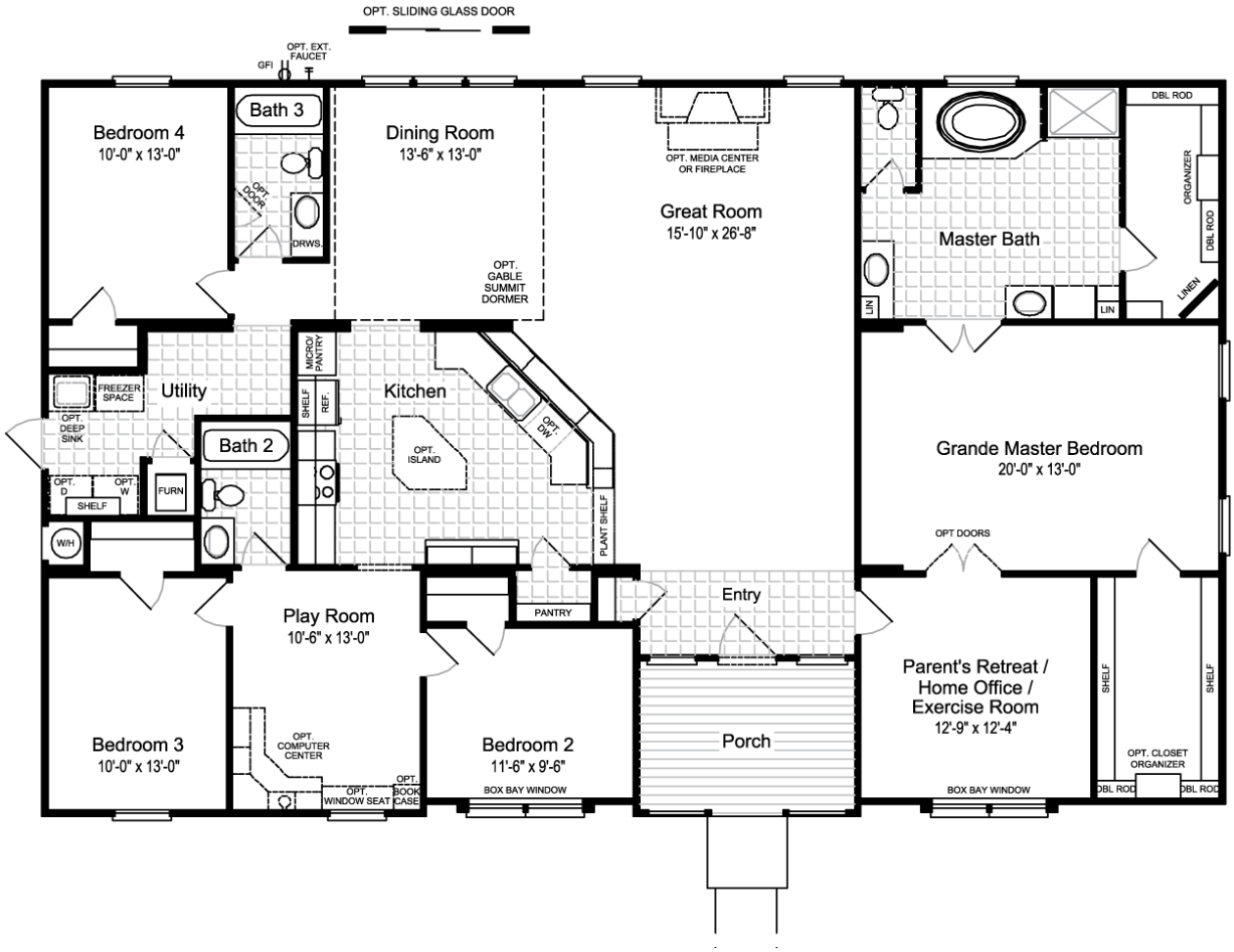
CMGT 235 Electrical and Mechanical Systems
Exam #2 – Plumbing Systems - 20 points each question

Use 2016 California Plumbing Code. Show all work for full credit

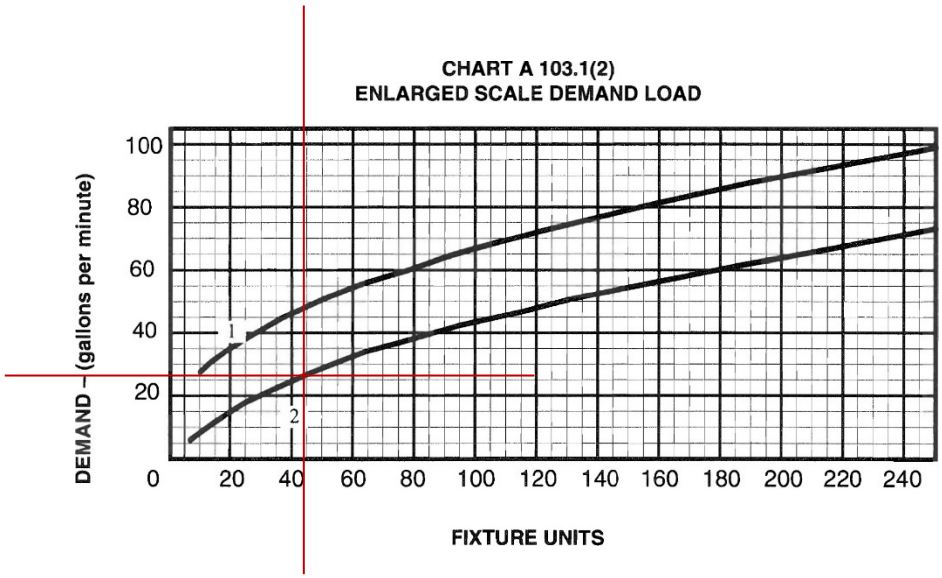
Name: **Answers**

1. Determine the Meter and Street Service size and the Building Supply and Branches Pipe size for the Dwelling shown. MDSSPA = 80 psi. The highest water outlet in the building is 9 feet above the source of supply. Pressure loss due to the meter is 5 psi. The maximum developed length of the piping between the source of supply and the furthest fixture is 92 feet. Each side of the house has a ½" hose bibb.



