



DRIPLINE INSTALLATION

INSTRUCTOR: JOHN RAFFIANI

HANDOUT

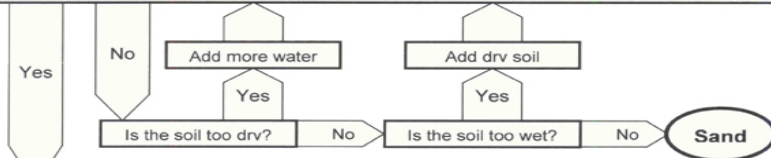


IF YOU ARE UNSURE OF THE SOIL TEXTURE DON'T BE AFRAID TO USE THE “RIBBON AND FEEL” METHOD

Soil Texture by Feel (EXT.COLOSTATE.EDU)

Start: Place soil in palm of hand. Add water drop-wise and knead the soil into a smooth and plastic consistency, like moist putty.

Does the soil remain in a ball when squeezed?



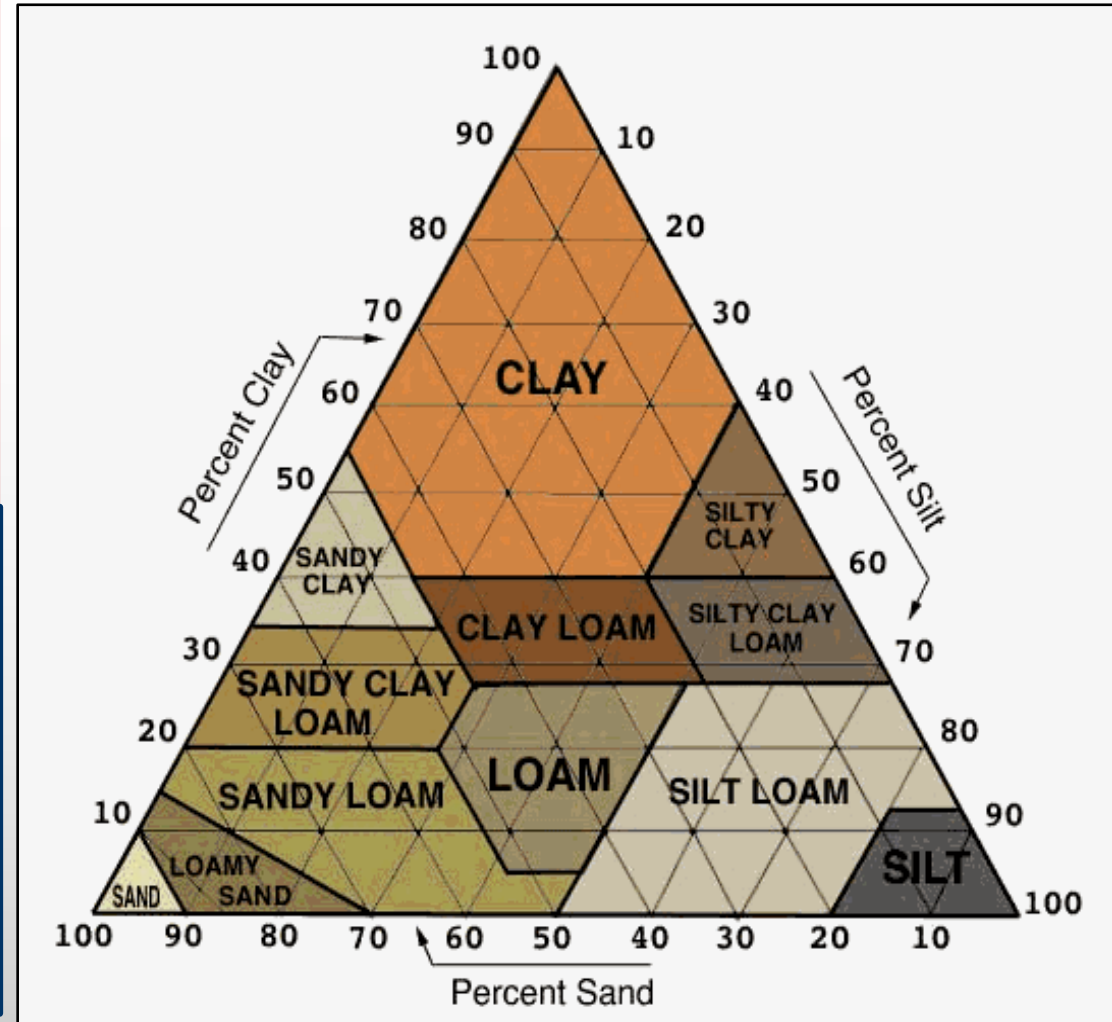
Place ball of soil between thumb and forefinger, gently pushing the soil between the thumb, squeezing it upward into a ribbon. Form a ribbon of uniform thickness and width. Allow ribbon to emerge and extend over the forefinger, breaking from its own weight.

Does the soil form a ribbon?



