-Greater                | 106,501-115,800              | 77,001-83,700                  | 47,401-51,500         | 6,000  |                          |
| -  | -                              | 115,801-125,500              | 83,701-90,600                  | 51,501-55,700         | 6,250  |                          |
| -  | -                              | 125,501-135,500              | 90,601-97,900                  | 55,701-60,200         | 6,500  |                          |
| -  | -                              | 135,501-145,800              | 97,901-106,800                 | 60,201-64,800         | 6,750  |                          |
| -  | -                              | 145,801-156,700              | 106,801-113,200                | 64,801-69,600         | 7,000  |                          |
| -  | -                              | 156,701-167,900              | 113,201-121,300                | 69,601-74,600         | 7,250  |                          |
| -  | -                              | 167,901-179,400              | 121,301-129,600                | 74,601-79,800         | 7,500  |                          |
| -  | -                              | 179,401-191,400              | 129,601-138,300                | 79,801-85,100         | 7,750  |                          |
| -  | -                              | 191,401-Greater              | 138,301-Greater                | 85,101-Greater        | 8,000  |                          |

For SI: 1 square foot = 0.0929 m<sup>2</sup>, 1 gallon per minute = 3.785 L/m, 1 pound per square inch = 6.895 kPa.

a. Types of construction are based on the *International Building Code*.

b. Measured at 20 psi residual pressure.

Exception: A reduction in required fire-flow of 50 percent, as *approved*, is allowed when the building is equipped with an *approved automatic sprinkler system*.

IFC TABLE C105.1 NUMBER AND DISTRIBUTION OF FIRE HYDRANTS

| Fire Flow Requirement | MINIMUM NUMBER OF HYDRANTS | AVERAGE SPACING BETWEEN HYDRANTS | MAXIMUM DISTANCE FROM ANY POINT ON STREET OR ROAD FRONTAGE TO HYDRANT (Engine Hose Lay) |
|-----------------------|----------------------------|----------------------------------|---|
| 1,750 or less         | 1                          | 500                              | 250   |
| 2,000-2,250           | 2                          | 450                              | 225   |
| 2,500 – 2,750         | 3                          | 450                              | 225   |
| 3,000 – 3,250         | 3                          | 400                              | 225   |
| 3,500 - 4,250         | 4                          | 350                              | 210   |
| 4,500 - 5,250         | 5                          | 300                              | 180   |
| 5,500 - 5,750         | 6                          | 300                              | 180   |
| 6,000 – 6,250         | 6                          | 250                              | 150   |
| 6,500 - 7,250         | 7                          | 250                              | 150   |
| 7,500 or more         | 8 or more                  | 200                              | 120   |

NOTE: TABLE REVISED FROM IFC TO INCLUDE INTERMEDIATE FIRE FLOWS.

## APPENDIX C- HOW TO FIGURE FIRE FLOW REQUIRED AND # OF HYDRANTS NEEDED

Example Problem: You have a Type V-B Construction Building, at 12, 000 square feet.