Step 1. Calculate the total WSFU

QTY	Fixture	WSFU	Total WSFU
2	BT/SWH	4.0	8.0
3	WC	2.5	7.5
4	LAV	1.0	4.0
1	BT	4.0	4.0
1	SHW	2.0	2.0
1	LT	1.5	1.5
1	CW	4.0	4.0
1	KS	1.5	1.5
1	DW	1.5	1.5
4	HB	2.5	10.0
Total WSFU			44.0



Demand Load = 26 gpm

Step 2. MDSSPA = 80 psi
Modification 1: 9 ft x 0.433 psi/ft = 3.897 psi = 4 psi
Modification 2: pressure loss due to the meter = 5 psi
Available Pressure = 80 – 4 -5 = 71 psi

Step 3. Maximum Developed Length = 1.2 x 92 feet = 110.4 ft = 110 ft

Summary:
WSFU = 44
Available Pressure = 71 psi
Effective Maximum Developed Length = 110 ft

TABLE 610.4
FIXTURE UNIT TABLE FOR DETERMINING WATER PIPE AND METER SIZES

METER AND STREET SERVICE (inches)	BUILDING SUPPLY AND BRANCHES (inches)	MAXIMUM ALLOWABLE LENGTH (feet)														
		40	60	80	100	150	200	250	300	400	500	600	700	800	900	1000
PRESSURE RANGE – Over 60 psi[1]																
¾	½[2]	7	7	7	6	5	4	3	3	2	1	1	1	1	1	0
¾	¾	20	20	20	20	17	13	11	10	8	7	6	6	5	4	4
¾	1	39	39	39	39	35	30	27	24	21	17	14	13	12	12	11
1	1	39	39	39	39	38	32	29	26	22	18	14	13	12	12	11
¾	1¼	39	39	39	39	39	39	39	39	34	28	26	25	23	22	21
1	1¼	78	78	78	78	74	62	53	47	39	31	26	25	23	22	21
1½	1¼	78	78	78	78	78	74	65	54	43	34	26	25	23	22	21
1	1½	85	85	85	85	85	85	85	85	81	64	51	48	46	43	40
1½	1½	151	151	151	151	151	151	130	113	88	73	51	51	46	43	40
2	1½	151	151	151	151	151	151	142	122	98	82	64	51	46	43	40
1	2	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85
1½	2	370	370	370	370	360	335	305	282	244	212	187	172	153	141	129
2	2	370	370	370	370	370	370	370	340	288	245	204	172	153	141	129
2	2½	654	654	654	654	654	650	610	570	510	460	430	404	380	356	329

For SI units: 1 inch = 25 mm, 1 foot = 304.8 mm, 1 pound-force per square inch = 6.8947 kPa

Notes:

[1] Available static pressure after head loss.

[2] Building supply, not less than ¾ of an inch (20 mm) nominal size.

Meter and Street Service = 1 inch
Building Supply and Branches = 1 ¼ inches

2. A busy airport has installed WaterSense toilets in all of the restrooms and 0.35 GPM aerators on the Lav faucets. If during a 24-hour period 3500 people use the toilet and wash their hands, how many gallons of water will be used? What is the percentage improvement from baseline fixtures?

Flush Fixture

	Design	Baseline
WC	1.28 gpf x 1 x 3500 = 4480 gal	1.6 gpf X 1 X 3500 = 5600 gal

Flow Fixture

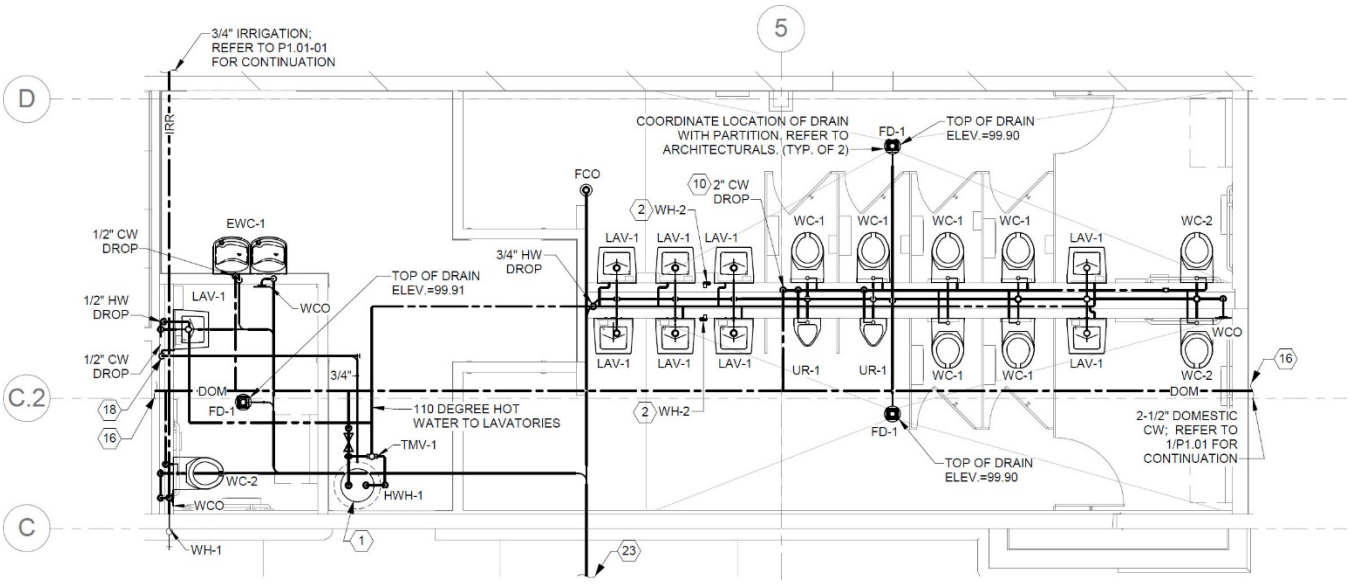
	Design	Baseline
LAV	0.35 gpm x 30s x 1min/60s x 3500 = 612.5 gal	0.5 x 30s x 1min/60s x 3500 = 875 gal

	Design	Baseline
Total	5092.5 gal	6475 gal

% Improvement from Baseline = [(6475 – 5092.5) / 6475] x 100 = 21.35 = 21%

3. A five-story office building has the restroom fixtures shown below on each floor. There is also one kitchen sink and a dishwasher in the staff room and a service sink in a janitor's closet on each floor. In July, the cooling tower requires 3 gpm for makeup water and the irrigation system requires 8 gpm. What flow rate should the service be designed to handle (in gpm)?

WC-1	Wall hung, Flushometer Valve Water Closet
WC-2	Wall hung, Flushometer Valve Water Closet
UR-1	Flushometer Valve Urinal
LAV-1	Lavatory
EWC-1	Split Level Water Cooler