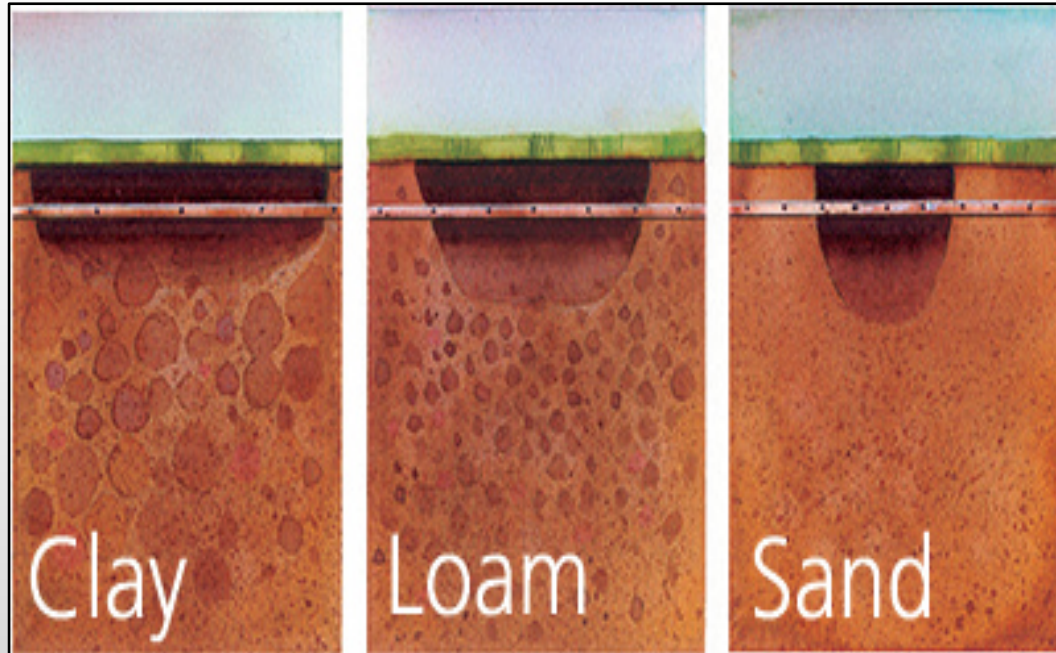
What kind of ribbon does it form?

Moisten a pinch of soil in palm and rub with forefinger		Forms a weak ribbon less than 1" before breaking	Forms a ribbon 1-2" before breaking	Forms a ribbon 2" or longer before breaking
Does it feel very gritty?	Yes	Sandy Loam	Sandy Clay Loam	Sandy Clay
Does it feel equally gritty and smooth?	Yes	Loam	Clay Loam	Clay
Does it feel very smooth?	Yes	Silt Loam	Silty Clay Loam	Silty Clay



WATER MOVEMENT IN SOILS

Inches of AW per Inch At Field Capacity



(NETAFIMUSA)

Soil Texture Class	Available Water (in./in.)	Basic Intake Rate (in./in.)
Clay	.17	.10
Silty Clay	.17	.15
Clay Loam	.18	.20
Loam	.17	.35
Sandy Loam	.12	.40
Loamy Sand	.08	.50
Sand	.06	.60

(WATERMOTION.COM)

QUICK QUIZ

IF YOUR SOIL IS CLAY LOAM AT FIELD CAPACITY HOW MUCH WATER IS AVAILABLE TO A SHRUB WITH 8 INCH ROOTS?

ANSWER:

$AW =$

8 INCH ROOTS X 0.18 INS./IN.

$= 1.44$ INCHES OF WATER

AVAILABLE TO THE PLANT

Soil Texture Class	Available Water (in./in.)	Basic Intake Rate (in./in.)
Clay	.17	.10
Silty Clay	.17	.15
Clay Loam	.18	.20
Loam	.17	.35
Sandy Loam	.12	.40
Loamy Sand	.08	.50
Sand	.06	.60

WATERING TO THE ROOT ZONE - QUICK QUIZ

$$AW = FC - PWP$$

Back to our chart showing **AW** per inch of 0.18 for clay loam:

As the soil approaches **PWP** (not MAD) it will need to

replace the prior 8 inch root zone's 1.44 inches

lost to **ET**. If your drip zone has a **PR** of

0.45 ins./hr. How long would you need to run

the zone to make up the 1.44 inches of water?

ANSWER:

$1.44 / 0.45 = 3.2 \times 60 = 192$ minutes. Assume an **IR** of 0.20 ins./hr. for clay loam.

What would be your maximum run time before runoff? How many run cycles?

Answer: $0.20 \text{ IR} / 0.45 \text{ PR} \times 60 = 26$ minutes. Number of cycles = $192\text{m} / 26\text{m} = 7$ cycles minimum *

* Chances are this plant is a goner. Not enough time unless runoff/ponding is not a problem for this emergency.