| Fire Flow Calculation Area<br>× 0.0929 for sq. meters |                               |                             |                               |                          | FIRE FLOW<br>GPM      | FLOW<br>DURATION<br>(hours) |
|---|-------------------------------|-----------------------------|-------------------------------|--------------------------|-----------------------|-----------------------------|
| Type I-A<br>I-B <sup>2</sup>                          | Type IIA<br>IIIA <sup>2</sup> | Type IV<br>V-A <sup>2</sup> | Type IIB<br>IIIB <sup>2</sup> | Type<br>V-B <sup>2</sup> | × 3.785 for<br>L/min. |                             |
| 22,700  | 12,700                        | 8,200                       | 5,900                         | 3,600                    | 1,500                 | 2                           |
| 30,200  | 17,000                        | 10,900                      | 7,900                         | 4,800                    | 1,750                 |                             |
| 38,700  | 21,800                        | 12,900                      | 9,800                         | 6,200                    | 2,000                 |                             |
| 48,300  | 24,200                        | 17,400                      | 12,600                        | 7,700                    | 2,250                 |                             |
| 59,000  | 33,200                        | 21,300                      | 15,400                        | 9,400                    | 2,500                 |                             |
| 70,900  | 39,700                        | 25,500                      | 18,400                        | 11,300                   | 2,750                 |                             |
| 83,700  | 47,100                        | 30,100                      | 21,800                        | <b>13,400</b>            | <b>3,000</b>          | <b>3</b>                    |
| 97,700  | 54,900                        | 35,200                      | 25,900                        | 15,600                   | 3,250                 |                             |
| 112,700   | 63,400                        | 40,600                      | 29,300                        | 18,000                   | 3,500                 |                             |
| 128,700   | 72,400                        | 46,400                      | 33,500                        | 20,600                   | 3,750                 |                             |
| 145,900   | 82,100                        | 52,500                      | 37,900                        | 23,300                   | 4,000                 | 4                           |
| 164,200   | 92,400                        | 59,100                      | 42,700                        | 26,300                   | 4,250                 |                             |
| 183,400   | 103,100                       | 66,000                      | 47,700                        | 29,300                   | 4,500                 |                             |
| 203,700   | 114,600                       | 73,300                      | 53,000                        | 32,600                   | 4,750                 |                             |
| 225,200   | 126,700                       | 81,100                      | 58,600                        | 36,000                   | 5,000                 |                             |
| 247,700   | 139,400                       | 89,200                      | 65,400                        | 39,600                   | 5,250                 |                             |
| 271,200   | 152,600                       | 97,700                      | 70,600                        | 43,400                   | 5,500                 |                             |
| 295,900   | 166,500                       | 106,500                     | 77,000                        | 47,400                   | 5,750                 |                             |
| Greater   | Greater                       | 115,800                     | 83,700                        | 51,500                   | 6,000                 |                             |
|   |                               | 125,500                     | 90,600                        | 55,700                   | 6,250                 |                             |
|   |                               | 135,500                     | 97,900                        | 60,200                   | 6,500                 |                             |
|   |                               | 145,800                     | 106,800                       | 64,800                   | 6,750                 |                             |
|   |                               | 156,700                     | 113,200                       | 69,600                   | 7,000                 |                             |
|   |                               | 167,900                     | 121,300                       | 74,600                   | 7,250                 |                             |
|   |                               | 179,400                     | 129,600                       | 79,800                   | 7,500                 |                             |
|   |                               | 191,400                     | 138,300                       | 85,100                   | 7,750                 |                             |
|   |                               | Greater                     | Greater                       | Greater                  | 8,000                 |                             |

- Notes: 1. The areas listed in this table represent the maximum allowable areas for the listed flow rates.  
2. Types of construction are based on the International Building Code