Each Floor

9 WC
2 UR
9 LAV
1 EWC

X 5 Floors

Table 610.10

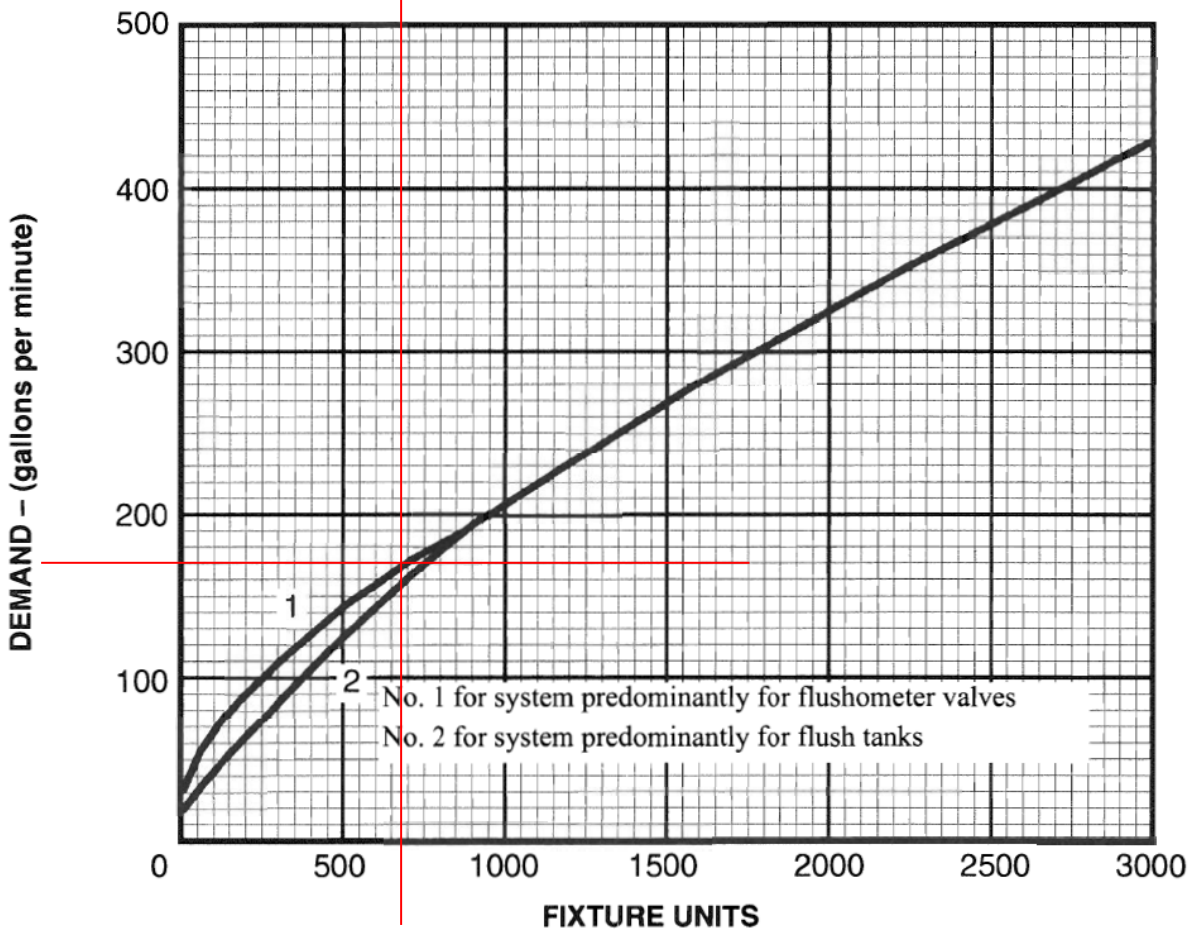
TOTAL WSFU = 45 WC (115 + 40 X10) + 1 UR (58 + 5X5) + 45 LAV (45.0) + 5 EWC (5X0.5) + 5 KS (5X1.5) + 5 DW (5X1.5) + 5 SS (5X 3.0)

TOTAL WSFU = 515 + 83 + 45 + 2.5 + 7.5 + 7.5 + 15.0 = 675.5 WSFU'

From Chart A 103.1(1) (Next Page)
Demand = 170 gpm

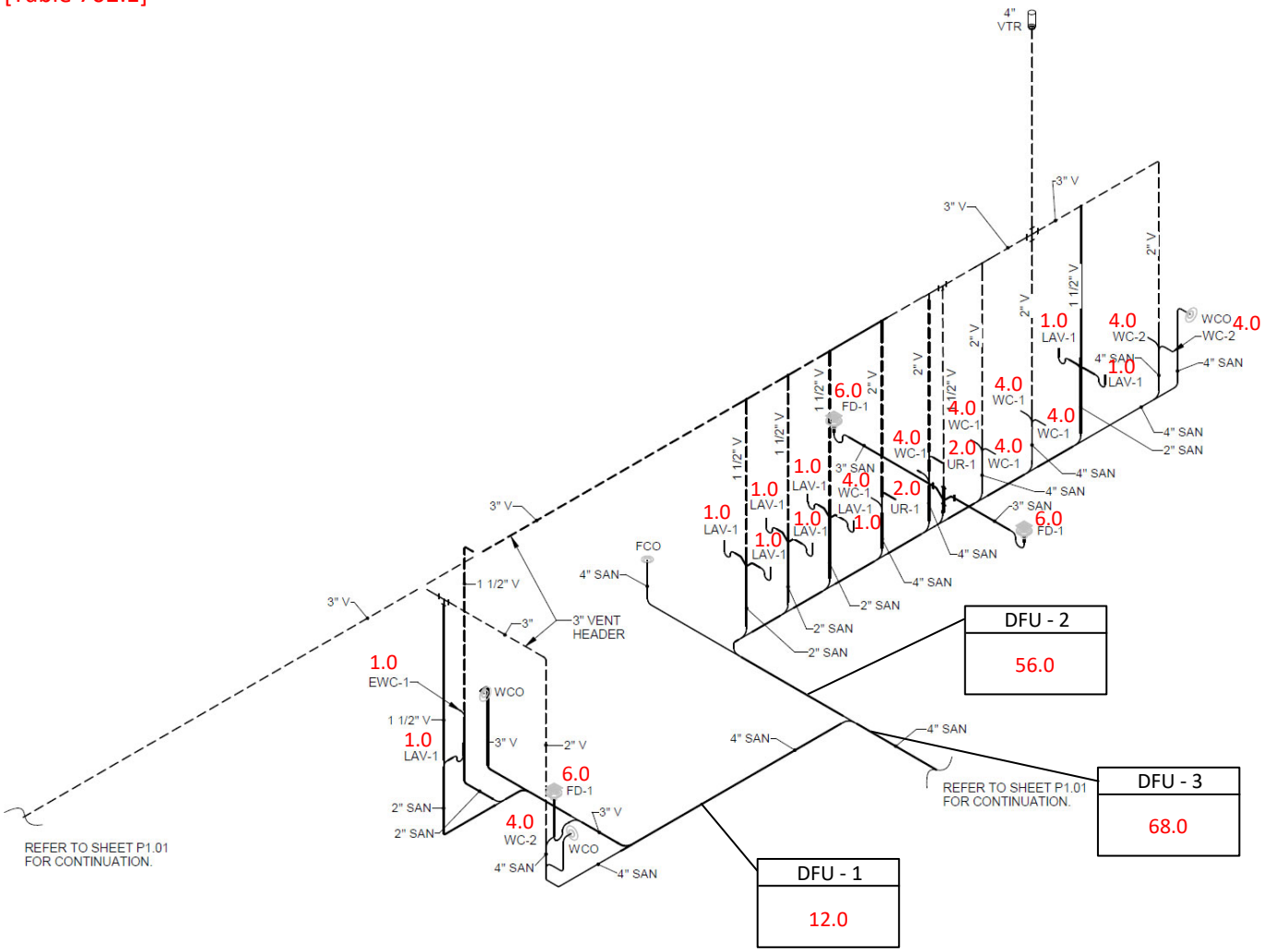
Total Flow Rate = 170 gpm + 3 gpm + 8 gpm = 181 gpm