Soil Texture Class	Available Water (in./in.)	Basic Intake Rate (in./in.)
Clay	.17	.10
Silty Clay	.17	.15
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Loam	.17	.35
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Sand	.06	.60

CONTROL KIT COMPONENTS

- LOW FLOW SOLENOID VALVES – 0.2 GPM MINIMUM (12 GPH)
- PRESSURE REDUCER (30-50 PSI)
- MESH FILTER (200 MESH = 75 MICRONS)

THE HIGHER THE MESH # THE SMALLER THE MICRONS AND THE SMALLER THE PARTICLE ALLOWED TO PASS THROUGH TO THE EMITTERS

WHEN DESIGNING A DRIPLINE INSTALLATION
THINK IN *GALLONS PER HOUR*
CONVERT TO *GPM* WHEN CHOOSING HEADER
SIZE AND CONTROL KITS

- $100 \text{ GPH} = 1.67 \text{ GPM}$
- $1000 \text{ GPH} = 16.7 \text{ GPM}$

CONVERTING *GPH* TO *GPM* AND *GPM* TO *GPH*

GPH (Gallons Per Hour) TO *GPM* (Gallons Per Minute)

EXAMPLE:

45 *GPH* DIVIDED BY 60 = 0.75 *GPM*

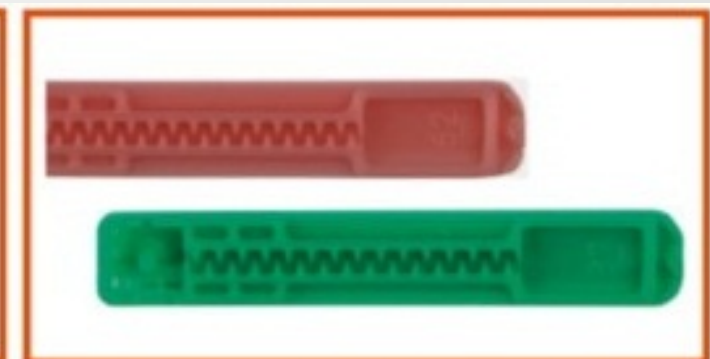
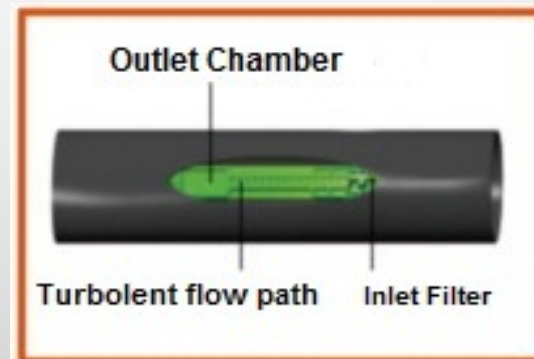
GPM (Gallons Per Minute) TO *GPH* (Gallons Per Hour)

EXAMPLE:

3.5 *GPM* MULTIPLY BY 60 = 210 *GPH*

17MM DRIPLINE

DRIPLINE (IMAGES COURTESY OF NETAFIM AND RAIN BIRD)

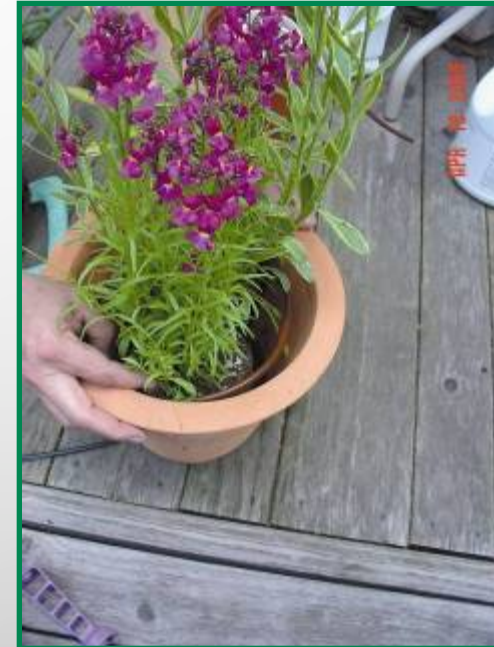


1/4" LANDSCAPE DRIP LINE (COURTESY OF RAIN BIRD)

- 6" AND 12" SPACING
- 100' COIL LENGTHS
- 10 TO 40 PSI OPERATING RANGE
- EMITTER FLOW RATE: 0.8 GPH AT 30 PSI
- NON PRESSURE COMPENSATING EMITTERS

Maximum Length of Run (feet)

Emitter Spacing	Maximum Length of Run	Flow per Ft. @ 15 psi
6"	19 feet	1 GPH/ft.
12"	33 feet	0.5 GPH/ft



PRACTICE PROBLEM 1

DETERMINE GPM USED FOR 14 CIRCULAR PLANTERS

- 1/4 INCH DRIPLINE 0.8 GPH EMITTERS @ 30 PSI - 6 INCH SPACINGS
- DIAMETER OF DRIPLINE RING IN PLANTER - 16 INCHES



SOLUTION:

- CIRCUMFERENCE IS $2 \times 3.14159 \left(\pi \right) 8 \text{ INS.} = 50.27 \text{ INCHES}$
- $50.27 \text{ INCHES} / 6 \text{ INCH EMITTER SPACING} = 8 \text{ EMITTERS PER PLANTER}$
- $8 \text{ EMITTERS} \times 0.8 \text{ GPH} = 6.4 \text{ GPH PER PLANTER}$
- $6.4 \text{ GPH} / 60 = 0.11 \text{ GPM PER PLANTER}$
- $0.11 \text{ GPM} \times 14 \text{ PLANTERS} = 1.54 \text{ GPM}$

BONUS QUIZ:

Prior to installing the dripline for your client they tell you they use 6.0 gallons every 3 days to keep the plants happy and don't want to lose the plants while on vacation. What is the run time per cycle every 3rd day?