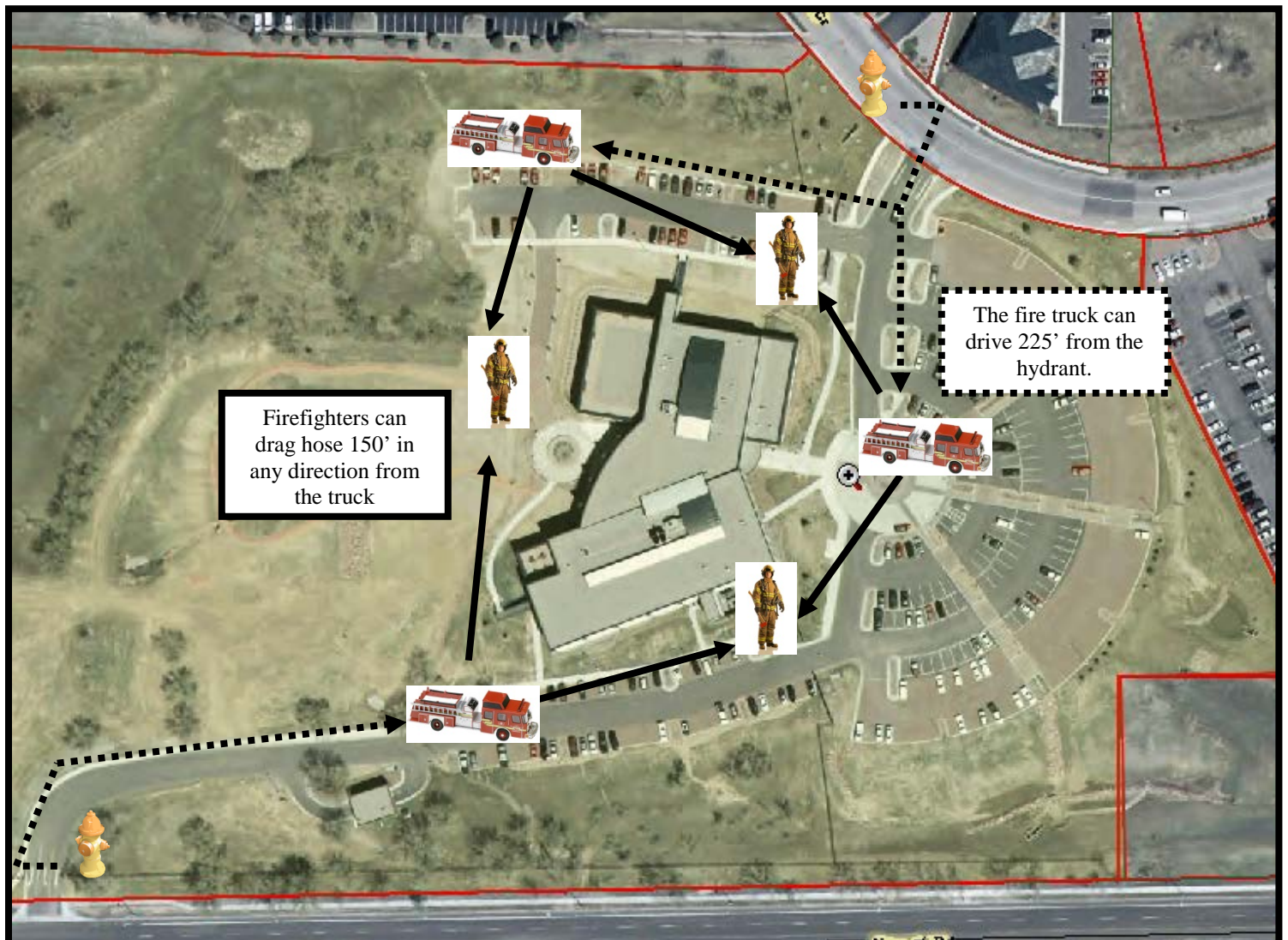
Table 2: Fire Hydrant Number & Distribution Requirements

| FIRE FLOW<br>REQUIREMENT<br>(gpm) | MINIMUM<br>Number of<br>HYDRANTS | Average Spacing<br>between Hydrants<br>(feet) | Maximum Distance from any point on Street<br>or Road Frontage to Hydrant (Engine Hose<br>Lay) |
|-----------------------------------|----------------------------------|---|---|
| × 3.785 for L/min                 |                                  | × 0.3048 for meters                           |   |
| 1,750 or less                     | 1                                | 500   | 250   |
| 2,000 - 2,250                     | 2                                | 450   | 225   |
| 2,500 - 2,750                     | 3                                | 450   | 225   |
| <b>3,000 - 3,250</b>              | <b>3</b>                         | <b>400</b>                                    | <b>225</b>  |
| 3,500 - 4,250                     | 4                                | 350   | 210   |
| 4,500 - 5,250                     | 5                                | 300   | 180   |
| 5,500 - 5,750                     | 6                                | 300   | 180   |
| 6,000 - 6,250                     | 6                                | 250   | 150   |
| 6,500 - 7,250                     | 7                                | 250   | 150   |
| 7,500 - 8,000                     | 8                                | 200   | 120   |

Example Problem (Con't): Type V-B Construction Building, at 12,000 square feet.

1. Select the column for the Building Type (V-B)
2. Move down that column to your building square footage The Table represents the maximum square footage at a given flow. In this case 12,000 sqft exceeds 11,300 and therefore you must move up to the 13,400 sqft line.
3. Follow that row to see what fire flow is required (3,000 GPM)
4. Find your required fire flow in Table 2. \* If you have a required fire flow of 1,850 gpm, you need to round up to 2,000 gpm.
5. Follow that row for your hydrant requirements (3 hydrants required, spaced 400 ft apart, with a maximum hose lay of 225 ft)
6. What does this tell you? Your building needs to be accessible on all sides for firefighters. From the numbers you found in the chart, the following picture will explain how you can meet the access requirement.

The 400-foot spacing is the maximum average spacing allowed between hydrants along a driveable surface. The 225-foot hose lay is the maximum distance the engine can drive from the hydrant, while laying hose down. From this point, you can measure 150-feet as a person would walk around the building.