CHART A 103.1(1)
ESTIMATE CURVES FOR DEMAND LOAD

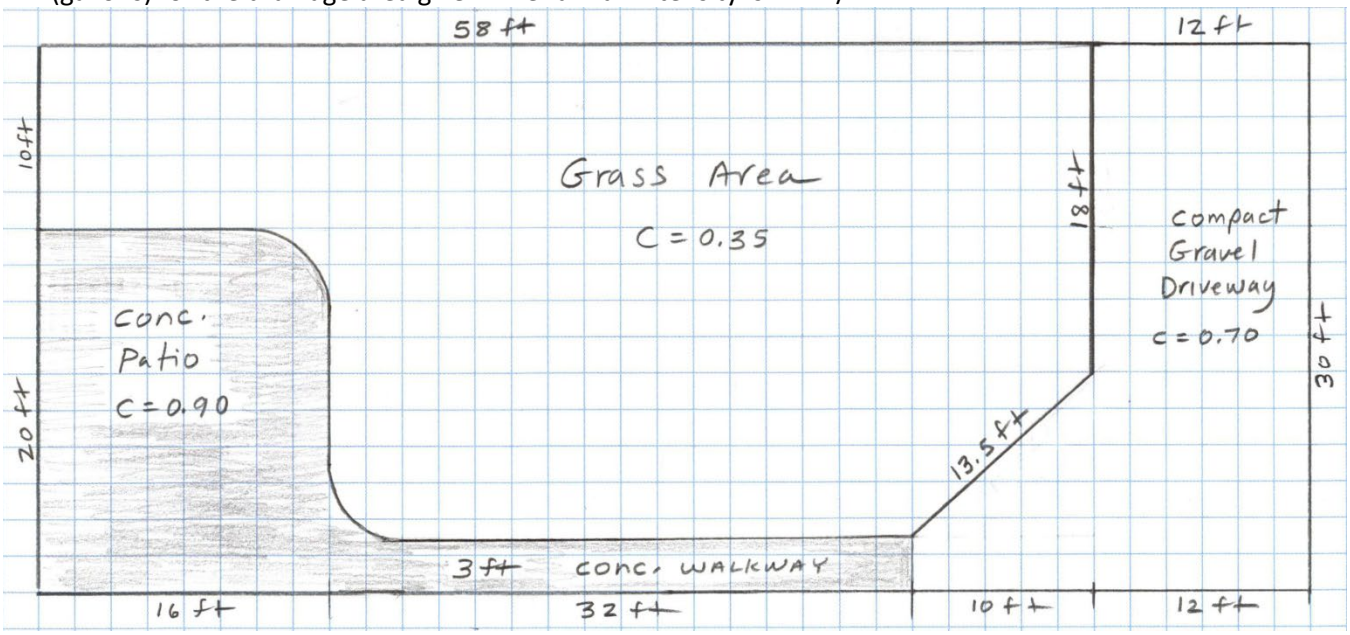


For SI units: 1 gallon per minute = 0.06 L/s

4. Determine the total DFUs for the riser shown at each location indicated. [Table 702.1]



5. For the residential site shown use the Rational Method to determine the peak runoff rate (gpm) and volume (gallons) for the drainage area given. The rainfall intensity is 4.2 in/hr.



The Rational Method equation is: Q = C x I x A where:
Q = Storm Water Runoff (in cubic feet per second)
C = Coefficient of Runoff
I = Rainfall Intensity (in inches per hour)
A = Area of Drainage Zone (in acres)

The equation above can be modified to give you runoff in gallons per minute.

The modified equation is: Q = (C x I x A) / 96.23 where:
Q = Storm Water Runoff (in gallons per minute, gpm)
C = Coefficient of Runoff
I = Rainfall Intensity (in inches per hour)
A = Area of Drainage Zone (in square feet)

Concrete Area
20 ft x 16 ft + 3 ft x 32 ft = 416 ft^2

Compact Gravel Area
12 ft x 30 ft + ½ x (10 ft x 9 ft) + 3 ft x 10 ft = 435 ft^2

Grass Area
10 ft x 58 ft + 17 ft x 42 ft – 45 ft2 = 1249 ft^2

Q = [(0.90 x 416) + (0.70 x 435) + (0.35 x 1249) x 4.2] / 96.23 = [(374.4 + 304.5 + 437.15) x 4.2)]/96.23 = 48.7 gpm

Use 60-minute storm:
Volume = 48.7 gpm x 60 min = 2,922 gal

TABLE 610.3
WATER SUPPLY FIXTURE UNITS (WSFU) AND MINIMUM FIXTURE BRANCH PIPE SIZES[3]

APPLIANCES, APPURTENANCES OR FIXTURES[2]	MINIMUM FIXTURE BRANCH PIPE SIZE[1,4] (inches)	PRIVATE	PUBLIC	ASSEMBLY[6]
Bathtub or Combination Bath/Shower (fill)	½	4.0	4.0	—
¾ inch Bathtub Fill Valve	¾	10.0	10.0	—
Bidet	½	1.0	—	—
Clothes Washer	½	4.0	4.0	—
Dental Unit, cuspidor	½	—	1.0	—
Dishwasher, domestic	½	1.5	1.5	—
Drinking Fountain or Water Cooler	½	0.5	0.5	0.75
Hose Bibb	½	2.5	2.5	—
Hose Bibb, each additional[8]	½	1.0	1.0	—
Lavatory	½	1.0	1.0	1.0
Lawn Sprinkler, each head[5]	—	1.0	1.0	—
Mobilehome or Manufactured Home, each (minimum)[9]	—	6.0	—	—
Sinks	—	—	—	—
Bar	½	1.0	2.0	—
Clinical Faucet	½	—	3.0	—
Clinical Flushometer Valve with or without faucet	1	—	8.0	—
Kitchen, domestic with or without dishwasher	½	1.5	1.5	—
Laundry	½	1.5	1.5	—
Service or Mop Basin	½	1.5	3.0	—
Washup, each set of faucets	½	—	2.0	—
Shower, per head	½	2.0	2.0	—
Urinal, 1.0 GPF Flushometer Valve	¾	See Footnote[7]		—
Urinal, greater than 1.0 GPF Flushometer Valve	¾	See Footnote[7]		—
Urinal, flush tank	½	2.0	2.0	3.0
Wash Fountain, circular spray	¾	—	4.0	—
Water Closet, 1.6 GPF Gravity Tank	½	2.5	2.5	3.5
Water Closet, 1.6 GPF Flushometer Tank	½	2.5	2.5	3.5
Water Closet, 1.6 GPF Flushometer Valve	1	See Footnote[7]		—
Water Closet, greater than 1.6 GPF Gravity Tank	½	3.0	5.5	7.0
Water Closet, greater than 1.6 GPF Flushometer Valve	1	See Footnote[7]		—

For SI units: 1 inch = 25 mm

Notes:

1 Size of the cold branch pipe, or both the hot and cold branch pipes.

2 Appliances, appurtenances, or fixtures not referenced in this table shall be permitted to be sized by reference to fixtures having a similar flow rate and frequency of use.

3 The listed fixture unit values represent their load on the cold water building supply. The separate cold water and hot water fixture unit value for fixtures having both hot and cold water connections shall be permitted to be each taken as three-quarter of the listed total value of the fixture.

