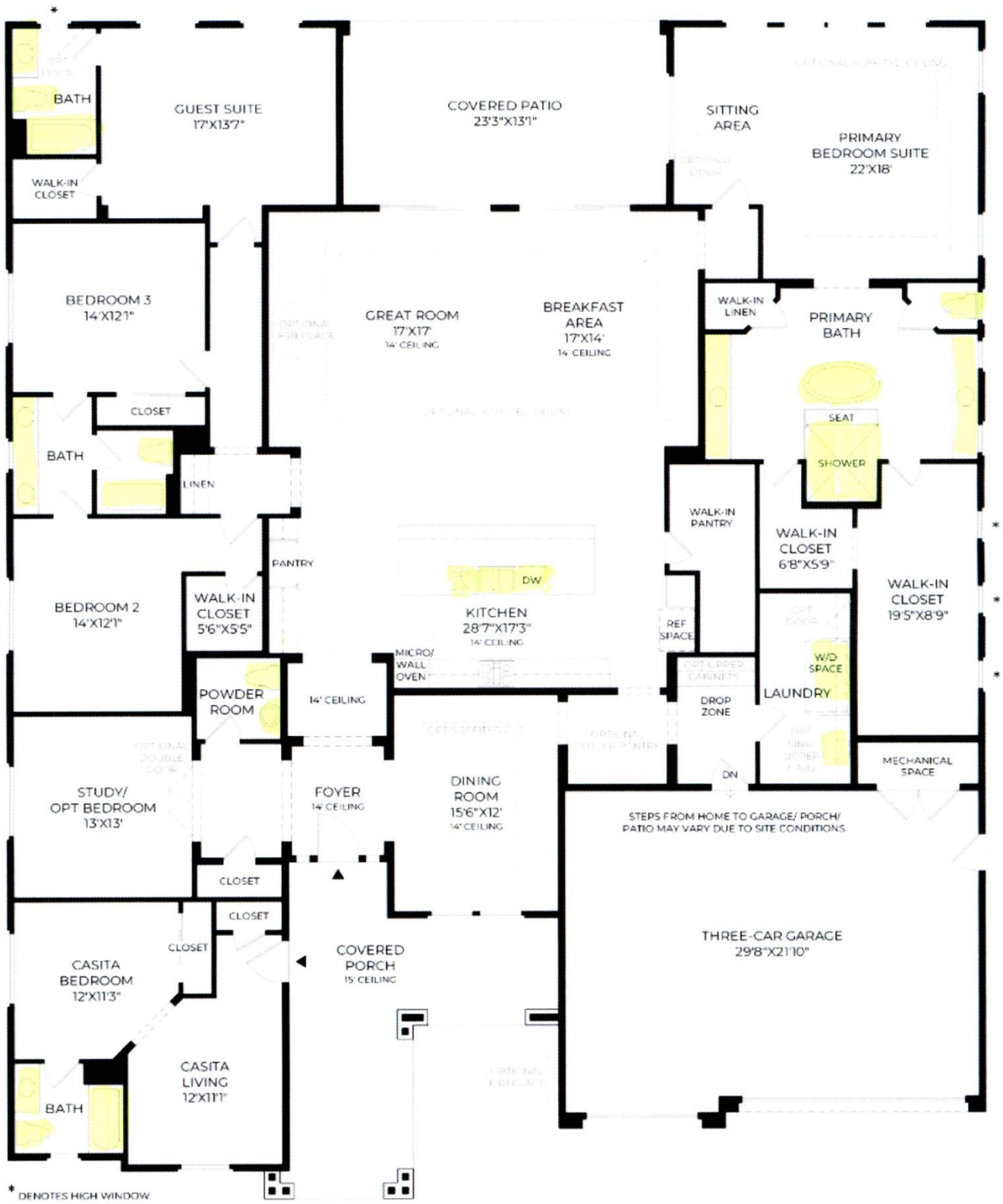
CMGT 235 – Electrical and Mechanical Systems

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:


BATH
GUEST SUITE
17'X13'7"
COVERED PATIO
23'3"X13'1"
SITTING
AREA
PRIMARY
BEDROOM SUITE
22'X18'
WALK-IN
CLOSET
BEDROOM 3
14'X12'1"
GREAT ROOM
17'X17'
14' CEILING
BREAKFAST
AREA
17'X14'
14' CEILING
WALK-IN
LINEN
PRIMARY
BATH
SEAT
SHOWER
CLOSET
BATH
LINEN
WALK-IN
PANTRY
WALK-IN
CLOSET
6'8"X5'9"
WALK-IN
CLOSET
19'5"X8'9"
PANTRY
DW
BEDROOM 2
14'X12'1"
WALK-IN
CLOSET
5'6"X5'5"
KITCHEN
28'7"X17'3"
14' CEILING
REF
SPACE
MICRO/
WALL
OVEN
W/D
SPACE
POWDER
ROOM
14' CEILING
LAUNDRY
DROP
ZONE
MECHANICAL
SPACE
STUDY/
OPT BEDROOM
13'X13'
FOYER
14' CEILING
DINING
ROOM
15'6"X12'
14' CEILING
DN
STEPS FROM HOME TO GARAGE/ PORCH/
PATIO MAY VARY DUE TO SITE CONDITIONS
CLOSET
CLOSET
CLOSET
COVERED
PORCH
15' CEILING
THREE-CAR GARAGE
29'8"X21'10"
CASITA
BEDROOM
12'X11'3"
CASITA
LIVING
12'X11'1"
BATH
* DENOTES HIGH WINDOW

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.

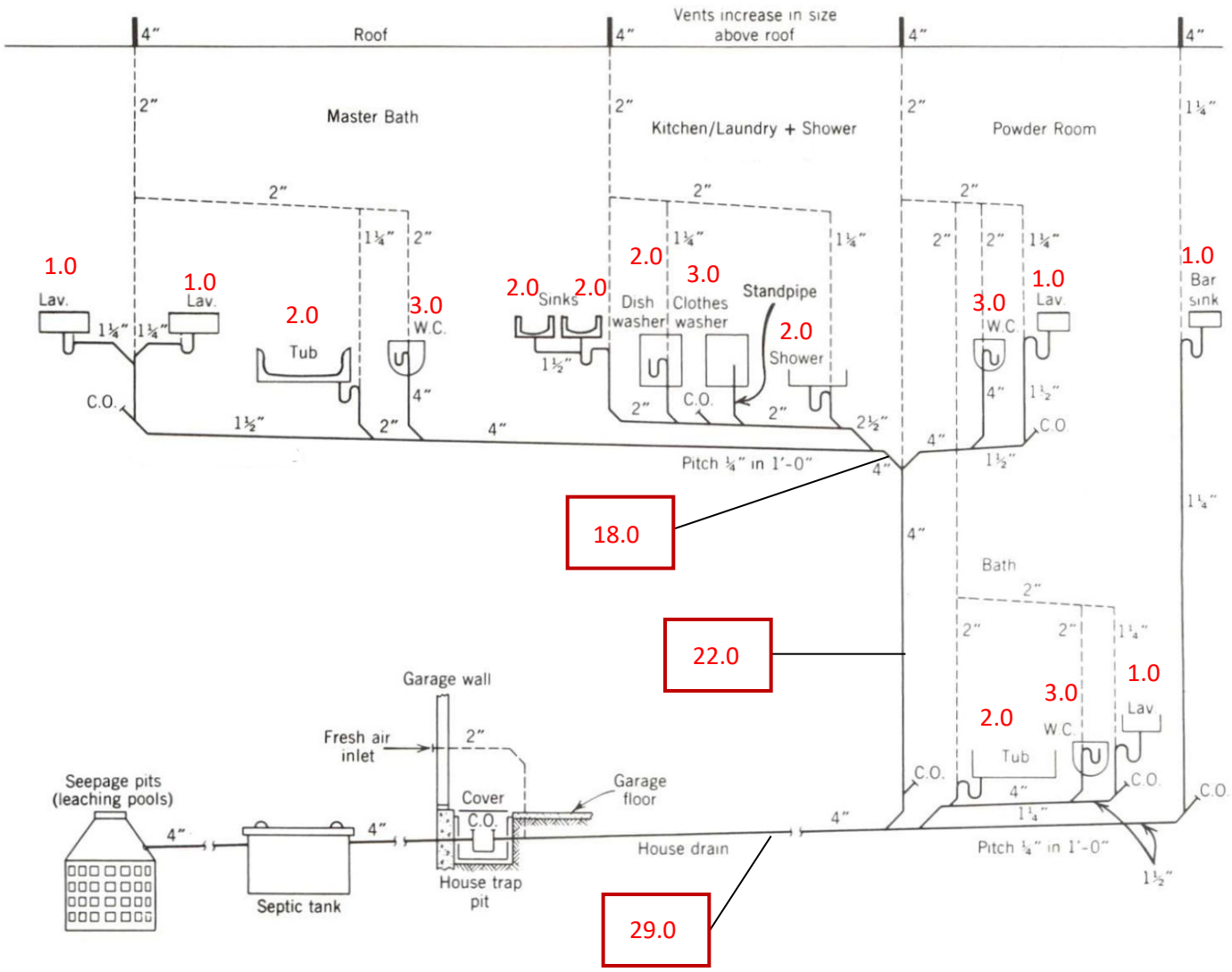
Water Supply Fixture Units							
Fixture	# of Fix.	HOT WSFU		COLD WSFU		TOTAL WSFU	
		EACH	THIS JOB	EACH	THIS JOB	EACH	THIS JOB
SHW	1	1.5	1.5	1.5	1.5	2.0	2.0
BT	1	3.0	3.0	3.0	3.0	4.0	4.0
BT/SHW	3	3.0	9.0	3.0	9.0	4.0	12.0
LAV	7	0.75	5.25	0.75	5.25	1.0	7.0
WC FT	5	---	---	2.50	12.50	2.5	12.5
KS	1	1.125	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:

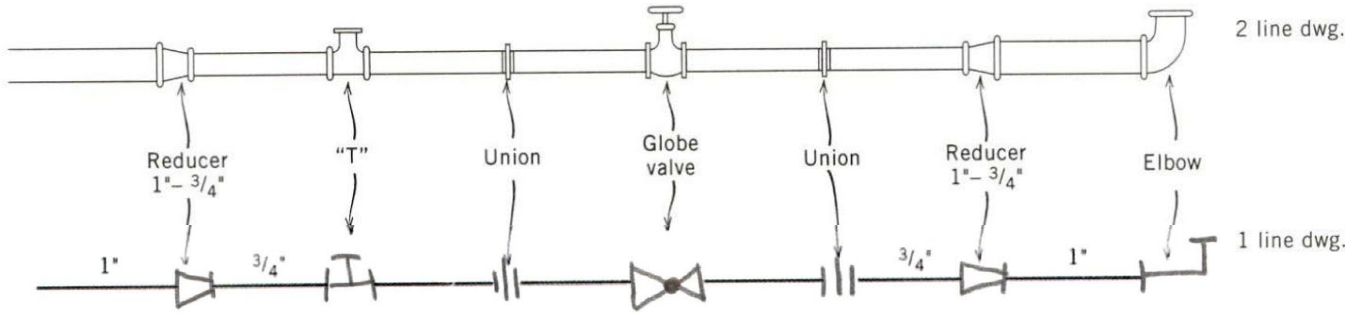
2016 CPC - Table 610.4

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 "

