

Drainage Calculations

Method and Explanation:

We will NSPC (National Standard Plumbing Code) and DFU (Drainage Fixture Unit) method to calculate pipes sizes of black and grey water drainage system.

Step -1:

Using Table 11.4.1 (NSPC), Drainage Fixture Unit (DFU) Values, we get the following DFU values of plumbing fixture used in our project:

WC (Water Closet) = 4 DFU

WB (Wash Basin) = 1 DFU

KS (Kitchen Sink) = 2 DFU

FD (Floor Drain) = 0 DFU

Using table 11.4.1, we can calculate total DFU for horizontal and vertical pipe in each toilet.

DFU (Drainage Fixture Units) is measure of estimated discharge in given drainage system. It measure the amount of waste water flowing into plumbing fixtures.

For example, using Table 11.4.1 (NSPC) we find that for "Water Closet 1.6 GPF Gravity or Pressure Tank" for heavy-use assembly DFU will be 4.

Step - 2:

After calculating total DFU(Drainage Fixture Unit) for each plumbing fixture, we use Table 11.5.1B (NSPC), which gives maximum number of Drainage Fixture Unit (DFU) that may be connected to the horizontal or vertical pipe (Stack).

From Table 11.5.1B, we can get the following:

Up to 6 DFU, the pipe size will be 2 inch,

7 DFU to 20 DFU, the pipe size will be 3 inch

21 DFU to 160 DFU, the pipe size will be 4 inch.

161 DFU to 620 DFU, pipe size will be 6 inch.

Vertical Pipes (Also called Stack) can carry more DFU.

Using Table 11.5.1B (NSPC), we can tabulate the following:

Pipe Size (inch)	Horizontal (DFU)	Vertical Pipe (DFU)
2"	6 DFU	10 DFU
3"	20 DFU	48 DFU
4"	160 DFU	240 DFU
6"	620 DFU	960 DFU

Step – 3:

Using table 5.2 (NSPC), we get the minimum pipe size to be used for each plumbing fixtures.

WB (Wash Basin): 1-1/2", minimum pipe size (NSPC Table 5.2)

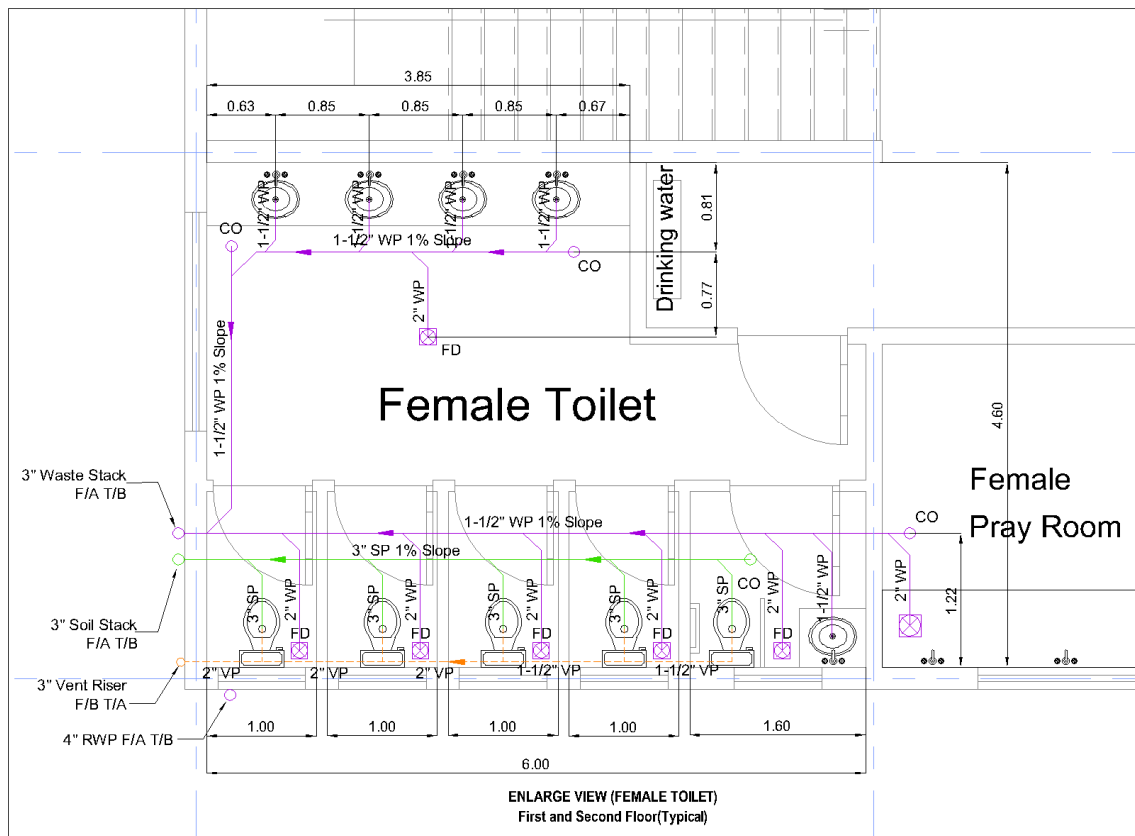
KS (Kitchen Sink): 1-1/2", minimum pipe size, (NSPC Table 5.2)

WC (Water Closet): 3" minimum pipe size. (UPC, Uniform Plumbing Code Table 7-3),

(Table 5.2, NSPC does not give minimum pipe size for WC. So we will use Table 7.3 from UPC (uniform Plumbing code) to get minimum pipe size for WC).

Step – 4: BLACK WATER PIPE SIZING IN FEMALE TOILETS (ALL FLOORS)

We will start our pipe size calculation from 2nd Floor (top floor). Because all drain is flowing down.



SECOND FLOOR – FEMALE TOILET

DFU for 01 WC = 4 DFU (From Table 11.4.1, NSPC)

We have total 05 Nos. of WC in this Female toilet.

Therefore, total DFU for 05 WC's in 2nd Floor Female Toilet = 5 x 4 DFU (i.e. 20 DFU)

Using the table 7.3 (UPC) individual pipe size for each WC shall be minimum 3". Using table 11.5.1B NSPC, 3" pipe can load only up to 20 DFU. Therefore, *horizontal pipe* size in 2nd Floor female toilet shall be minimum 3". And Vertical pipe size from 2nd Floor up to 1st Floor female toilet will be 3".