4 The listed minimum supply branch pipe sizes for individual fixtures are the nominal (I.D.) pipe size.

5 For fixtures or supply connections likely to impose continuous flow demands, determine the required flow in gallons per minute (gpm) (L/s), and add it separately to the demand in gpm (L/s) for the distribution system or portions thereof.

6 Assembly [Public Use (See Table 422.1)].

7 Where sizing flushometer systems, see Section 610.10.

8 Reduced fixture unit loading for additional hose bibbs is to be used where sizing total building demand and for pipe sizing where more than one hose bibb is supplied by a segment of water distribution pipe. The fixture branch to each hose bibb shall be sized on the basis of 2.5 fixture units.

9 *For water supply fixture unit values related to lots within mobilehome parks in all parts of the State of California, see California Code of Regulations, Title 25, Division 1, Chapter 2, Article 5, Section 1278. For water supply fixture unit values related to lots within special occupancy parks in all parts of the State of California, see California Code of Regulations, Title 25, Division 1, Chapter 2.2, Article 5, Section 2278.*

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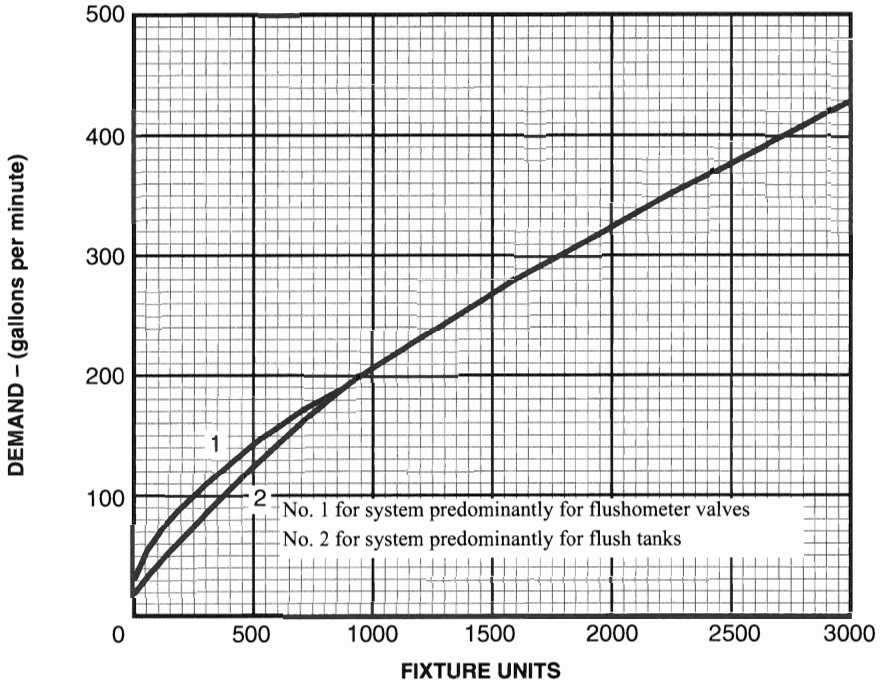
CHART A 103.1(1)
ESTIMATE CURVES FOR DEMAND LOAD



For SI units: 1 gallon per minute = 0.06 L/s

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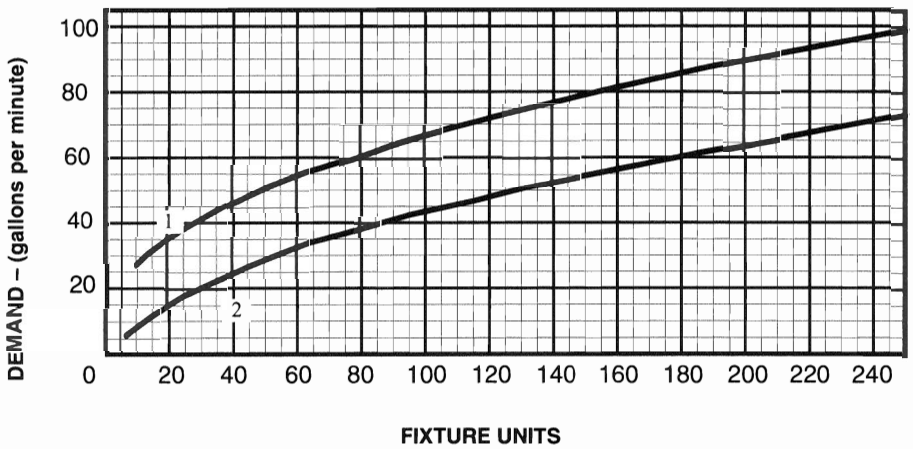
CHART A 103.1(2)
ENLARGED SCALE DEMAND LOAD



For SI units: 1 gallon per minute = 0.06 L/s

TABLE 610.4
FIXTURE UNIT TABLE FOR DETERMINING WATER PIPE AND METER SIZES

METER AND STREET SERVICE (inches)	BUILDING SUPPLY AND BRANCHES (inches)	MAXIMUM ALLOWABLE LENGTH (feet)														
		40	60	80	100	150	200	250	300	400	500	600	700	800	900	1000
PRESSURE RANGE – 30 to 45 psi[1]																
¾	½[2]	6	5	4	3	2	1	1	1	0	0	0	0	0	0	0
¾	¾	16	16	14	12	9	6	5	5	4	4	3	2	2	2	1
¾	1	29	25	23	21	17	15	13	12	10	8	6	6	6	6	6
1	1	36	31	27	25	20	17	15	13	12	10	8	6	6	6	6
¾	1¼	36	33	31	28	24	23	21	19	17	16	13	12	12	11	11
1	1¼	54	47	42	38	32	28	25	23	19	17	14	12	12	11	11
1½	1¼	78	68	57	48	38	32	28	25	21	18	15	12	12	11	11
1	1½	85	84	79	65	56	48	43	38	32	28	26	22	21	20	20
1½	1½	150	124	105	91	70	57	49	45	36	31	26	23	21	20	20
2	1½	151	129	129	110	80	64	53	46	38	32	27	23	21	20	20
1	2	85	85	85	85	85	85	82	80	66	61	57	52	49	46	43
1½	2	220	205	190	176	155	138	127	120	104	85	70	61	57	54	51
2	2	370	327	292	265	217	185	164	147	124	96	70	61	57	54	51
2	2½	445	418	390	370	330	300	280	265	240	220	198	175	158	143	133
PRESSURE RANGE – 46 to 60 psi[1]																
¾	½[2]	7	7	6	5	4	3	2	2	1	1	1	0	0	0	0
¾	¾	20	20	19	17	14	11	9	8	6	5	4	4	3	3	3
¾	1	39	39	36	33	28	23	21	19	17	14	12	10	9	8	8
1	1	39	39	39	36	30	25	23	20	18	15	12	10	9	8	8
¾	1¼	39	39	39	39	39	39	34	32	27	25	22	19	19	17	16
1	1¼	78	78	76	67	52	44	39	36	30	27	24	20	19	17	16
1½	1¼	78	78	78	78	66	52	44	39	33	29	24	20	19	17	16
1	1½	85	85	85	85	85	85	80	67	55	49	41	37	34	32	30
1½	1½	151	151	151	151	128	105	90	78	62	52	42	38	35	32	30
2	1½	151	151	151	151	150	117	98	84	67	55	42	38	35	32	30
1	2	85	85	85	85	85	85	85	85	85	85	85	85	85	83	80
1½	2	370	370	340	318	272	240	220	198	170	150	135	123	110	102	94
2	2	370	370	370	370	368	318	280	250	205	165	142	123	110	102	94
2	2½	654	640	610	580	535	500	470	440	400	365	335	315	285	267	250
PRESSURE RANGE – Over 60 psi[1]																
¾	½[2]	7	7	7	6	5	4	3	3	2	1	1	1	1	1	0
¾	¾	20	20	20	20	17	13	11	10	8	7	6	6	5	4	4
¾	1	39	39	39	39	35	30	27	24	21	17	14	13	12	12	11
1	1	39	39	39	39	38	32	29	26	22	18	14	13	12	12	11
¾	1¼	39	39	39	39	39	39	39	39	34	28	26	25	23	22	21
1	1¼	78	78	78	78	74	62	53	47	39	31	26	25	23	22	21
1½	1¼	78	78	78	78	78	74	65	54	43	34	26	25	23	22	21
1	1½	85	85	85	85	85	85	85	85	81	64	51	48	46	43	40
1½	1½	151	151	151	151	151	151	130	113	88	73	51	51	46	43	40
2	1½	151	151	151	151	151	151	142	122	98	82	64	51	46	43	40
1	2	85	85	85	85	85	85	85	85	85	85	85	85	85	85	85
1½	2	370	370	370	370	360	335	305	282	244	212	187	172	153	141	129
2	2	370	370	370	370	370	370	370	340	288	245	204	172	153	141	129
2	2½	654	654	654	654	654	650	610	570	510	460	430	404	380	356	329