$6.0 \text{ GALLONS} / 1.54 \text{ GPM} \approx 4 \text{ MINUTES}$

DRIPLINE TUBING FROM VARIOUS MANUFACTURERS

- EMITTER GPH DISCHARGE RATES OF 0.26, 0.33, 0.40, 0.53, 0.60, 0.77, 0.80, 0.90 AND 1.16
- EMITTER SPACINGS - 6 INCHES, 12 INCHES, 18 INCHES AND 24 INCHES
- EMITTERS WITH CHECK VALVES OPTIONAL FOR SLOPES
- OPTIONAL COPPER USED TO STOP ROOT INTRUSION
(OR AN EMBEDDED HERBICIDE SUCH AS ROOTGUARD)

DRIPLINE EMITTERS WITH INTEGRATED CHECK VALVES

ADVANTAGES OF A CHECK VALVE:

- 3.5 PSI CHECK VALVE BUILT IN TO EVERY EMITTER
- UP TO 8' ELEVATION CHANGE
- NECESSARY FOR SLOPED AREAS
- **HELPS PREVENT VACUUM ACTION & GRIT SUCTION**
- EVEN WATERING TOP TO BOTTOM
- NO DRAINAGE AT LOW POINTS
- DRIPLINE REMAINS CHARGED AFTER IRRIGATION CYCLE

DISADVANTAGES:

- FREEZE DAMAGE IF NOT

WINTERIZED CORRECTLY*

- * COMPRESSED AIR INPUT @ 40 PSI OR LESS. WAIT UNTIL EMITTERS ARE “HISSING” THEN BRIEFLY OPEN FLUSH VALVE AT LOW POINT FOR FINAL WATER DISCHARGE (**MY METHOD**)



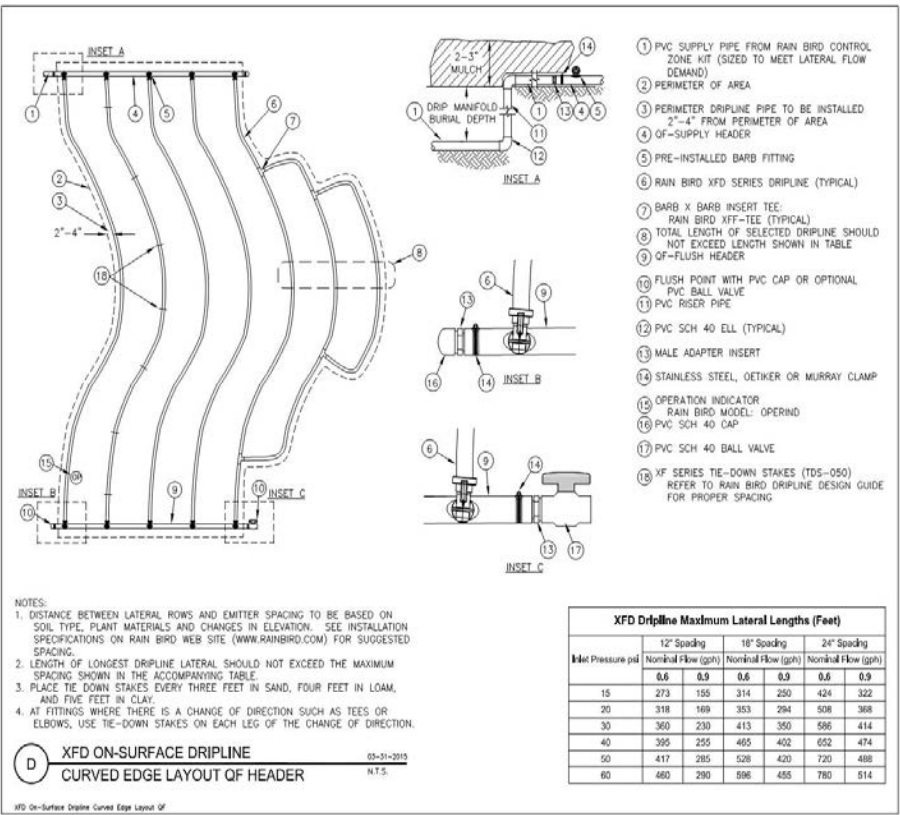
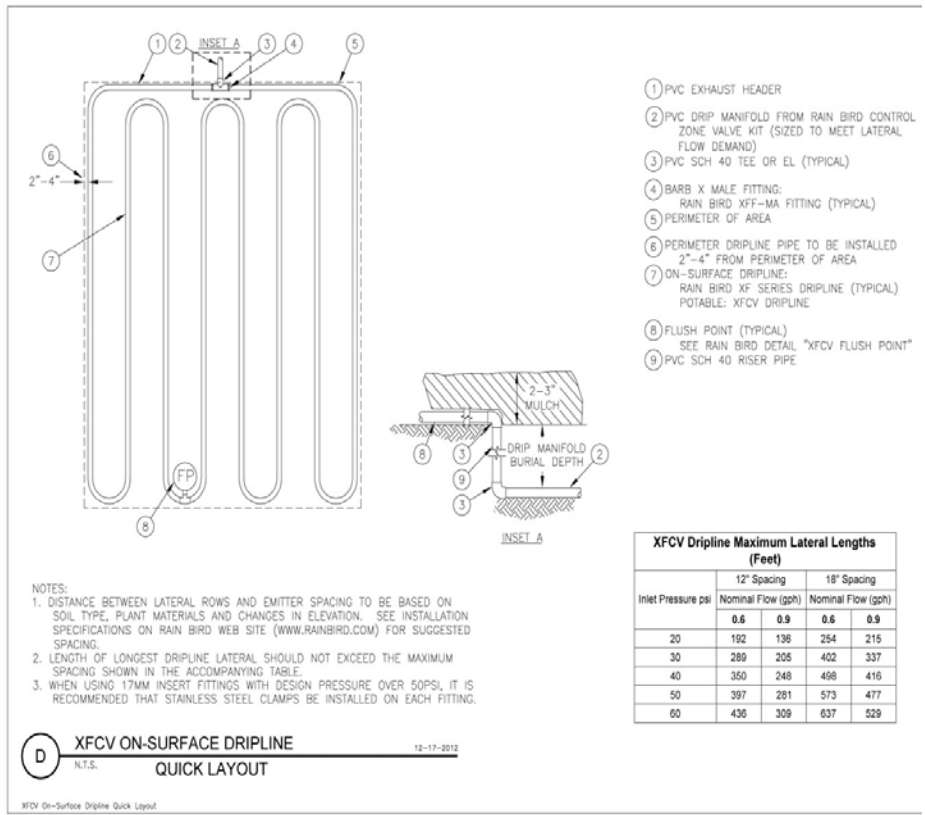
KEY POINTS TO REMEMBER FOR MOST SITUATIONS