“Refer to Black Water Schematic Diagram for Female Toilets”.

FIRST FLOOR – FEMALE TOILET

DFU for 01 WC = 4 DFU (From Table 11.4.1, NSPC)

We have total 05 Nos. of WC in this toilet.

Total DFU for all 05 Nos. WC's in 1st Floor = 5 x 4 DFU (i.e. 20 DFU).

Now total DFU in First Floor = 1st floor DFU + 2nd Floor DFU
= 20+20 (40 DFU)

Using table 11.5.1B (NSPC), 3" pipe can load only up to 20 DFU. Therefore, *horizontal pipe* size in 1st floor toilet shall be minimum 3". But Vertical pipe size from 1st Floor to Ground Floor will be 4", because total DFU is 40 (which is more than 20 DFU).

GROUND FLOOR – FEMALE TOILET

Similarly, total DFU for all WC in Ground Floor = 5 x 4 DFU (i.e. 20 DFU).

Now total DFU in Ground Floor = 20 DFU (2nd Floor) + 20 DFU (1st Floor) +20 DFU (Ground Floor) = 60 DFU.

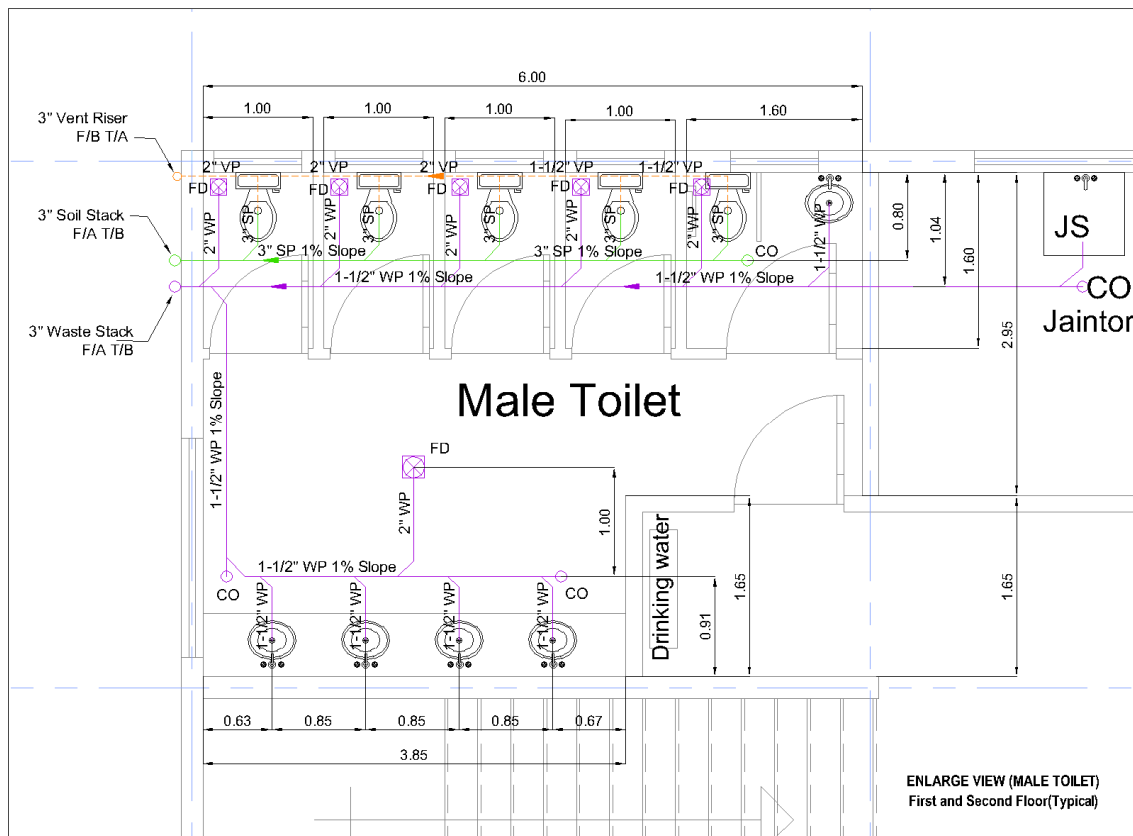
Individual and horizontal pipe size shall remain same i.e. minimum 3".

But Vertical pipe size from Ground Floor will be 4", since total DFU is more than 20.

“Refer to Black Water Schematic Diagram for Female Toilets”.

Step – 5: BLACK WATER PIPE SIZING IN MALE TOILETS (ALL FLOORS)

We will start our pipe size calculation from 2nd Floor (top floor). Because all drain is flowing down.



SECOND FLOOR – MALE TOILET

DFU for 01 WC = 4 DFU (From Table 11.4.1, NSPC)

We have total 05 Nos. of WC in this Male toilet.

Therefore, total DFU for 05 WC's in 2nd Floor Male Toilet = 5 x 4 DFU (i.e. 20 DFU)

Using the table 7.3 (UPC) individual pipe size for each WC shall be minimum 3". Using table 11.5.1B NSPC, 3" pipe can load only up to 20 DFU. Therefore, horizontal pipe size in 2nd Floor Male toilet shall be minimum 3". And Vertical pipe size from 2nd Floor up to 1st Floor Male toilet will be 3".

"Refer to Black Water Schematic Diagram for Male Toilets".

FIRST FLOOR – MALE TOILET

DFU for 01 WC = 4 DFU (From Table 11.4.1, NSPC)

We have total 05 Nos. of WC in this toilet.

Total DFU for all 05 Nos. WC's in 1st Floor = 5 x 4 DFU (i.e. 20 DFU).

Now total DFU in First Floor = 1st floor DFU + 2nd Floor DFU
= 20+20 (40 DFU)

Using table 11.5.1B (NSPC), 3" pipe can load only up to 20 DFU. Therefore, horizontal pipe size in 1st floor toilet shall be minimum 3". But Vertical pipe size from 1st Floor to Ground Floor will be 4", because total DFU is 40 (which is more than 20 DFU).

