

**R309-510. Facility Design and Operation: Minimum Sizing Requirements.**

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## **R309-510. Facility Design and Operation: Minimum Sizing Requirements.**

### ***R309-510-1. Purpose.***

This rule specifies the minimum requirements for the sizing of public drinking water facilities such as sources (and their associated treatment facilities), storage tanks, and pipelines. It is intended to be applied in conjunction with R309-500 through R309-550. Collectively, these rules govern the design, construction, operation and maintenance of public drinking water system facilities. These rules are intended to assure that such facilities are reliably capable of supplying adequate quantities of water which consistently meet applicable drinking water quality requirements and do not pose a threat to general public health.

***Guidance: The intent of this rule is to regulate the design and construction of public drinking water systems and facilities. Neither the Drinking Water Board nor the Director of the Division of Drinking Water has the jurisdiction to regulate impact fees, water rates, or water rights.***

### ***R309-510-2. Authority.***

This rule is promulgated by the Drinking Water Board as authorized by Title 19, Environmental Quality Code, Chapter 4, Safe Drinking Water Act, Subsection 104(1)(a)(ii) of the Utah Code and in accordance with Title 63G, Chapter 3 of the same, known as the Administrative Rulemaking Act.

### ***R309-510-3. Definitions.***

Definitions for certain terms used in this rule are given in R309-110 but may be further clarified herein.

### ***R309-510-4. General.***

(1) This rule provides minimum quantities and flow rates that shall be used in the design of new systems and in the evaluation of water source, storage facility, and pipeline capacities, unless a public water system has obtained a capacity reduction per R309-510-5. Water demand may vary significantly depending on water system size, type, land use, urbanization, location, precipitation, etc. Therefore, public water systems may submit system-specific water use data to justify alternative sizing requirements in accordance with R309-510-5.

(2) When designing a public water system, the sizing requirements for indoor water use, irrigation, and fire suppression (as required by the local fire code official) shall be included as appropriate.

(3) Local authorities may impose more stringent design requirements on public water systems than the minimum sizing requirements of this rule.

(4) Public water systems shall consider daily, weekly, monthly, seasonal, and yearly variations of source capacity and system demand and shall verify that the capacities of drinking water facilities are sufficiently sized.

(5) The Director may modify the sizing requirements based on the unique nature and use of a water system.

***Guidance: The intent of this rule is to minimize the possibility that a Public Water System will run out of water. If a water system runs out of water, it creates risks to public health and safety, including contaminated water entering under-pressurized water lines and the loss of water for fire protection.***

### **R309-510-5. Reduction of Sizing Requirements.**

(1) Water systems that want to use system-specific design criteria that are below the state's minimum sizing requirements may submit a request for a reduction to the Director. Each request shall include supporting information justifying the reduction in source, storage, or pipeline sizing.

***Guidance: The Division has jurisdiction over Public Drinking Water Systems. Any reduction request must be initiated by a Public Drinking Water System.***

(2) Depending on the reduction being sought, the supporting information may include actual water use data representing peak day demand, average day demand for indoor and irrigation uses, fire flow requirements established by the local fire code official, etc. Each reduction request and supporting information will be reviewed on a case-by-case basis because of the wide variety of factors to be considered, such as water system configuration and size, built-in redundancy, water user type, safety factors, method and quality of data collected, water losses, reliability of the source, etc.

(3) Prior to collecting or compiling water use data for a reduction request, a public water system shall consult with the Division of Drinking Water to identify the information needed for a reduction request and to establish a data collection protocol.

(4) The data submitted for a source reduction request shall be sufficient to account for daily, seasonal, and yearly variations in source and demand.

(5) If data justifying a reduction are accepted by the Director, the sizing requirements may be reduced. The requirements shall not be less than the 90<sup>th</sup> percentile of acceptable readings.

(6) If a reduction is granted on the basis of limited water use, enforceable water use restrictions must be in place, shall be consistently enforced by the water system or local

authority, and shall be accepted by the Director.