- PLANTS NEED WATER ON AT LEAST TWO SIDES
- USE THE SAME EMITTER SPACING THROUGHOUT THE DRIP ZONE
- THE CLOSER THE EMITTERS AND LATERALS ARE THE HIGHER THE *PR*
- IF USED FOR THE GROW-IN PHASE ON NEW LANDSCAPES KEEP IN MIND THE TYPE OF PLANT AND HOW IT'S MATURE SIZE MIGHT AFFECT YOUR INSTALLATION
- INCREASE OR DECREASE EMITTER SPACINGS AND LATERAL LINE SPACING ACCORDING TO SOIL TEXTURE, GENERAL SOIL CONDITIONS AND SLOPE
- TYPE OF PLANTS AT TOP AND BOTTOM OF SLOPED BEDS AND THEIR SPACINGS
- LOCATE DRIPLINES AN APPROPRIATE DISTANCE AWAY FROM HARDSCAPES TO AVOID DAMAGE FROM ROUTINE MAINTENANCE
- BE WARY OF DRIPLINES CLOSER THAN TWO FEET TO BUILDINGS. CHECK ADJACENT BASEMENT WALLS FOR ANY DAMPNESS ISSUES PRIOR TO DESIGNING
- ASCERTAIN AREA FACTORS THAT COULD COMPROMISE THE FUTURE FUNCTIONAL EFFICIENCY OF THE DRIPLINES (SUCH AS RODENTS, FOOT TRAFFIC, CHILDREN PLAYING)

WATER MOVEMENT ON STEEP SLOPES WITHIN THE SOIL PROFILE CAN BE SIGNIFICANT

- CONSIDER A SEPARATE ZONE FOR THE BOTTOM $1/3$ OF THE SLOPE
- ALWAYS RUN DRIPLINE LATERALS PERPENDICULAR (ACROSS) THE SLOPE WHENEVER POSSIBLE
- **WHEN USING A SINGLE ZONE WITH SLOPES GREATER THAN 3% INCREASE THE DRIPLINE SPACING BY 25% IN THE BOTTOM $1/3$ OF THE ZONE**