GROUND FLOOR – MALE TOILET

Similarly, total DFU for all WC in Ground Floor = 5 x 4 DFU (i.e. 20 DFU).

Now total DFU in Ground Floor = 20 DFU (2nd Floor) + 20 DFU (1st Floor) +20 DFU (Ground Floor) = 60 DFU.

Individual and horizontal pipe size shall remain same i.e. minimum 3".

But Vertical pipe size from Ground Floor will be 4", since total DFU is more than 20.

"Refer to Black Water Schematic Diagram for Male Toilets".

Step – 6: GREY WATER PIPE SIZING IN FEMALE TOILETS (ALL FLOORS)

We will start our pipe size calculation from 2nd Floor (top floor). Because all drain is flowing down.

SECOND FLOOR – FEMALE TOILET

DFU for 01 WB (Wash Basin) = 1 DFU (From Table 11.4.1, NSPC)

We have total 04 Nos. of WB in one side toilet 01 WB and 01 JS (Janitor Sink) in other side of same toilet.

Therefore, total DFU for 04 WB's in 2nd Floor Toilet = 4 x 1 DFU (i.e. 4 DFU).

Also, total DFU for 01 WB's & 01 JS in 2nd Floor Toilet = 1 x 1 DFU + 2 x 1 (i.e. 3 DFU)

1-1/2" pipe size can load up to 3 DFU in horizontal line and 2" can load up to 6 DFU in horizontal.

Therefore, horizontal pipe size will be 1-1/2" on each side.

Total DFU in vertical pipe (stack) = 4 DFU + 3 DFU = 7 DFU. Therefore, vertical pipe size will be 2". Since 2" can load only up to 10 DFU in vertical position (Stack).

"Refer to Grey Water Schematic Diagram for Female Toilets".

FIRST FLOOR – FEMALE TOILET

DFU for 01 WB (Wash Basin) = 1 DFU (From Table 11.4.1, NSPC)

We have total 04 Nos. of WB in one side toilet 01 WB and 01 JS (Janitor Sink) in other side of same toilet.

Therefore, total DFU for 04 WB's in 2nd Floor Toilet = 4 x 1 DFU (i.e. 4 DFU).

Also, total DFU for 01 WB's & 01 JS in 2nd Floor Toilet = 1 x 1 DFU + 2 x 1 (i.e. 3 DFU)

1-1/2" pipe size can load up to 3 DFU in horizontal line and 2" can load up to 6 DFU in horizontal.

Therefore, horizontal pipe size will be 1-1/2" on each side.

Total DFU in vertical pipe (stack) = 4 DFU + 3 DFU + 7 DFU (1st Floor DFU) = 14 DFU.

Therefore, vertical pipe size will be 3". Since 2" can load only up to 10 DFU in vertical position (Stack). But 3" can load up to 48 DFU in vertical position (Stack).

"Refer to Grey Water Schematic Diagram for Female Toilets".

GROUND FLOOR – FEMALE TOILET

DFU for 01 WB (Wash Basin) = 1 DFU (From Table 11.4.1, NSPC)

We have total 04 Nos. of WB in one side toilet 01 WB and 01 JS (Janitor Sink) in other side of same toilet.

Therefore, total DFU for 04 WB's in 2nd Floor Toilet = 4 x 1 DFU (i.e. 4 DFU).

Also, total DFU for 01 WB's & 01 JS in 2nd Floor Toilet = 1 x 1 DFU + 2 x 1 (i.e. 3 DFU)

1-1/2" pipe size can load up to 3 DFU in horizontal line and 2" can load up to 6 DFU in horizontal.

Therefore, horizontal pipe size will be 1-1/2" on each side.

Total DFU in vertical pipe (stack) = 4 DFU + 3 DFU + 7 DFU (1st Floor DFU) + 7 DFU (Ground Floor) = 21 DFU.

Therefore, vertical pipe size will be 3". Since 2" can load only up to 10 DFU in vertical position (Stack). But 3" can load up to 48 DFU in vertical position (Stack).

Horizontal pipe size in Ground Floor shall be 4", since 3" can load only up to 20 DFU in horizontal position.

"Refer to Grey Water Schematic Diagram for Female Toilets".

Step – 7: GREY WATER PIPE SIZING IN MALE TOILETS (ALL FLOORS)

We will start our pipe size calculation from 2nd Floor (top floor). Because all drain is flowing down.

SECOND FLOOR – MALE TOILET

DFU for 01 WB (Wash Basin) = 1 DFU (From Table 11.4.1, NSPC)

We have total 04 Nos. of WB in one side toilet 01 WB and 01 JS (Janitor Sink) in other side of same toilet.

Therefore, total DFU for 04 WB's in 2nd Floor Toilet = 4 x 1 DFU (i.e. 4 DFU).

Also, total DFU for 01 WB's & 01 JS in 2nd Floor Toilet = 1 x 1 DFU + 2 x 1 (i.e. 3 DFU)

1-1/2" pipe size can load up to 3 DFU in horizontal line and 2" can load up to 6 DFU in horizontal.

Therefore, horizontal pipe size will be 1-1/2" on each side.

Total DFU in vertical pipe (stack) = 4 DFU + 3 DFU = 7 DFU. Therefore, vertical pipe size will be 2". Since 2" can load only up to 10 DFU in vertical position (Stack).

"Refer to Grey Water Schematic Diagram for Male Toilets".

FIRST FLOOR – MALE TOILET

DFU for 01 WB (Wash Basin) = 1 DFU (From Table 11.4.1, NSPC)

We have total 04 Nos. of WB in one side toilet 01 WB and 01 JS (Janitor Sink) in other side of same toilet.

Therefore, total DFU for 04 WB's in 2nd Floor Toilet = 4 x 1 DFU (i.e. 4 DFU).

Also, total DFU for 01 WB's & 01 JS in 2nd Floor Toilet = 1 x 1 DFU + 2 x 1 (i.e. 3 DFU)

1-1/2" pipe size can load up to 3 DFU in horizontal line and 2" can load up to 6 DFU in horizontal.

Therefore, horizontal pipe size will be 1-1/2" on each side.