(7) The Director may re-evaluate any reduction if the nature or use of the water system changes.

***Guidance: The Division of Drinking Water has developed two documents to aid public water systems in understanding the information needed to request a reduction in the source or storage requirement.***

- ***“Information Needed for Reduction in Source Sizing”***
- ***“Information Needed for Reduction in Storage Sizing”***

***These documents are available on the Division of Drinking Water’s website.***

### **R309-510-6. Water Conservation.**

Drinking water systems shall use the water resources of the state efficiently. The minimum sizing requirements of this rule are based on typical water consumption patterns in the State of Utah. Where legally-enforceable water conservation measures exist, the sizing requirements in this rule may be reduced on a case-by-case basis by the Director.

### **R309-510-7. Source Sizing.**

#### **(1) Peak Day Demand and Average Yearly Demand.**

Sources shall legally and physically meet water demands under two conditions:

- (a) The water system’s source capacity shall be able to meet the anticipated water demand on the day of highest water consumption, which is the peak day demand.
- (b) The water system’s source capacity shall also be able to provide one year's supply of water, which is the average yearly demand.

***Guidance: Water systems should investigate the availability and validity of water rights for their systems. Consult the Division of Water Rights concerning the legal right to use water.***

#### **(2) Indoor Water Use.**

Tables 510-1 and 510-2 shall be used as the minimum sizing requirements for peak day demand and average yearly demand for indoor water use unless a public water system has obtained a reduction per R309-510-5.

Table 510-1 Source Demand for Indoor Use		
Type of Connection	Peak Day Demand	Average Yearly Demand
Year-Round Use		
Residential	800 gpd/conn	146,000 gal./conn
Equivalent Residential Connection (ERC)	800 gpd/ERC	146,000 gal./ERC
Seasonal / Non-Residential Use		
Modern Recreation Camp	60 gpd/person	(See Note 1)
Semi-Developed Camp		
a. With pit privies	5 gpd/person	(See Note 1)
b. With flush toilets	20 gpd/person	(See Note 1)
Hotels, Motel & Resort	150 gpd/unit	(See Note 1)
Labor Camp	50 gpd/person	(See Note 1)
Recreational Vehicle Park	100 gpd/pad	(See Note 1)
Roadway Rest Stop	7 gpd/vehicle	(See Note 1)
Recreational Home Development (i.e., developments with limited water use) [See Note 2]	400 gpd/conn	(See Note 1)

**NOTES FOR TABLE 510-1:**

Note 1. Average yearly demand shall be calculated by multiplying the number of days in the designated water system operating period by the peak day demand unless a reduction has been granted in accordance with R309-510-5.

Note 2. To be considered a Recreational Home Development (i.e., developments with limited water use) as listed in Table 510-1, dwellings shall not have more than 8 plumbing fixture units, in accordance with the state-adopted plumbing code, and shall not be larger than 1,000 square feet. For a new not-yet-constructed development to be considered as a development with limited water use, it must have enforceable restrictions in place that are enforced by the water system or local authority and are accepted by the Director.

**Guidance:** *The Division of Drinking Water is in the process of proposing a study to gather water use data from public water systems representing various sizes, types, and locations throughout the state. The residential source demand requirements in Table 510-1 will be re-evaluated based on the water use study data.*

TABLE 510-2 Source Demand for Indoor Use - Individual Establishments (Note 1)	
Type of Establishment	Peak Day Demand (gpd) (Notes 2 & 3)
Airports	3