PLANTING BED LAYOUTS CAN TAKE ANY FORM

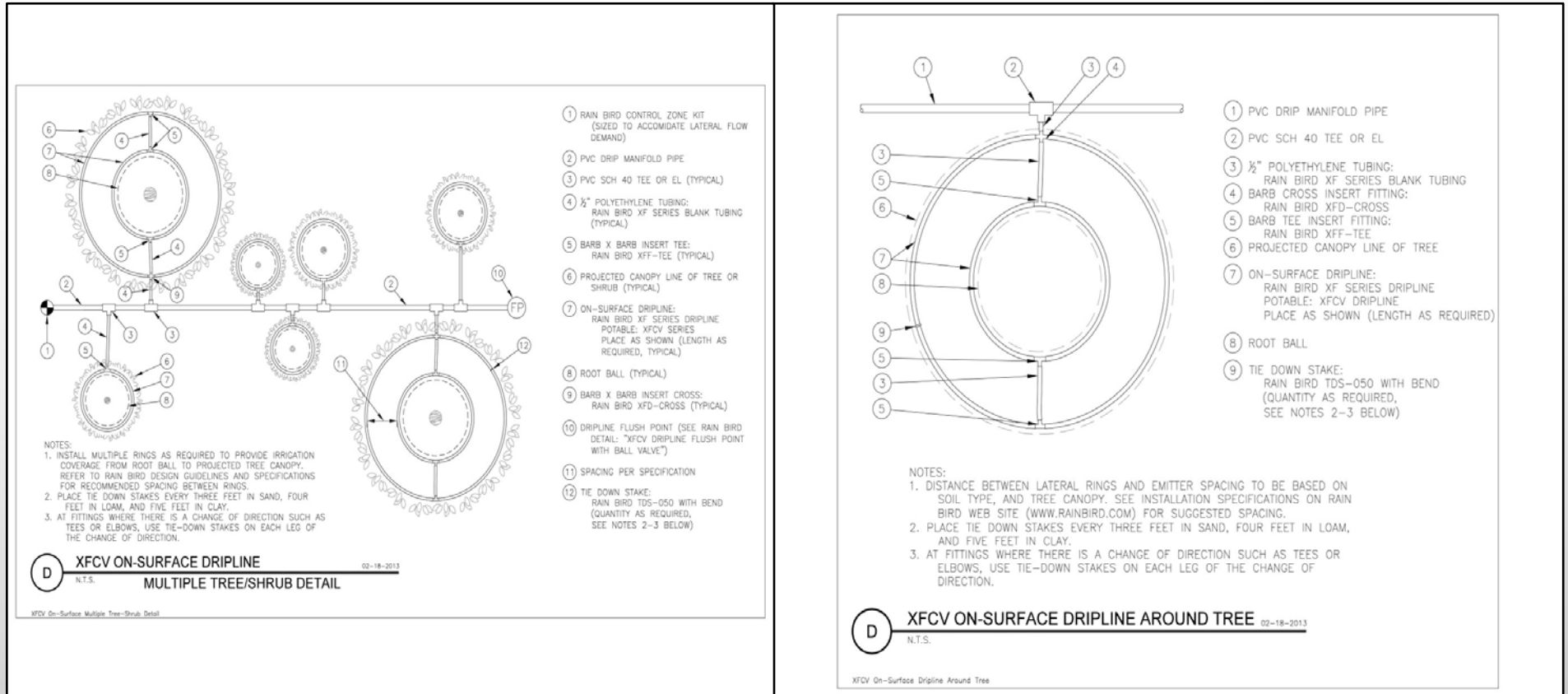


CIRCULAR VS. LATERAL DESIGN

GENERALLY HIGHER PR

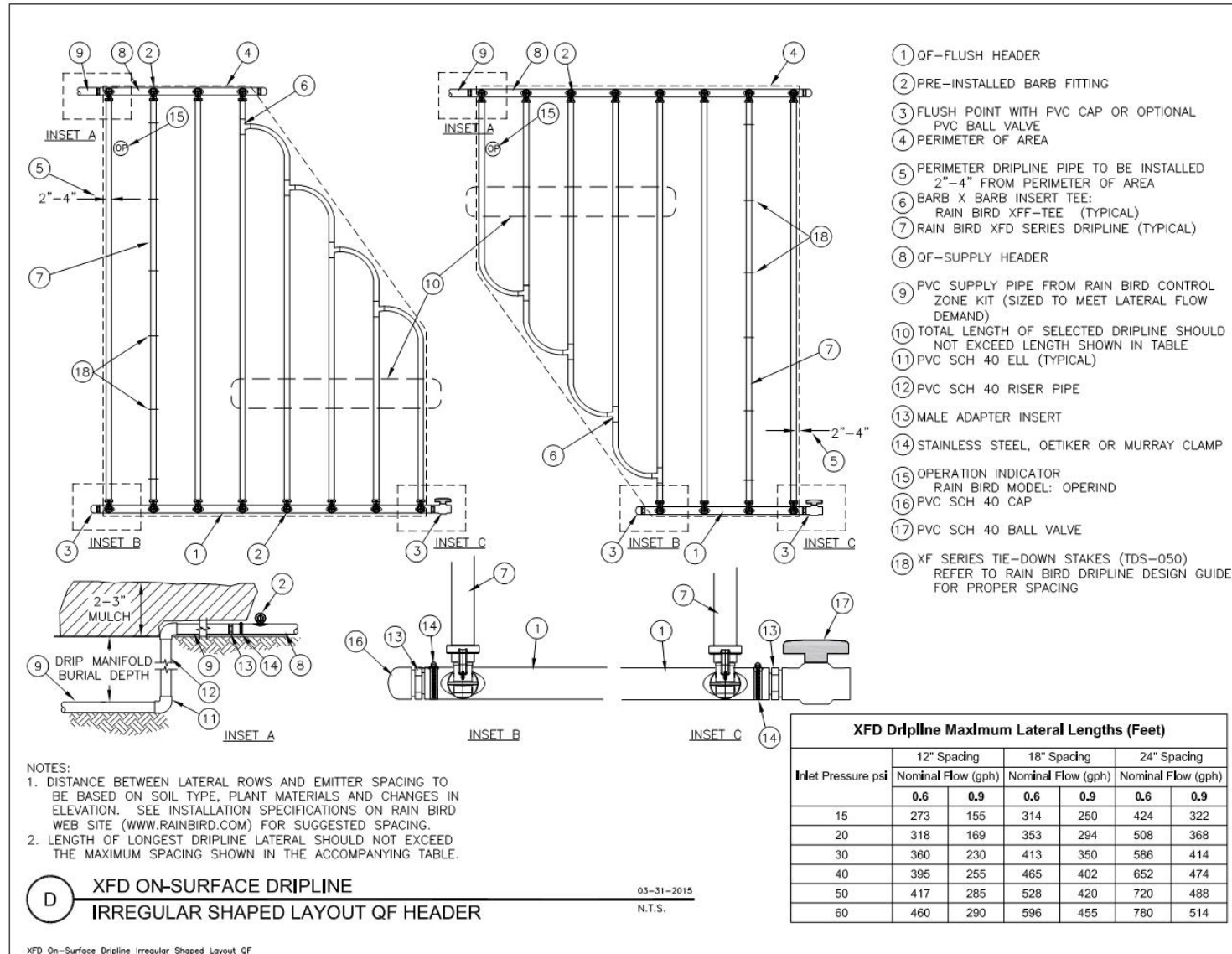
NUMBER OF CIRCLES CAN INCREASE TO WATER LARGER SPECIMENS

USE BLANK TUBING TO SEND WATER TO INDIVIDUAL PLANTS



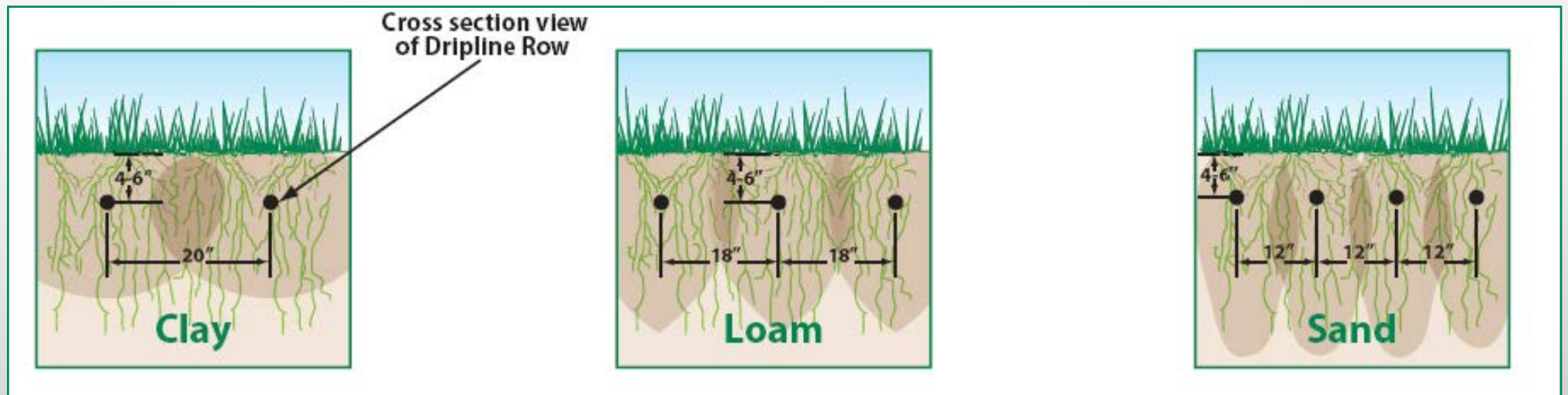
SUBSURFACE DESIGN PATTERNS – TURF

NOTE: PATTERNS MUST BE CONSISTENT IN TURF APPLICATIONS



ALWAYS CONSIDER AERATION WHEN DESIGNING DRIPLINE INSTALLATIONS FOR TURF

- TO AVOID AERATION DAMAGE TURF DRIPLINE SHOULD BE BURIED A MINIMUM OF 4"



BASIC DESIGN SPECS BY SOIL TEXTURE

Guidelines	Clay	Loam	Sand
Emitter Flow Rate	0.4 GPH	0.6 GPH	0.9GPH
Emitter Spacing	18"	18"	12"
Lateral Tubing Spacing	18"-24"	18"-24"	16"-20"
Maximum Burial Depth	6"	6"	6"
Application Rate – in/hr Basic Soil Intake Rate-in/hr	.29 - .21 0.10	.42 - .35 0.35	1.08 - .87 0.60