Total DFU in vertical pipe (stack) = 4 DFU + 3 DFU + 7 DFU (1st Floor DFU) = 14 DFU.

Therefore, vertical pipe size will be 3". Since 2" can load only up to 10 DFU in vertical position (Stack). But 3" can load up to 48 DFU in vertical position (Stack).

"Refer to Grey Water Schematic Diagram for Male Toilets".

GROUND FLOOR – MALE TOILET

DFU for 01 WB (Wash Basin) = 1 DFU (From Table 11.4.1, NSPC)

We have total 04 Nos. of WB in one side toilet 01 WB and 01 JS (Janitor Sink) in other side of same toilet.

Therefore, total DFU for 04 WB's in 2nd Floor Toilet = 4 x 1 DFU (i.e. 4 DFU).

Also, total DFU for 01 WB's & 01 JS in 2nd Floor Toilet = 1 x 1 DFU + 2 x 1 (i.e. 3 DFU)

1-1/2" pipe size can load up to 3 DFU in horizontal line and 2" can load up to 6 DFU in horizontal.

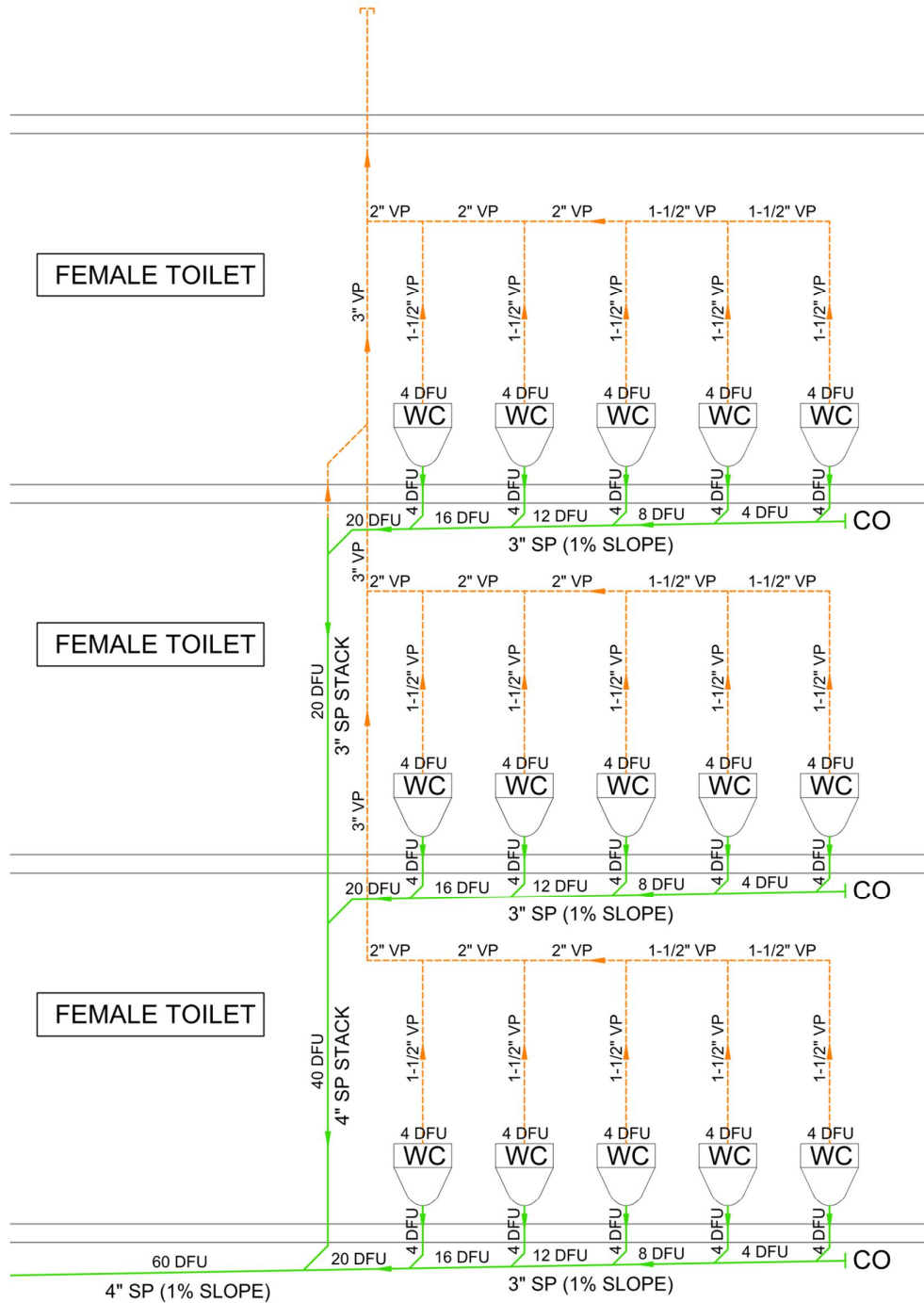
Therefore, horizontal pipe size will be 1-1/2" on each side.

Total DFU in vertical pipe (stack) = 4 DFU + 3 DFU + 7 DFU (1st Floor DFU) + 7 DFU (Ground Floor) = 21 DFU.