a. per passenger b. per employee	15
Boarding Houses a. for each resident boarder and employee b. for each nonresident boarders	50 10
Bowling Alleys, per alley a. with snack bar b. with no snack bar	100 85
Churches, per person	5
Country Clubs a. per resident member b. per nonresident member c. per employee	100 25 15
Dentist's Office a. per chair b. per staff member	200 35
Doctor's Office a. per patient b. per staff member	10 35
Fairgrounds, per person	1
Fire Stations, per person a. with full time employees and food prep b. with no full time employees and no food prep	70 5
Gyms a. per participant b. per spectator	25 4
Hairdresser a. per chair b. per operator	50 35
Hospitals, per bed space	250
Industrial Buildings, per 8 hour shift, per employee (exclusive of industrial waste) a. with showers b. with no showers	35 15
Launderette, per washer	580
Movie Theaters a. auditorium, per seat b. drive-in, per car space	5 10
Nursing Homes, per bed space	280
Office Buildings & Business Establishments, per shift, per employee (sanitary wastes only) a. with cafeteria b. with no cafeteria	25 15
Picnic Parks, per person (toilet wastes only)	5
Restaurants	

a. ordinary restaurants (not 24 hour service)	35 per seat
b. 24 hour service	50 per seat
c. single service customer utensils only	2 per customer
d. or, per customer served (includes toilet and kitchen wastes)	10
Rooming House, per person	40
Schools, per person	
a. boarding	75
b. day, without cafeteria, gym or showers	15
c. day, with cafeteria, but no gym or showers	20
d. day, with cafeteria, gym and showers	25
Service Stations	
a. per vehicle served, or	10
b. per gas pump	250
Skating Rink, Dance Halls, etc., per person	
a. no kitchen wastes	10
b. additional for kitchen wastes	3
Ski Areas, per person (no kitchen waste)	10
Stores	
a. per public toilet room	500
b. per employee	11
Swimming Pools and Bathhouses, per person (Note 4)	10
Taverns, Bars, Cocktail Lounges, per seat	20
Visitors Centers, per visitor	5

**NOTES FOR TABLE 510-2:**

Note 1. When more than one use will occur, the multiple uses shall be considered in determining total demand. Small industrial plants maintaining a cafeteria or showers and club houses or motels maintaining swimming pools or laundries are typical examples of multiple uses. Uses other than those listed above shall be considered in relation to established demands from known or similar installations.

Note 2. Source capacity must at least equal the peak day demand of the system. Determine this by assuming the facility is used to its maximum, e.g., the physical capacity of the facility.

Note 3. To determine the average day demand for establishments listed in Table 510-2, divide the peak day demand by 2, unless alternative data are accepted by the Director.

***Guidance: Table 510-1 assumes a peaking factor of 2 between the peak day demand and the average day demand for residential connections. The same default peaking factor of 2 may be used to estimate the average day demand from the numbers in Table 510-2. Water systems may impose more stringent requirements.***

Note 4. Or Peak Day Demand = 20 x [Water Area (ft<sup>2</sup>)/30] + Deck Area (ft<sup>2</sup>)

### (3) Irrigation Use.

If a water system provides water for irrigation, Table 510-3 shall be used to determine the peak day demand and average yearly demand for irrigation water use. The following procedure shall be used:

- (a) Determine the location of the water system on the map entitled *Irrigated Crop Consumptive Use Zones and Normal Annual Effective Precipitation, Utah* as prepared by the Soil Conservation Service (available from the Division). Find the numbered zone, one through six, in which the water system is located (if located in an area described "non-arable" find nearest numbered zone).

***Guidance: The irrigation zone map is provided below. This map is available on the Division of Drinking Water's website.***

- (b) Determine the net number of acres which may be irrigated.

***Guidance: To determine the net number of acres to be irrigated, start with the gross acreage, then subtract any area of roadway, driveway, sidewalk, or patio pavement along with housing foundation footprints that can be reasonably expected for lots within a new subdivision or which is representative of existing lots. Before any other land area which may be considered "non-irrigated" (e.g., steep slopes, wooded acres, etc.) is subtracted from the gross area, the Director should be consulted and agree that the land in question will not be irrigated. For instance, in the case of a heavily wooded mountain home subdivision, it may be claimed that large lawns will not be put in by the lot owners. The division should review and concur with this judgment.***

- (c) Refer to Table 510-3, which assumes direct application of water to vegetation, to determine peak day demand and average yearly demand for irrigation use.