For SI units: 1 inch = 25 mm, 1 foot = 304.8 mm, 1 pound-force per square inch = 6.8947 kPa

Notes:

[1] Available static pressure after head loss.

[2] Building supply, not less than ¾ of an inch (20 mm) nominal size.

Appendix A. For alternate methods of sizing water supply systems, see Appendix C.

610.6 Friction and Pressure Loss. Except where the type of pipe used and the water characteristics are such that no decrease in capacity due to length of service (age of system) is expected, friction-loss data shall be obtained from the "Fairly Rough" or "Rough" charts in Appendix A of this code. Friction or pressure losses in water meter, valve, and fittings shall be obtained from the same sources. Pressure losses through water-treating equipment, backflow prevention devices, or other flow-restricting devices shall be computed in accordance with Section 610.2.

610.7 Conditions for Using Table 610.4. On a proposed water piping installation sized using Table 610.4, the following conditions shall be determined:

(1) Total number of fixture units as determined from Table 610.3, Equivalent Fixture Units, for the fixtures to be installed.

(2) Developed length of supply pipe from meter to most remote outlet.

(3) Difference in elevation between the meter or other source of supply and the highest fixture or outlet.

(4) Pressure in the street main or other source of supply at the locality where the installation is to be made.

(5) In localities where there is a fluctuation of pressure in the main throughout the day, the water piping system shall be designed on the basis of the minimum pressure available.

610.8 Size of Meter and Building Supply Pipe Using Table 610.4. The size of the meter and the building supply pipe shall be determined as follows:

(1) Determine the available pressure at the water meter or other source of supply.

(2) Add or subtract depending on positive or negative elevation change, ½ psi (3.4 kPa) for each foot (305 mm) of difference in elevation between such source of supply and the highest water supply outlet in the building or on the premises.

(3) Use the "pressure range" group within which this pressure will fall using Table 610.4.

(4) Select the "length" column that is equal to or longer than the required length.

(5) Follow down the column to a fixture unit value equal to or exceeding the total number of fixture units required by the installation.

(6) Having located the proper fixture unit value for the required length, sizes of meter and building supply pipe as found in the two left-hand columns shall be applied.

No building supply pipe shall be less than ¾ of an inch (20 mm) in diameter.

610.9 Size of Branches. Where Table 610.4 is used, the minimum size of each branch shall be determined by the number of fixture units to be served by that branch, the total developed length of the system, and the meter and street service size in accordance with Section 610.8. No branch piping is required to be larger in size than that required by Table 610.4 for the building supply pipe.

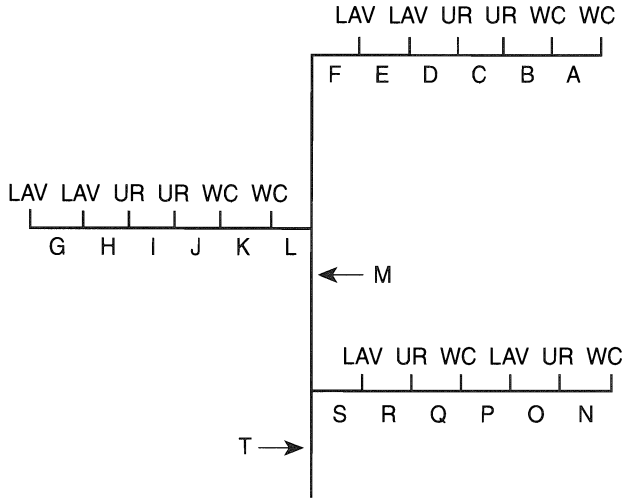
610.10 Sizing for Flushometer Valves. Where using Table 610.4 to size water supply systems serving flushometer valves, the number of flushometer fixture units assigned to every section of pipe, whether branch or main, shall be determined by the number and category of flushometer valves served by that section of pipe, in accordance with Table 610.10. Piping supplying a flushometer valve shall be not less in size than the valve inlet.

Where using Table 610.10 to size water piping, care shall be exercised to assign flushometer fixture units based on the number and category of fixtures served.

TABLE 610.10
FLUSHOMETER FIXTURE UNITS FOR WATER SIZING USING TABLE 610.3

FIXTURE CATEGORY: WATER CLOSET WITH FLUSHOMETER VALVES		
NUMBER OF FLUSHOMETER VALVES	**INDIVIDUAL FIXTURE UNITS ASSIGNED IN DECREASING VALUE**	**FIXTURE UNITS ASSIGNED FOR WATER CLOSETS AND SIMILAR 10-UNIT FIXTURES IN ACCUMULATIVE VALUES**
1	40	40
2	30	70
3	20	90
4	15	105
5 or more	10 each	115 plus 10 for each additional fixture in excess of 5
FIXTURE CATEGORY: URINALS WITH FLUSHOMETER VALVES		
NUMBER OF FLUSHOMETER VALVES	**INDIVIDUAL FIXTURE UNITS ASSIGNED IN DECREASING VALUE**	**FIXTURE UNITS ASSIGNED FOR URINALS AND SIMILAR 5-UNIT FIXTURES IN ACCUMULATIVE VALUES**
1	20	20
2	15	35
3	10	45
4	8	53
5 or more	5 each	58 plus 5 for each additional fixture in excess of 5

In the example below, fixture units assigned to each section of pipe are computed. Each capital letter refers to the section of pipe above it, unless otherwise shown.