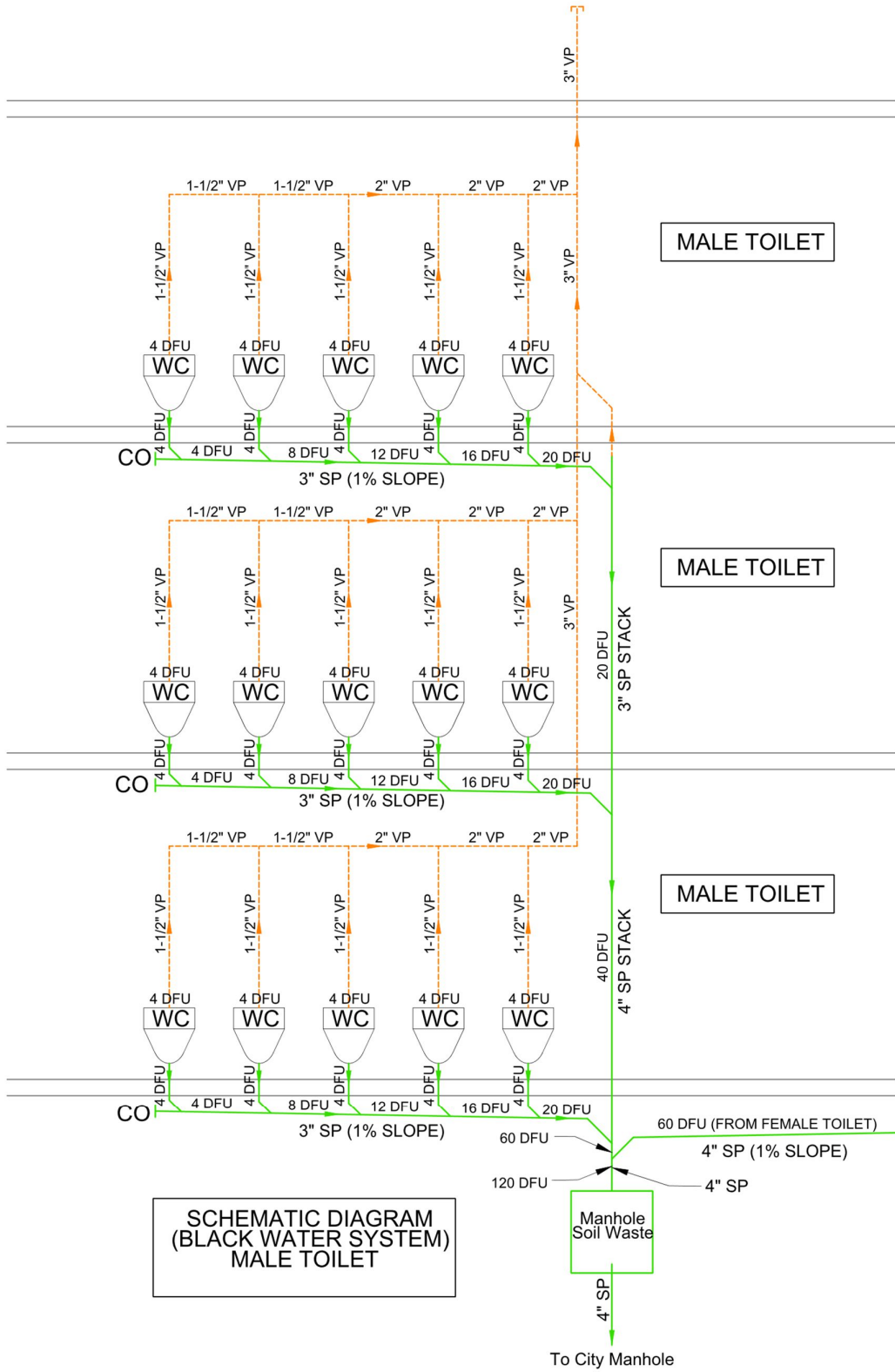
Therefore, vertical pipe size will be 3". Since 2" can load only up to 10 DFU in vertical position (Stack). But 3" can load up to 48 DFU in vertical position (Stack).

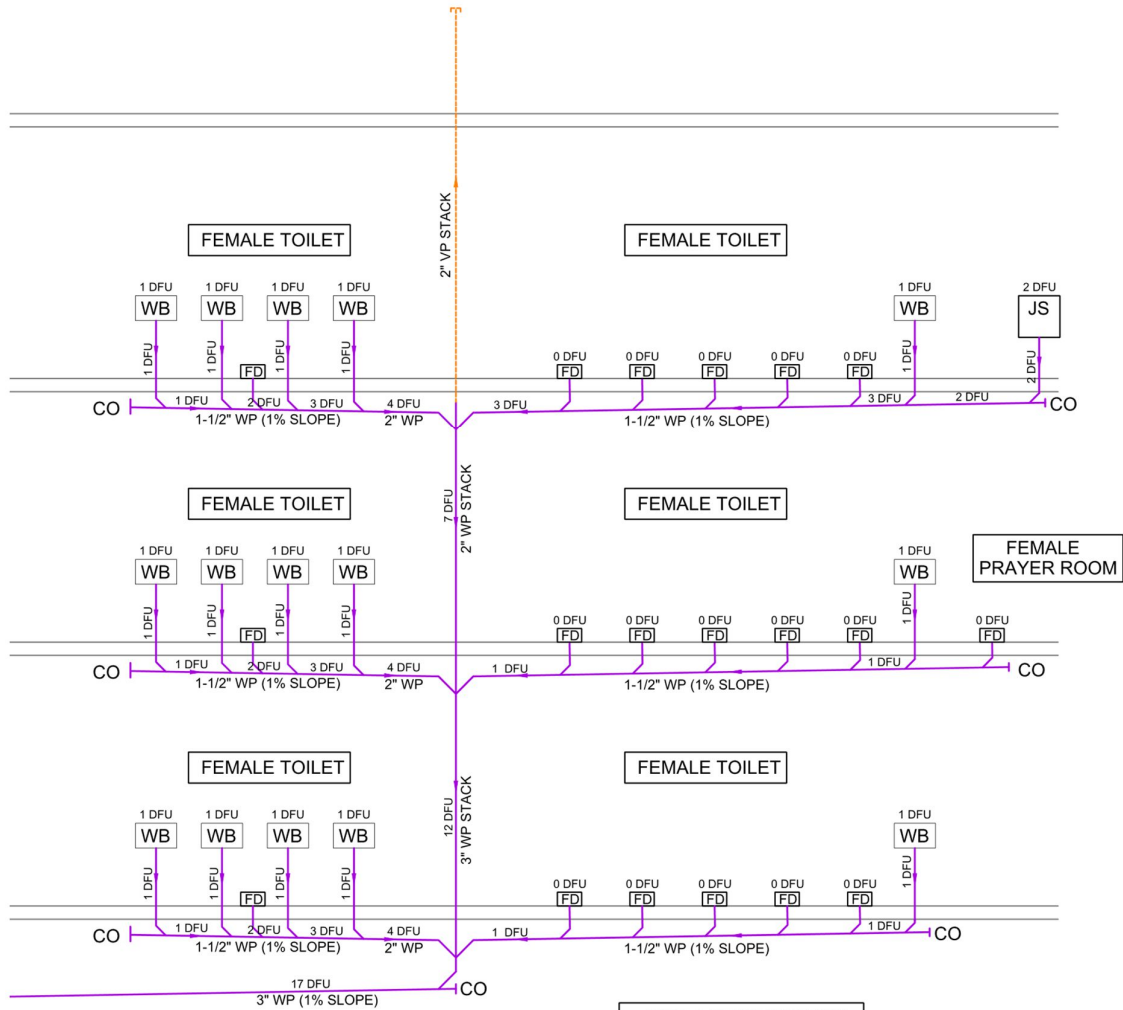
Horizontal pipe size in Ground Floor shall be 4", since 3" can load only up to 20 DFU in horizontal position.

