**CMGT 235 – Electrical and Mechanical Systems**

Department of Construction Management 🏵 California State University, Chico

Exam #2 [100 points]

**You may work with one person or individually. Every student SHALL complete their own answer sheet.**

|  |
| --- |
| Name:  Solution |
| Name: |



1. Complete the following steps for the dwelling plan provided. The owner has approved all options shown.

**Step 1.** Calculate the Available Water Pressure

MDSSPA = 60 psi

Highest Fixture = 10 feet above the source of supply

Meter Pressure loss = 5 psi

Water Softener Pressure Loss = 9 psi

Available Pressure = 60 psi – 10 x 0.433 – 5 psi -9 psi = 41.67 psi

**Step 2.** Determine the Effective Maximum Developed Length (DL) of Pipe

Length of pipe to the Furthest Fixture = 105 feet

DL = 105 ft x 1.5 = 157.5 ft

**Step 3**. Complete the WSFU table below. [2016 CPC - Table 610.3]

Mark all fixtures shown on the plan using a yellow highlighter.

There is a total of five ½" hose bibbs: three on one supply segment and two on another supply segment.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Water Supply Fixture Units | | | | | | | |
| Fixture | # of Fix. | HOT WSFU | | COLD WSFU | | TOTAL WSFU | |
| EACH | THIS JOB | EACH | THIS JOB | EACH | THIS JOB |
| SHW | 1 | 1.5 | 1.5 | 1.5 | 1.5 | 2.0 | 2.0 |
| BT | 1 | 3.0 | 3.0 | 3.0 | 3.0 | 4.0 | 4.0 |
| BT/SHW | 3 | 3.0 | 9.0 | 3.0 | 9.0 | 4.0 | 12.0 |
| LAV | 7 | 0.75 | 5.25 | 0.75 | 5.25 | 1.0 | 7.0 |
| WC FT | 5 | --- | --- | 2.50 | 12.50 | 2.5 | 12.5 |
| KS | 1 | 1.125 | 1.125 | 1.125 | 1.125 | 1.5 | 1.5 |
| DW | 2 | 1.5 | 3.0 | --- | --- | 1.5 | 3.0 |
| CW | 1 | 3.0 | 3.0 | 3.0 | 3.0 | 4.0 | 4.0 |
| LT | 1 | 1.125 | 1.125 | 1.125 | 1.125 | 1.5 | 1.5 |
| HB | 5 | --- | --- | 5.0+3.0 | 8.0 | 8.0 | 8.0 |
| TOTALS |  |  | 27.0 |  | 44.5 |  | 55.5 |

**Step 4.** Use the 2016 CPC Table 610.4 complete the table below for your results:

**2016 CPC - Table 610.4**

|  |  |
| --- | --- |
| Pressure Range | **30 to 45 psi** |
| Maximum Allowable Length | **200** |
| **Distribution Piping** | **Pipe Size (inches)** |
| Meter and Street Service | 1 ½ “ |
| Building Supply | 1 ½ “ |
| Cold Water Supply | 1 ½ “ |
| Hot Water Supply | 1 ¼ “ |

1. For the private residence shown write the individual DFU value above each fixture and determine the total DFU at the points indicated.

Diagram, engineering drawing

Description automatically generated

27.0

1.0

2.0

3.0

16.0

20.0

1.0

1.0

3.0

2.0

3.0

2.0

2.0

3.0

2.0

1.0

1.0

1. For the 2-line drawing shown complete the 1-line drawing by replacing each fitting in the locations shown with its corresponding symbol found on drawing P-011 located on lorisweb.com [CMGT 235 DIS 20].

A picture containing text, antenna

Description automatically generated

1. 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 8.0 in/hr.

Diagram

Description automatically generated

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 - C=1.0 OR C=0.9

60 ft x 63 ft – 30 ft x 24 ft = 3780 ft2 – 720 ft2 = 3,060 ft2

Compact Gravel Area - C = 0.70

9 ft x 36 ft = 324 ft2

Grass Area - C=0.35

42 ft x 36 ft = 1,512 ft2

Loam Light Veg. - C=0.45

6 ft x 120 ft + 9 ft X 63 ft = 720 ft2 + 567 ft2 = 1,287 ft2

Sand – Bare - C=0.50

51 ft x 27 ft = 1,377 ft2

Q = [(0.9 x 3,060) + (0.70 x 324) + (0.35 x 1,512) + (0.45 x 1,287) + (0.50 x 1,377)] x 8.0 inches/hr / 96.23

C=0.9 Q = 38,221.2/96.23 = 397.19 gpm

C=1.0 Q = 40,669.2/96.23 = 422.62 gpm

Use 60-minute storm:

Volume = 397.19 gpm x 60 min = 23,831 gal

Volume = 422.62 gpm x 60 min = 25,357 gal

1. For a building in Wilmington, NC, determine the minimum size roof drain, horizontal pipe, and leader pipe for the roof shown. Use the 2016 CPC Appendix D rainfall rate with no amendments.

Diagram

Description automatically generated

**Minimum Roof Drain Size**

Rainfall Rate = 4/4 inches / hr

Table 1101.12

2” 2880/4.4 = 636 sf

3” 8800/4.4 = 2000 sf

**4” 18400/4.4 = 4182 sf 4” minimum drain**

**Minimum Horizontal Drain Pipe**

Table 1101.8 – ¼ in/ft slope

4” 10,600/4.4 = 2409 sf

**5” 18880/4.4 = 4290 sf 5” minimum horizonal drain pipe**

**If one Leader serves each drain (2500 sf)**

Table 1101.12

**4” 18,400/4.4 = 4182 sf 4” minimum leader pipe but can’t reduce in the direction of flow so must use 5”**

**5” minimum Leader Required**