## APPENDIX D - SUPPLEMENTAL INFORMATION

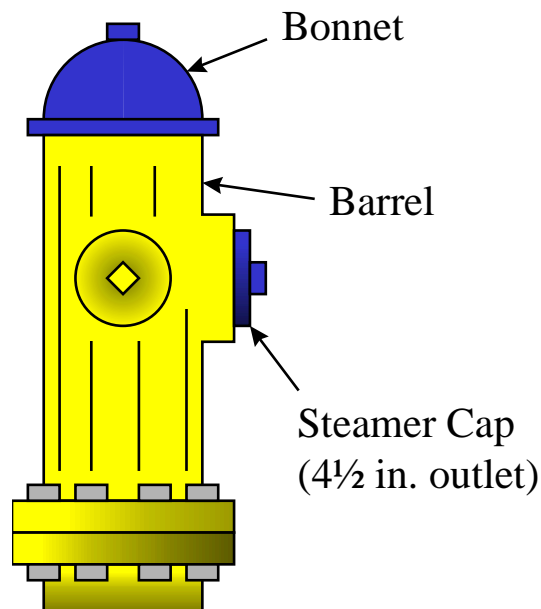
*This information is provided to explain, in further detail, the requirements of CSFD.*

### A. Hydrants.

1. Colors and Painting. Hydrant colors are based upon the available flow measured at 20 psi residual pressure under maximum day demand conditions. All hydrants, public or private, shall be painted in accordance with the table below. Also included for your convenience, are the manufacturers and specifications for the paint used on public hydrants. This is not to imply only these manufacturer's products are acceptable. Any manufacturer's products that are equivalent in color and quality are acceptable.

| Fire Flows (gpm) | Color  | Painted on:          |
|------------------|--------|----------------------|
| 0 - 499          | Red    | Bonnet               |
| 500 - 999        | Orange | Bonnet               |
| 1,000 - 1,499    | Green  | Bonnet               |
| 1,500 - 3,000    | Blue   | Bonnet               |
| Above 3,000      | Blue   | Bonnet & Steamer Cap |
| -                | Yellow | Barrel               |

| Color  | Manufacturer | Specification             |
|--------|--------------|---------------------------|
| Red    | Rustoleum    | Safety Red #2163          |
| Orange | Aerovoe      | Orange #305               |
| Green  | Rustoleum    | John Deere Green #7424830 |
| Blue   | Aerovoe      | Ford Blue #560            |
| Yellow | Rustoleum    | Equipment Yellow #2148    |



2. FIRE LINES.

Fire lines must be flushed and hydrostatically tested prior to the connection of any aboveground piping. Be advised the chlorination flush performed by Colorado Springs Utilities does not satisfy the requirements of CSFD for flushing the fire lines, as it is not meet the velocity required per NFPA. The table below is taken from NFPA 24 *Installation of Private Fire Service Mains and Their Appurtenances* to assist you in selecting the proper equipment to flush a fire line. Fire lines supplying fire pumps are required to be flushed at a higher velocity. Consult NFPA 20, Chapter 14 for these required flow rates.

Fire Lines shall also be hydrostatically tested at a minimum of 200 psi or 50 psi over the static pressure for a minimum of 2 hours.

| <i>Underground<br/>Pipe Size (in)</i> | <i>Required<br/>Flow Rate (gpm)</i> | <i>Hose/Pipe Sizes</i> |    |    |    |    |    |
|---------------------------------------|-------------------------------------|------------------------|----|----|----|----|----|
|                                       |                                     | 2½"                    | 3" | 4" | 5" | 6" | 8" |
| 4                                     | 390                                 | 1                      | 1  | 1  | -  | -  | -  |
| 6                                     | 880                                 | 2                      | 2  | 1  | 1  | 1  | -  |
| 8                                     | 1560                                | 4                      | 3  | 2  | 1  | 1  | 1  |
| 10                                    | 2440                                | 6                      | 4  | 3  | 2  | 1  | 1  |
| 12                                    | 3520                                | 8                      | 6  | 4  | 2  | 2  | 1  |



# APPENDIX E-FLOW CHART FOR WATER PLAN SUBMITTALS

Procedural Flow Chart for Water Plan Submitted to Fire Construction Services