"Refer to Grey Water Schematic Diagram for Male Toilets".

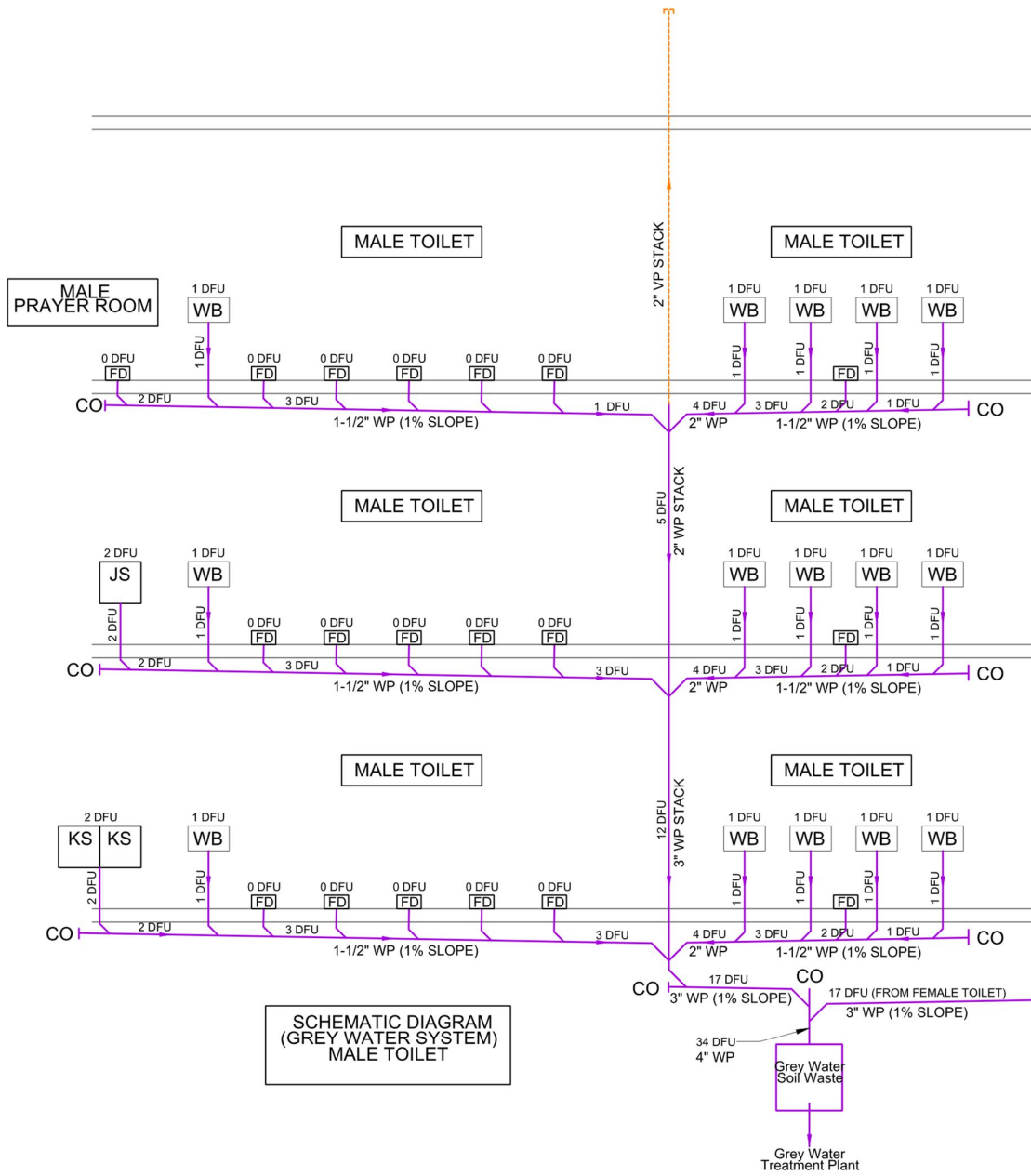


**SCHEMATIC DIAGRAM
(BLACK WATER SYSTEM)
FEMALE TOILET**





SCHEMATIC DIAGRAM
(GREY WATER SYSTEM)
FEMALE TOILET



**Table 11.4.1 (Continued)
DRAINAGE FIXTURE UNIT (DFU) VALUES**

	HEAVY-USE ASSEMBLY		
	OTHER THAN DWELLING UNITS		
	SERVING 3 OR MORE DWELLING UNITS		
	INDIVIDUAL DWELLING UNITS		
INDIVIDUAL FIXTURES			
Bathtub or Combination Bath/Shower, 1-1/2" Trap	2	2	
Bidet, 1-1/4" Trap	1	1	
Clothes Washer, Domestic, 2" Standpipe	3	3	3
Dishwasher, Domestic, with Independent Drain	2	2	2
Drinking Fountain or Watercooler			0.5
Food-Waste-Grinder, Commercial, 2" Min Trap			3
Floor Drain, Auxiliary			0
Kitchen Sink, Domestic, with One 1-1/2" Trap	2	2	2
Kitchen Sink, Domestic, with Food-Waste-Grinder	2	2	2
Kitchen Sink, Domestic, with Dishwasher	3	3	3
Kitchen Sink, Domestic, with Grinder and Dishwasher	3	3	3
Laundry Sink, One or Two Compartments, 1-1/2" Waste	2	2	2
Laundry Sink, with Discharge from Clothes Washer	2	2	2
Lavatory, 1-1/4" Waste	1	1	1
Mop Basin, 3" Trap			3
Service Sink, 3" Trap			3
Shower Stall, 1-1/2" Trap	2	2	2
Shower Stall, 2" Trap	2	2	2
Showers, Group, per Head (Continuous Use)			5
Sink, 1-1/2" Trap	2	2	2
Sink, 2" Trap	3	3	3
Sink, 3" Trap			5
Trap Size, 1-1/4" (Other)	1	1	1
Trap Size, 1-1/2" (Other)	2	2	2
Trap Size, 2" (Other)	3	3	3
Trap Size, 3" (Other)			5
Trap Size, 4" (Other)			6
Urinal, 1.0 GPF			4
Urinal, Greater Than 1.0 GPF			5
Wash Fountain, 1-1/2" Trap			2
Wash Fountain, 2" Trap			3
Wash Sink, Each Set of Faucets			2

Table 11.4.1 (Continued) DRAINAGE FIXTURE UNIT (DFU) VALUES				
HEAVY-USE ASSEMBLY				
OTHER THAN DWELLING UNITS				
SERVING 3 OR MORE DWELLING UNITS				
INDIVIDUAL DWELLING UNITS				
	3	4	5	6
Water Closet, 1.6 GPF Gravity or Pressure Tank	3	3	4	6
Water Closet, 1.6 GPF Flushometer Valve	3	3	4	6
Water Closet, 3.5 GPF Gravity Tank	4	4	6	8
Water Closet, 3.5 GPF Flushometer Valve	4	4	6	8
Whirlpool Bath or Combination Bath/Shower, 1-1/2" Trap	2	2		

NOTES FOR TABLE 11.4.1:

1. A Bathroom Group, for the purposes of this Table, consists of not more than one water closet, up to two lavatories, and either one bathtub, one bath/shower combination, or one shower stall. Other fixtures within the bathing facility shall be counted separately to determine the total drainage fixture unit load.
2. A Half-Bath or Powder Room, for the purposes of this Table, consists of one water closet and one lavatory.
3. For unlisted fixtures, refer to a listed fixture having a similar flow and frequency of use.
4. When drainage fixture unit (DFU) values are added to determine the load on the drainage system or portions thereof, round the sum to the nearest whole number before referring to Tables 11.5.1A, 11.5.1B, or 12.16.6A for sizing the drainage and vent piping. Values of 0.5 or more should be rounded up to the next higher whole number (9.5 = 10 DFU). Values of 0.4 or less should be rounded down to the next lower whole number (9.4 = 9 DFU).