Minutes to Apply 0.25 inches of Water	52 - 71	36 - 43	14 - 17

YOU GET THE CALL-YOUR CLIENT HAS HAD ENOUGH OF LOOKING AT THE NEIGHBOR'S UNKEMPT YARD

- THEY WANT TO INSTALL FENCING BUT IT ONLY RISES 6 FEET AND THEY NEED 8 TO BLOCK THE VIEW
- YOU RECOMMEND 5 FOOT EMERALD ARBORVITAE FOR THE JOB – 80 FEET OF THEM SPACED 3 FEET APART PLANTED IN A 42 INCH WIDE BERM OF **SANDY LOAM TOPSOIL**
- YOU TELL THE CLIENT THE **BMP** FOR FAST GROWTH WOULD BE TO ADD A SURFACE DRIPLINE ZONE COVERED BY 2 INCHES OF MULCH
- YOU CHOOSE 0.6 GPH EMITTERS AT 12" SPACINGS-A TOTAL LENGTH OF 160 FEET.



$$KC = \text{SPECIES FACTOR} \times \text{DENSITY FACTOR} \times \text{MICROCLIMATE FACTOR}$$

$$\begin{array}{ccccc} \text{HIGH} & \times & \text{HIGH} & \times & \text{HIGH} = \\ \text{WATER LOVING SHRUB} & & \text{DENSE SPACING} & & \text{DIRECT SUN} \\ 0.9 & \times & 1.3 & \times & 1.4 = 1.64 \end{array}$$