A: 1 WC = 40 F.U.
B: 2 WC = 70 F.U.
C: 2 WC (70) + 1 UR (20) = 90 F.U.
D: 2 WC (70) + 2 UR (35) = 105 F.U.
E: 2 WC (70) + 2 UR (35) + 1 LAV (1) = 106 F.U.
F: 2 WC (70) + 2 UR (35) + 2 LAV (2) = 107 F.U.
G: 1 LAV = 1 F.U.
H: 2 LAV = 2 F.U.
I: 2 LAV (2) + 1 UR (20) = 22 F.U.
J: 2 LAV (2)+ 2 UR (35) = 37 F.U.
K: 2 LAV (2) + 2 UR (35) + 1 WC (40) = 77 F.U.
L: 2 LAV (2) + 2 UR (35) + 2 WC (70) = 107 F.U.
M: 4 WC (105) + 4 UR (53) + 4 LAV (4) = 162 F.U.
N: 1 WC = 40 F.U.
O: 1 WC (40) + 1 UR (20) = 60 F.U.
P: 1 WC (40) + 1 UR (20) + 1 LAV (1) = 61 F.U.
Q: 2 WC (70) + 1 UR (20) + 1 LAV (1) = 91 F.U.
R: 2 WC (70) + 2 UR (35) + 1 LAV (1) = 106 F.U.
S: 2 WC (70) + 2 UR (35) + 2 LAV (2) = 107 F.U.
T: 6 WC (125) + 6 UR (63) + 6 LAV (6) = 194 F.U.

EXAMPLE 610.10
SIZING METHOD FOR PUBLIC USE FIXTURES USING TABLE 610.10

610.11 Sizing Systems for Flushometer Tanks. The size of branches and mains serving flushometer tanks shall be consistent with the sizing procedures for flush tank water closets.

610.12 Sizing for Velocity. Water piping systems shall not exceed the maximum velocities listed in this section or Appendix A.

610.12.1 Copper Tube Systems. Maximum velocities in copper and copper alloy tube and fitting systems shall not exceed 8 feet per second (ft/s) (2.4 m/s) in cold water and 5 ft/s (1.5 m/s) in hot water.

610.12.2 Tubing Systems Using Copper Fittings. Maximum velocities through copper fittings in tubing other than copper shall not exceed 8 ft/s (2.4 m/s) in cold water and 5 ft/s (1.5 m/s) in hot water.

610.13 Exceptions. The provisions of this section relative to size of water piping shall not apply to the following:

(1) Water supply piping systems designed in accordance with recognized engineering procedures acceptable to the Authority Having Jurisdiction.

(2) Alteration of or minor additions to existing installations, provided the Authority Having Jurisdiction finds that there will be an adequate supply of water to operate fixtures.

(3) Replacement of existing fixtures or appliances.

(4) Piping that is part of fixture equipment.

(5) Unusual conditions where, in the judgment of the Authority Having Jurisdiction, an adequate supply of water is provided to operate fixtures and equipment.

(6) The size and material of irrigation water piping installed outside of a building or structure and separated from the potable water supply by means of an approved air gap or backflow prevention device is not regulated by this code. The potable water piping system supplying each such irrigation system shall be adequately sized as required elsewhere in this chapter to deliver the full connected demand of both the domestic use and the irrigation systems.

611.0 Drinking Water Treatment Units.

611.1 Application. Drinking water treatment units shall comply with NSF 42 or NSF 53. Water softeners shall comply with NSF 44. Ultraviolet water treatment systems shall comply with NSF 55. Reverse osmosis drinking water treatment systems shall comply with NSF 58. Drinking water distillation systems shall comply with NSF 62.

611.2 Air Gap Discharge. Discharge from drinking water treatment units shall enter the drainage system through an air gap in accordance with Table 603.3.1 or an air gap device in accordance with Table 603.2, NSF 58, or IAPMO PS 65.

611.3 Connection Tubing. The tubing to and from drinking water treatment units shall be of a size and material as recommended by the manufacturer. The tubing shall comply with the requirements of NSF 14, NSF 42, NSF 44, NSF 53, NSF 55, NSF 58, NSF 62 or the appropriate material standards referenced in Table 1701.1.

611.4 Sizing of Residential Softeners. Residential-use water softeners shall be sized in accordance with Table 611.4.

612.0 Residential Fire Sprinkler Systems.

612.1 Where Required. Where residential sprinkler systems are required in one and two family dwellings or townhouses, the systems shall be installed by an ASSE Series 7000 certified installer in accordance with this section or NFPA 13D. This section shall be considered equivalent to NFPA 13D. Partial residential sprinkler systems shall be permitted to be installed in buildings not required to be equipped with a residential sprinkler system.

TABLE 702.1
DRAINAGE FIXTURE UNIT VALUES (DFU)

PLUMBING APPLIANCES, APPURTENANCES, OR FIXTURES	MINIMUM SIZE TRAP AND TRAP ARM[7] (inches)	PRIVATE	PUBLIC	ASSEMBLY[8]
Bathtub or Combination Bath/Shower	1½	2.0	2.0	—
Bidet	1¼	1.0	—	—
Bidet	1½	2.0	—	—
Clothes Washer, domestic, standpipe[5]	2	3.0	3.0	3.0
Dental Unit, cuspidor	1¼	—	1.0	1.0
Dishwasher, domestic, with independent drain[2]	1½	2.0	2.0	2.0
Drinking Fountain or Water Cooler	1¼	0.5	0.5	1.0
Food Waste Disposer, commercial	2	—	3.0	3.0
Floor Drain, emergency	2	—	0.0	0.0
Floor Drain (for additional sizes see Section 702.0)	2	2.0	2.0	2.0
Shower, single-head trap	2	2.0	2.0	2.0
Multi-head, each additional	2	1.0	1.0	1.0
Lavatory	1¼	1.0	1.0	1.0
Lavatories in sets	1½	2.0	2.0	2.0
Washfountain	1½	—	2.0	2.0
Washfountain	2	—	3.0	3.0
Mobilehome or Manufactured Home, trap[9]	3	*6.0*	—	—
Receptor, indirect waste[1,3]	1½	See footnote[1,3]		
Receptor, indirect waste[1,4]	2	See footnote[1,4]		
Receptor, indirect waste[1]	3	See footnote[1]		
Sinks	—	—	—	—
Bar	1½	1.0	—	—
Bar[2]	1½	—	2.0	2.0
Clinical	3	—	6.0	6.0
Commercial with food waste[2]	1½	—	3.0	3.0
Exam Room	1½	—	1.0	—
Special Purpose[2]	1½	2.0	3.0	3.0
Special Purpose	2	3.0	4.0	4.0
Special Purpose	3	—	6.0	6.0
Kitchen, domestic[2] (with or without food waste disposer, dishwasher, or both)	1½	2.0	2.0	—
Laundry[2] (with or without discharge from a clothes washer)	1½	2.0	2.0	2.0
Service or Mop Basin	2	—	3.0	3.0
Service or Mop Basin	3	—	3.0	3.0
Service, flushing rim	3	—	6.0	6.0
Wash, each set of faucets	—	—	2.0	2.0
Urinal, integral trap 1.0 GPF[2]	2	2.0	2.0	5.0
Urinal, integral trap greater than 1.0 GPF	2	2.0	2.0	6.0
Urinal, exposed trap[2]	1½	2.0	2.0	5.0
Water Closet, 1.6 GPF Gravity Tank[6]	3	3.0	4.0	6.0
Water Closet, 1.6 GPF Flushometer Tank[6]	3	3.0	4.0	6.0
Water Closet, 1.6 GPF Flushometer Valve[6]	3	3.0	4.0	6.0
Water Closet, greater than 1.6 GPF Gravity Tank[6]	3	4.0	6.0	8.0
Water Closet, greater than 1.6 GPF Flushometer Valve[6]	3	4.0	6.0	8.0