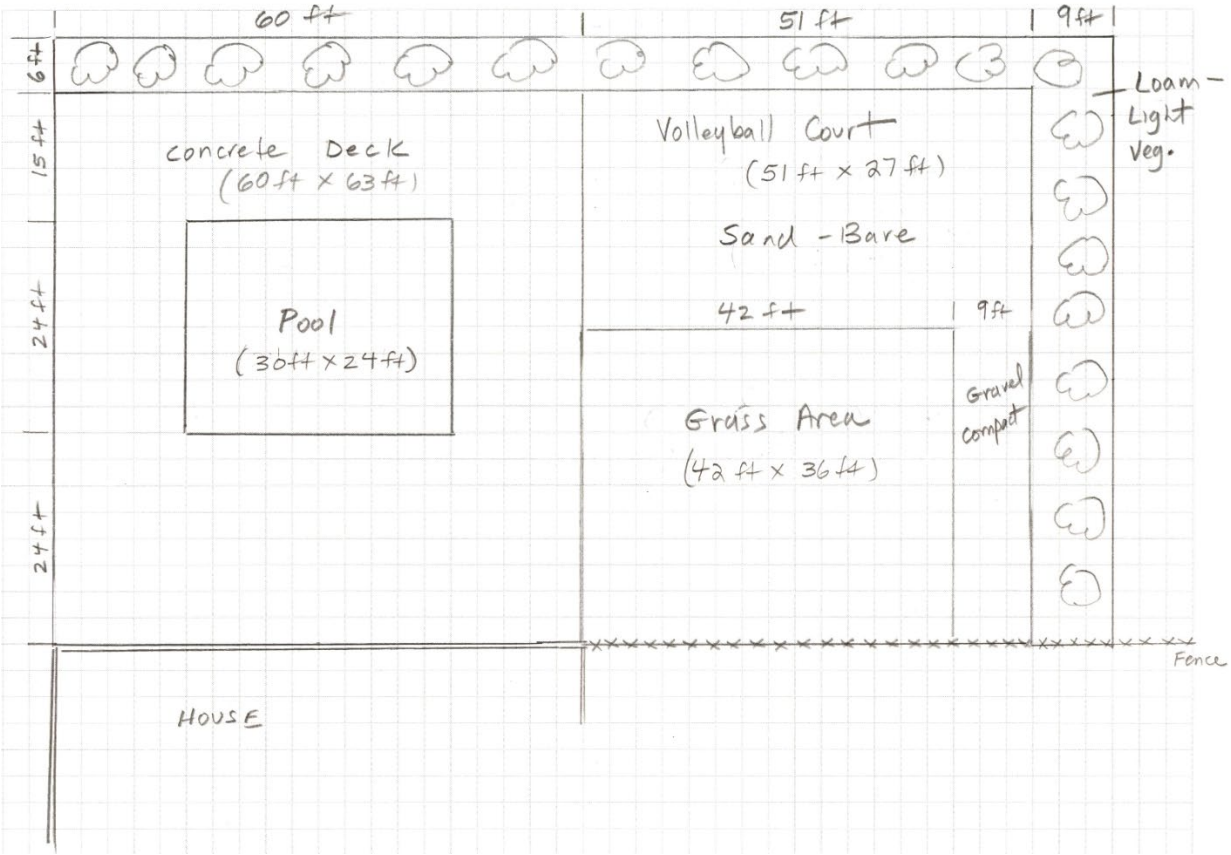
2. For the private residence shown write the individual DFU value above each fixture and determine the total DFU at the points indicated.



3. 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].



4. 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.



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 ft^2 – 720 ft^2 = 3,060 ft^2

Compact Gravel Area - C = 0.70
9 ft x 36 ft = 324 ft^2

Grass Area - C=0.35
42 ft x 36 ft = 1,512 ft^2

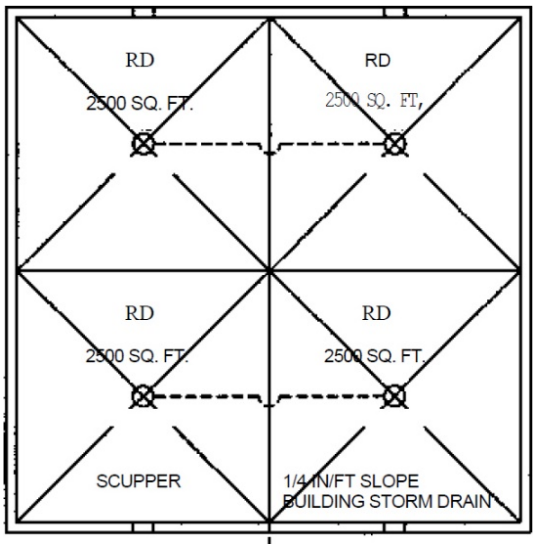
Loam Light Veg. - C=0.45
6 ft x 120 ft + 9 ft X 63 ft = 720 ft^2 + 567 ft^2 = 1,287 ft^2

Sand – Bare - C=0.50
51 ft x 27 ft = 1,377 ft^2

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

5. 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.



Appendix D Rainfall Rate
Wilmington, NC - Rainfall Rate = 4.4 inches / hr

Table 1101.12
Minimum Roof Drain Size - Each drain serves 2500 sf
2" 2880/4.4 = 636 sf
3" 8800/4.4 = 2000 sf
4" 18400/4.4 = 4182 sf **4" minimum drain**

Table 1101.8 – ¼ in/ft slope
Minimum Horizontal Drain Pipe – Each drain serves 2500 sf
4" 10,600/4.4 = 2409 sf
5" 18880/4.4 = 4290 sf **5" minimum horizonal drain pipe**

Table 1101.12
If one Leader serves each drain (Roof Area = 2500 sf)
3" 8800/4.4 = 2000 sf
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

If one Leader serves the entire roof (Roof Area = 10,000 sf)
5" 34600/4.4 = 7,864 sf
6" 54000/4.4 = 12,273 sf

6" minimum leader required