5. "Other Than Dwelling Units" applies to business, commercial, industrial, and assembly occupancies other than those defined under "Heavy-Use Assembly." Included are the public and common areas in hotels, motels, and multi-dwelling buildings.
6. "Heavy-Use Assembly" applies to toilet facilities in occupancies that place heavy, but intermittent, time-based loads on the drainage system, such as; schools, auditoriums, stadiums, race courses, transportation terminals, theaters, and similar occupancies where queuing is likely to occur during periods of peak use.
7. Where other than water-supplied fixtures discharge into the drainage system, allow 2 DFU for each gallon per minute (gpm) of flow. (See Section 11.4.2.)

Table 5.2 MINIMUM SIZE OF NON-INTEGRAL TRAPS	
Plumbing Fixture	Trap Size in inches
Bathtub (with or without overhead shower)	1-1/2
Bidet	1-1/4
Clothes washing machine standpipe	2
Combination sink and wash (laundry) sink with food waste grinder unit	1-1/2 (1)
Combination kitchen sink, domestic dishwasher, and food waste grinder	1-1/2
Dental unit or cuspidor	1-1/4
Dental lavatory	1-1/4
Drinking fountain	1-1/4
Dishwasher, commercial	2
Dishwasher, domestic (non-integral trap)	1-1/2
Floor drain	2
Food waste grinder, commercial use	2
Food waste grinder, domestic use	1-1/2
Kitchen sink, domestic, with food waste grinder unit	1-1/2
Kitchen sink, domestic	1-1/2
Lavatory, common (private and public)	1-1/4
Lavatory (barber shop, beauty parlor or surgeon's)	1-1/2
Lavatory, multiple type (wash fountain or wash sink)	1-1/2
Laundry tray (1 or 2 compartments)	1-1/2
Shower stall or shower drain (single shower head)	1-1/2
Shower stall or shower drain (multiple shower heads)	2
Sink (surgeon's)	1-1/2
Sink (flushing rim type, flush valve supplied)	3
Sink (service type with floor outlet trap standard)	3
Sink (service type with P trap)	2
Sink, commercial (pot, scullery, or similar type)	2
Sink, commercial (with food grinder unit)	2

**Table 11.5.1B
HORIZONTAL FIXTURE BRANCHES AND STACKS**

Maximum Number of Drainage Fixture Units (DFU) That May Be Connected to Any Horizontal Fixture Branch, a Stack of Three Branch Intervals or Less, or Stacks of more than Three Branch Intervals

Pipe Size- Inches	Any Horizontal Fixture Branch ¹	One Stack of Three Branch Intervals or Less	Stacks with more than Three Branch Intervals	
			Total for Stack	Total in One Branch Interval
1-1/4	1	1	1	1
1-1/2	3	4	8	2
2	6	10	24	6
3	20 ²	48 ³	72 ³	20 ³
4	160	240	500	90
5	360	540	1,100	200
6	620	960	1,900	350
8	1,400	2,200	3,600	600
10	2,500	3,800	5,600	1,000
12	3,900	8,400	8,400	1,500
15	7,000			

Table 7-3

UNIFORM PLUMBING CODE

TABLE 7-3
Drainage Fixture Unit Values (DFU)