- (d) Consider water losses due to factors such as evaporation, irrigation delivery method, overwatering, pipe leaks, etc. Apply a safety factor to the irrigation demand in the design accordingly.

Table 510-3 Source Demand for Irrigation		
Map Zone	Peak Day Demand (gpm/irrigated acre)	Average Yearly Demand (AF/ irrigated acre) (Note 1)



1	2.26	1.17
2	2.80	1.23
3	3.39	1.66
4	3.96	1.87
5	4.52	2.69
6	4.90	3.26

**NOTE FOR TABLE 510-3:**

Note 1. The average yearly demand for irrigation water use (in acre-feet per irrigated acre) is based on 213 days of irrigation, e.g., April 1 to October 31.

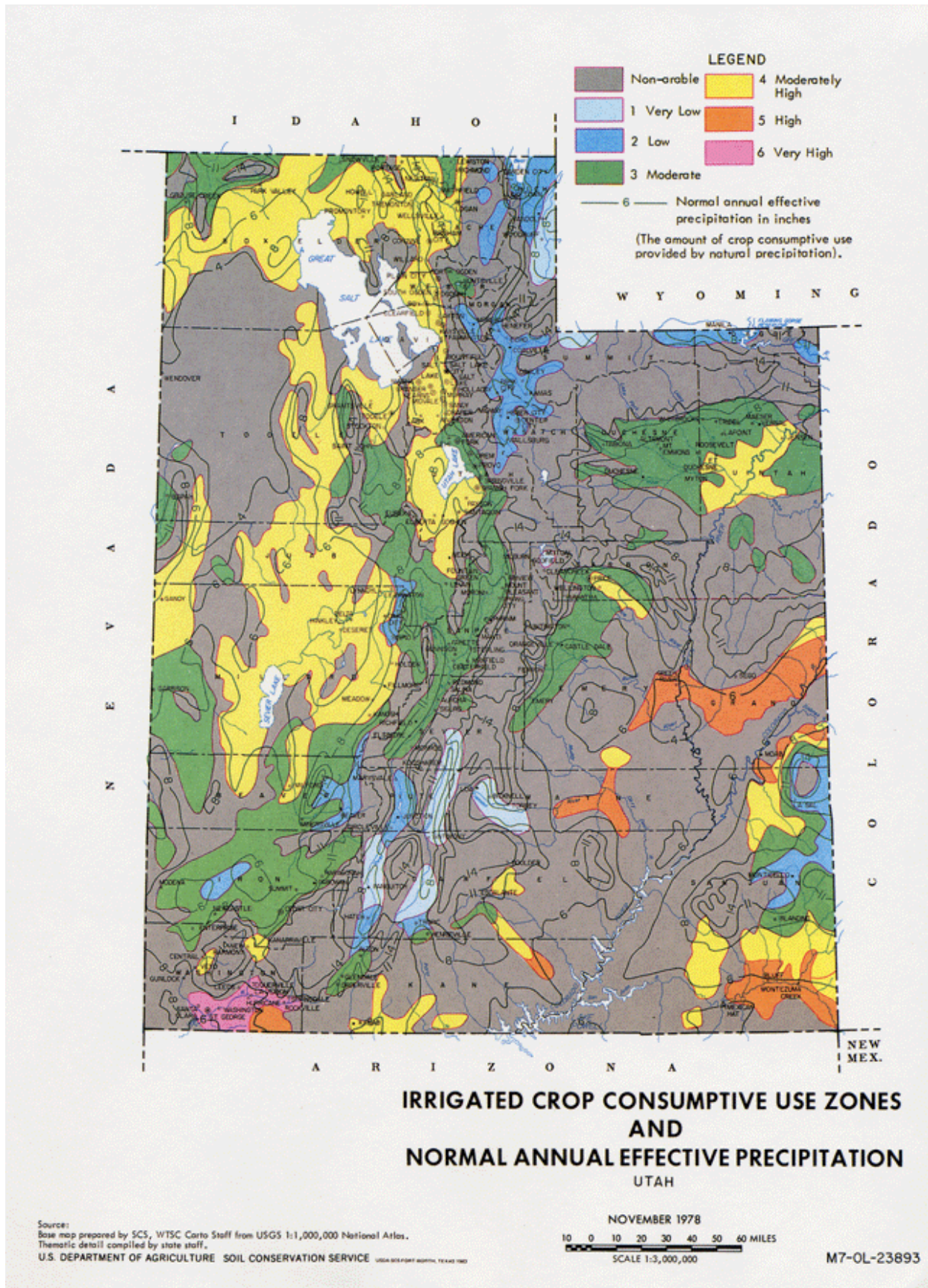
*Guidance: If the irrigation season differs from the assumed 213 days, the average yearly demand numbers may need to adjusted.*