For SI units: 1 inch = 25 mm

Notes:

1 Indirect waste receptors shall be sized based on the total drainage capacity of the fixtures that drain therein to, in accordance with Table 702.2(2).

2 Provide a 2 inch (50 mm) minimum drain.

3 For refrigerators, coffee urns, water stations, and similar low demands.

4 For commercial sinks, dishwashers, and similar moderate or heavy demands.

5 Buildings having a clothes-washing area with clothes washers in a battery of three or more clothes washers shall be rated at 6 fixture units each for purposes of sizing common horizontal and vertical drainage piping.

6 Water closets shall be computed as 6 fixture units where determining septic tank sizes based on Appendix H of this code.

7 Trap sizes shall not be increased to the point where the fixture discharge is capable of being inadequate to maintain their self-scouring properties.

8 Assembly [Public Use (see Table 422.1)].

9 *For drainage fixture unit values related to lots within mobilehome parks in all parts of the State of California, see California Code of Regulations, Title 25, Division 1, Chapter 2, Article 5, Section 1268. For drainage fixture unit values related to lots within special occupancy parks in all parts of the State of California, see California Code of Regulations, Title 25, Division 1, Chapter 2.2, Article 5, Section 2268.*

Maximum drainage fixture units for a fixture trap and trap arm loadings for sizes up to 4 inches (100 mm) shall be in accordance with Table 702.2(1).

702.2 Intermittent Flow. Drainage fixture units for intermittent flow into the drainage system shall be computed on the rated discharge capacity in gallons per minute (gpm) (L/s) in accordance with Table 702.2(2).

702.3 Continuous Flow. For a continuous flow into a drainage system, such as from a pump, sump ejector, air conditioning equipment, or similar device, 2 fixture units shall be equal to each gallon per minute (gpm) (L/s) of flow.

TABLE 702.2(1)
MAXIMUM DRAINAGE FIXTURE UNITS FOR A TRAP AND TRAP ARM*

SIZE OF TRAP AND TRAP ARM (inches)	DRAINAGE FIXTURE UNIT VALUES (DFU)
1¼	1 unit
1½	3 units
2	4 units
3	6 units
4	8 units

For SI Units: 1 inch = 25 mm

* **Exception:** On self-service laundries.

TABLE 702.2(2)
DISCHARGE CAPACITY IN GALLONS PER MINUTE FOR INTERMITTENT FLOW ONLY*

GPM	FIXTURE UNITS
Up to 7½	Equals 1 Fixture Unit
Greater than 7½ to 15	Equals 2 Fixture Units
Greater than 15 to 30	Equals 4 Fixture Units
Greater than 30 to 50	Equals 6 Fixture Units

For SI units: 1 gallon per minute = 0.06 L/s

* Discharge capacity exceeding 50 gallons per minute (3.15 L/s) shall be determined by the Authority Having Jurisdiction.

703.0 Size of Drainage Piping.

703.1 Minimum Size. The minimum sizes of vertical, horizontal, or both drainage piping shall be determined from the total of fixture units connected thereto, and additionally, in the case of vertical drainage pipes, in accordance with their length.

703.2 Maximum Number of Fixture Units. Table 703.2 shows the maximum number of fixture units allowed on a vertical or horizontal drainage pipe, building drain, or building sewer of a given size; the maximum number of fixture units allowed on a branch interval of a given size; and the maximum length (in feet and meters) of a vertical drainage pipe of a given size.

703.3 Sizing per Appendix C. For alternate method of sizing drainage piping, see Appendix C.

704.0 Fixture Connections (Drainage).

704.1 Inlet Fittings. Drainage piping shall be provided with approved inlet fittings for fixture connections, correctly located according to the size and type of fixture proposed to be connected.

704.2 Single Vertical Drainage Pipe. Two fixtures set back-to-back, or side-by-side, within the distance allowed between a trap and its vent shall be permitted to be served by a single vertical drainage pipe provided that each fixture wastes separately into an approved double-fixture fitting having inlet openings at the same level.

704.3 Commercial Sinks. Pot sinks, scullery sinks, dishwashing sinks, silverware sinks, and other similar fixtures shall be connected directly to the drainage system. A floor drain shall be provided adjacent to the fixture, and the fixture shall be connected on the sewer side of the floor drain trap, provided that no other drainage line is connected between the floor drain waste connection and the fixture drain. The fixture and floor drain shall be trapped and vented in accordance with this code.

705.0 Joints and Connections.

705.1 ABS and ABS Co-Extruded Plastic Pipe and Joints. Joining methods for ABS plastic pipe and fittings shall be installed in accordance with the manufacturer's installation instructions and shall comply with Section 705.1.1 through Section 705.1.3.

705.1.1 Mechanical Joints. Mechanical joints shall be designed to provide a permanent seal and shall be of the mechanical or push-on joint. The push-on joint shall include an elastomeric gasket in accordance with ASTM D3212 and shall provide a compressive force against the spigot and socket after assembly to provide a permanent seal.

705.1.2 Solvent Cement Joints. Solvent cement joints for ABS pipe and fittings shall be clean from dirt and moisture. Pipe shall be cut square and shall be deburred. Where surfaces to be joined are cleaned and free of dirt, moisture, oil, and other foreign material, solvent cement in accordance with ASTM D2235 shall be applied to all joint surfaces. Joints shall be made while both the inside socket surface and outside surface of pipe are wet with solvent cement. Hold joint in place and undisturbed for 1 minute after assembly. ***[HCD 1 & HCD 2]*** *Plastic pipe and fittings joined with solvent cement shall utilize Low VOC primer(s), if a primer is required, and Low VOC cement(s) as defined in Section 214.0.*

705.1.3 Threaded Joints. Threads shall comply with ASME B1.20.1. A minimum of Schedule 80 shall be permitted to be threaded. Molded threads on adapter fittings for transition to threaded joints shall be permitted. Thread sealant compound shall be applied to male threads, insoluble in water, and nontoxic. The joint between the pipe and transition fitting shall be of the solvent cement type. Caution shall be used during assembly to prevent over tightening of the ABS components once the thread sealant compound has been applied.

705.2 Cast-Iron Pipe and Joints. Joining methods for cast-iron pipe and fittings shall be installed in accordance with