Inch	mm
1-1/4	32
1-1/2	40
2	50
2-1/2	65
3	80

Plumbing Appliance, Appurtenance, or Fixture	Min. Size Trap and Trap Arm ¹	Private	Public	Assembly ²
Bathtub or Combination Bath/Shower.....	1-1/2"	2.0	2.0	
Bidet.....	1-1/4"	1.0		
Bidet.....	1-1/2"	2.0		
Clothes Washer, domestic, standpipe ³	2"	3.0	3.0	3.0
Dental Unit, cuspidor.....	1-1/4"		1.0	1.0
Dishwasher, domestic, with independent drain.....	1-1/2"	2.0	2.0	2.0
Drinking Fountain or Watercooler (per head).....	1-1/4"	0.5	0.5	1.0
Food-Waste-Grinder, commercial.....	2"		3.0	3.0
Floor Drain, emergency.....	2"		0.0	0.0
Floor Drain (for additional sizes see Section 702).....	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, single.....	1-1/4"	1.0	1.0	1.0
Lavatory, in sets of two or three.....	1-1/2"	2.0	2.0	2.0
Washfountain.....	1-1/2"		2.0	2.0
Washfountain.....	2"		3.0	3.0
Mobile Home, trap.....	3"	12.0		
Receptor, indirect waste ⁴	1-1/2"			See footnote ^{1,2}
Receptor, indirect waste ⁴	2"			See footnote ^{1,4}
Receptor, indirect waste ⁴	3"			See footnote ¹
Sinks				
Bar.....	1-1/2"	1.0		
Bar.....	1-1/2"		2.0	2.0
Clinical.....	3"		6.0	6.0
Commercial with food waste.....	1-1/2"		3.0	3.0
Special Purpose.....	1-1/2"	2.0	3.0	3.0
Special Purpose.....	2"	3.0	4.0	4.0
Special Purpose.....	3"		6.0	6.0
Kitchen, domestic.....	1-1/2"	2.0	2.0	
(with or without food-waste grinder and/or dishwasher)				
Laundry.....	1-1/2"	2.0	2.0	2.0
(with or without discharge from a clothes washer)				
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 ⁵	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.....	1-1/2"	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

¹ Indirect waste receptors shall be sized based on the total drainage capacity of the fixtures that drain therein to, in accordance with Table 7-4.

² Provide a 2" (51 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 (3) or more clothes washers shall be rated at six (6) fixture units each for purposes of sizing common horizontal and vertical drainage piping.

⁶ Water closets shall be computed as six (6) fixture units when determining septic tank sizes based on Appendix K of this code.

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

⁸ Assembly [Public Use (See Table 4-1)].

Vent Pipe Sizing:

Table 12.16 (National standard plumbing code illustrated) we find that 1-1/2” vent pipe can connect up to 8 drainage fixture units. And 2” vent pipe can connect up to 20 DFU. Each WC has a 1-1/2” vent pipe connected to it as each WC has a value of 4 DFU. As the vent pipes are connected together as shown in figure 1.1 the DFU value exceeds 8 DFU which means that a 2” pipe has to be used.

Sizing vent pipe based on this table.

Refer to the black and grey water drainage riser diagram.

Table 12.16 SIZE AND LENGTH OF VENTS										
Size of Fixture Drain, Drainage Stack, or Building Drain (inches)	Drainage Fixture Units Connected	Diameter of Vent Required (inches) for the Maximum Length of Vent (feet)								
		1-1/4”	1-1/2”	2”	2-1/2”	3”	4”	5”	6”	8”
1-1/4”	1	(1)								
1-1/2”	8	50	150							
2”	12	30	75	200						
2”	20	26	50	150						
3”	10		30	100	200	600				
3”	30			60	200	500				
3”	60			50	80	400				
4”	100			35	100	260	1000			
4”	200			30	90	250	900			
4”	500			20	70	180	700			
5”	200				35	80	350	1000		
5”	500				30	70	300	900		
5”	1100				20	50	200	700		
6”	350					50	200	400	1300	
6”	620					30	125	300	1100	
6”	960					24	100	250	1000	
6”	1900					20	70	200	700	
8”	600						50	150	500	1300
8”	1400						40	100	400	1200
8”	2200						30	80	350	1100
8”	3600						25	60	250	800
10”	1000							75	125	1000
10”	2500							50	100	500
10”	3800							30	80	350
10”	5600							25	60	250

Calculating Roof Drains Pipe Sizing

Using table 11-1 (Metric) from NSPC:

Considering maximum rainfall of Kuwait to be 84.12 mm/h according to Kuwait Meteorological Center (2019).

The projected roof Area of our building is 673 m² (From AutoCAD drawings)

The minimum roof drain pipe size shall be 100 mm (4”) at 6 places.

These values show that our pipe size should be 100mm which is 4 inches as our building area is more than 321 m². Our design will have 4-inch drainpipes at 6 places so that the water can be drained easily within our 1% slope.

STORM DRAINAGE

Table 11-1

TABLE 11-1
Sizing Roof Drains, Leaders, and Vertical Rainwater Piping^{1,2,3}

Size of Drain, Leader, or Pipe, Inches	Flow, gpm	Maximum Allowable Horizontal Projected Roof Areas Square Feet at Various Rainfall Rates					
		1 in./h	2 in./h	3 in./h	4 in./h	5 in./h	6 in./h
2	23	2,176	1,088	725	544	435	363
3	67	6440	3,220	2,147	1,610	1,288	1,073
4	144	13,840	6,920	4,613	3,460	2,768	2,307
5	261	25,120	12,560	8,373	6,280	5,024	4,187
6	424	40,800	20,400	13,600	10,200	8,160	6,800
8	913	88,000	44,000	29,333	22,000	17,600	14,667

TABLE 11-1 (Metric)
Sizing Roof Drains, Leaders, and Vertical Rainwater Piping^{1,2,3}

Size of Drain Leader or Pipe, mm	Flow, L/s	Maximum Allowable Horizontal Projected Roof Areas Square Meters at Various Rainfall Rates					
		25 mm/h	50 mm/h	75 mm/h	100 mm/h	125 mm/h	150 mm/h
50	1.5	202	101	67	51	40	34
80	4.2	600	300	200	150	120	100
100	9.1	1,286	643	429	321	257	214
125	16.5	2,334	1,117	778	583	467	389
150	26.8	3,790	1,895	1,263	948	758	632
200	57.6	8,175	4,088	2,725	2,044	1,635	1,363