**(4) Variations in Source Yield.**

(a) Water systems shall consider that flow from sources may vary seasonally and yearly. Where flow varies, the number of service connections supported by a source shall be based on the minimum seasonal flow rate compared to the corresponding seasonal demand.

(b) Where source capacity is limited by the capacity of treatment facilities, the maximum number of service connections shall be determined using the treatment plant design capacity instead of the source capacity.

*Guidance: Some water sources, such as deep wells, yield consistent quantities of water while others, such as springs, yield inconsistent quantities that vary seasonally and annually. Sources that yield inconsistent quantities of water should be studied and understood prior to the commitment of those sources for future uses, such as providing will-serve letters or approving proposed developments.*



**R309-510-8. Storage Sizing.**

**(1) General.**

Each public water system, or storage facility serving connections within a specific area, shall provide:

- (a) equalization storage volume, to satisfy average day demands for water for indoor use and irrigation use,
- (b) fire flow storage volume, if the water system is equipped with fire hydrants intended to provide fire suppression water or as required by the local fire code official, and
- (c) emergency storage, if deemed appropriate by the water supplier or the Director.

**(2) Equalization Storage.**

- (a) All public drinking water systems shall provide equalization storage. The amount of equalization storage varies with the nature of the water system, the extent of irrigation use, and the location and configuration of the water system.
- (b) Table 510-4 lists required equalization storage for indoor use. Storage requirements for non-community systems not listed in this table shall be determined by calculating the average day demands from the information given in Table 510-2.

***Guidance: Water systems capable of meeting the intent of the equalization storage requirements, for example, by redundancy configuration or operation strategy, may request a reduction in storage sizing requirements per R309-510-5.***

Table 510-4 Storage Volume for Indoor Use	
Type	Volume Required (gallons)
<b>Community Systems</b>	
Residential; per single resident service connection	400
Non-Residential; per Equivalent Residential Connection (ERC)	400
<b>Non-Community Systems</b>	
Modern Recreation Camp; per person	30
Semi-Developed Camp; per person	
a. with Pit Privies	2.5
b. with Flush Toilets	10
Hotel, Motel, & Resorts; per unit	75

Labor Camp; per unit	25
Recreational Vehicle Park; per pad	50
Roadway Rest Stop; per vehicle	3.5
Recreational Home Development (i.e., developments with limited water use); per connection (See Note 2 in Table 510-1)	400

(c) Where a drinking water system provides water for irrigation use, Table 510-5 shall be used to determine the minimum equalization storage volumes for irrigation. The procedure for determining the map zone and irrigated acreage for using Table 510-5 is outlined in R309-510-7(3).

Table 510-5 Storage Volume for Irrigation Use	
Map Zone	Volume Required (gallons/irrigated acre)
1	1,782
2	1,873
3	2,528
4	2,848
5	4,081
6	4,964

### (3) Fire Flow Storage.

(a) Fire flow storage shall be provided if fire flow is required by the local fire code official or if fire hydrants intended for fire flow are installed.

(b) Water systems shall consult with the local fire code official regarding needed fire flows in the area under consideration. The fire flow information shall be provided to the Division during the plan review process.

(c) When direction from the local fire code official is not available, the water system shall use Appendix B of the International Fire Code, 2015 edition, for guidance. Unless otherwise approved by the local fire code official, the fire flow and fire flow duration shall not be less than 1,000 gallons per minute for 60 minutes.

***Guidance: Utah has adopted a state-wide fire code. However, local fire code officials are authorized to determine fire flow requirements in their jurisdictions.***

### (4) Emergency Storage.

Emergency storage shall be considered during the design process. The amount of emergency storage shall be based upon an assessment of risk and the desired degree of system

dependability. The Director may require emergency storage when it is warranted to protect public health and welfare.

**Guidance:** *It is advisable to provide water storage for emergency situations, such as pipeline failures, major trunk main failures, equipment failures, electrical power outages, water treatment facility failures, raw-water supply contamination, or natural disasters. Generally, the need for emergency storage shall be determined by the water supplier and design engineer.*

## **R309-510-9. Distribution System Sizing.**

### **(1) General Requirements.**

The distribution system shall be designed to ensure adequate flow and that minimum water pressures as required in R309-105-9 exist at all points within the distribution system.

### **(2) Peak Instantaneous Demand for Indoor Water Use.**

(a) Large or complex water systems may determine peak instantaneous demand using hydraulic modeling. The hydraulic model must either apply an instantaneous peaking factor to account for peak instantaneous demand or use actual peak instantaneous water flow data.

(b) Alternatively, the peak instantaneous demand for a single pipeline shall be calculated for indoor use using the following equation:

$$Q = 10.8 \times N^{0.64}$$

where N equals the total number of ERC's, and Q equals the total flow (gpm) delivered to the total connections served by that pipeline.

**Guidance:** *The equation above should only be used to estimate the flow required for N connections from a single pipeline and should not be used to estimate node or junction demands utilized in hydraulic analyses.*

(c) For Recreational Vehicle Parks, the peak instantaneous flow for indoor use shall be based on the following:

Table 510-6 Peak Instantaneous Demand for Indoor Water Use for Recreational Vehicle Parks	
Number of Connections	Formula
0 to 59	$Q=4N$

60 to 239	$Q = 80 + 20N^{0.5}$
240 or greater	$Q = 1.6N$

**NOTES FOR TABLE 510-6:**

Q is total peak instantaneous demand (gpm). N is the maximum number of connections. However, if the only water use is via service buildings, the peak instantaneous demand shall be calculated for the number of plumbing fixture units as presented in the state-adopted plumbing code.

(d) For small non-community water systems, the peak instantaneous demand for indoor water use shall be calculated on a per-building basis for the number of plumbing fixture units as presented in the state-adopted plumbing code.

**(3) Peak Instantaneous Demand for Irrigation Use.**

Peak instantaneous demand for irrigation use is given in Table 510-7. The procedure for determining the map zone and irrigated acreage for using Table 510-7 is outlined in R309-510-7(3).

Table 510-7 Peak Instantaneous Demand for Irrigation Use	
Map Zone	Peak Instantaneous Demand (gpm/irrigated acre)
1	4.52
2	5.60
3	6.78
4	7.92
5	9.04
6	9.80

**(4) Fire Flow.**

(a) Distribution systems shall be designed to deliver needed fire flow if fire flow is required by the local fire code official or if fire hydrants intended for fire flow are provided. The distribution system shall be sized to provide minimum pressures as required by R309-105-9 to all points in the distribution system when needed fire flows are imposed during peak day demand in the distribution system.

(b) The water system shall consult with the local fire code official regarding needed fire flow in the area under consideration. The fire flow information shall be provided to the Division during the plan review process.

(c) If direction from the local fire code official is not available, the water system shall use Appendix B of the International Fire Code, 2015 edition, for guidance. Unless otherwise approved by the local fire code official, the fire flow and fire flow duration shall not be less than 1,000 gallons per minute for 60 minutes.

**KEY: drinking water, minimum sizing, water conservation**

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