Most Important

TABLE 4-2: ESTIMATED SPECIES FACTORS			
Plant Type	Low	Average	High
Trees	0.2	0.5	0.9
Shrubs	0.2	0.5	0.7
Ground covers	0.2	0.5	0.7
Mixed trees, shrubs, ground covers	0.2	0.5	0.9

TABLE 4-3: ESTIMATED DENSITY FACTORS			
Plant Type	Low	Average	High
Trees	0.5	1.0	1.3
Shrubs	0.5	1.0	1.1
Ground covers	0.5	1.0	1.1
Mixed trees, shrubs, ground cover	0.6	1.1	1.3

TABLE 4-4: ESTIMATED MICROCLIMATE FACTORS			
Plant Type	Low	Average	High
Trees	0.5	1.0	1.4
Shrubs	0.5	1.0	1.3
Ground covers	0.5	1.0	1.2
Mixed trees, shrubs, ground cover	0.5	1.0	1.4

You plant in July in Summit NJ – your monthly **PET** is 4.46 inches / 31 = 0.144 inches per day.
 Your (**Kc**) is 1.64 x 0.144 inches per day = 0.24 inches per day

USE THE CHART TO FIND THE *PR* THAT MATCHES YOUR CHOICE OF EMITTER SPACING, GPH AND ROW SPACING

- OUR ARBORVITAE DRIPLINE ZONE *PR* IS 0.83 INCHES PER HOUR BY CHART

TABLE 5: APPLICATION RATE

Lateral Row Spacing (in Inches)											
Emitter Spacing	12"	13"	14"	15"	16"	17"	18"	19"	20"	22"	24"
0.4 GPH Emitter Flow (Inches per hour)											
12"	0.67	0.62	0.58	0.54	0.51	0.48	0.45	0.43	0.40	0.37	0.34
18"	0.45	0.41	0.39	0.36	0.34	0.32	0.30	0.28	0.27	0.25	0.22
24"	0.34	0.31	0.29	0.27	0.25	0.24	0.22	0.21	0.20	0.18	0.17
0.6 GPH Emitter Flow (Inches per hour)											
12"	0.96	0.89	0.83	0.77	0.72	0.68	0.64	0.61	0.58	0.53	0.48
18"	0.64	0.59	0.55	0.51	0.48	0.45	0.43	0.41	0.39	0.35	0.32
24"	0.48	0.44	0.41	0.39	0.36	0.34	0.32	0.30	0.29	0.26	0.24
0.9 GPH Emitter Flow (Inches per hour)											
12"	1.44	1.33	1.24	1.16	1.08	1.02	0.96	0.91	0.87	0.79	0.72
18"	0.96	0.89	0.83	0.77	0.72	0.68	0.64	0.61	0.58	0.53	0.48
24"	0.72	0.67	0.62	0.58	0.54	0.51	0.48	0.46	0.43	0.39	0.36

FAST FACTORING OF DRIP LINE GROSS APPLICATION RATE USING GPM AND ROW SPACING YIELDS ABOUT THE SAME RESULT

$$AR = (0.963 \times QT) / ST$$

- **WHERE:**

AR = GROSS APPLICATION RATE IN INCHES/HOUR

QT = TUBING FLOW RATE IN GPM/100 FEET

ST = TUBING SPACING IN FEET

- **EXAMPLE:**

160 FEET 0.6 GPH EMITTERS EVERY 12 INCHES WITH ROW SPACING 14 INCHES APART

0.6 GPH DRIP LINE / 60 = .01 GPM X 100 = 1.0 GPM (BY CHART 1.02 GPM)

0.963 X 1.02 / 1.17 FT. (14" / 12")

$$1.54 / 1.17 = 0.84 \text{ IN./HR.}$$

SCHEDULING ZONE RUN TIMES AND FREQUENCY

- ✓ THE NEW ARBORVITAE NEED **0.24 INCHES PER DAY** DURING THEIR ESTABLISHMENT PERIOD (**PWR**)
- ✓ THE NEW DRIPLINE ZONE APPLIES WATER AT AN AVERAGE **PR** OF **0.83 INS./HR.**

THE FORMULA FOR DETERMINING RUN TIMES:

$$\textit{Run Time} = \frac{PWR}{PR} \times 60$$

OUR EXAMPLE: **18 MINUTES** $\approx 0.24 / 0.83 \times 60$

(ALWAYS ROUND UP WHEN
IRRIGATING)

MAXIMUM TIME TO RUNOFF

- VARIOUS CHARTS NOTE **SANDY LOAM SOIL INTAKE RATES** FROM **0.4 TO 1.02 INS./HR.** SINCE SANDY LOAM DRAINS RAPIDLY LET'S USE THE AVERAGE OF THE SCALE **0.71 INS./HR.** FOR **A MAXIMUM RUN TIME BEFORE RUNOFF OCCURS:**

$$\text{Cycle Run Time} = \frac{\text{IR}}{\text{PR}} \times 60$$

OUR EXAMPLE: **51 MINUTES** = $0.71 / 0.83 \times 60$

THUS OUR RUN TIME OF **18 MINUTES** IS GOOD

FINAL PROGRAM

- 18 MINUTES OF RUN TIME APPLIES 0.24 INCHES OF WATER (DAILY **PWR**)
- **DUE TO RAPID SOIL PERCOLATION BREAK THIS INTO TWO 9 MINUTE CYCLES AT LEAST TWO HOURS APART (KEEP TO THE HEAVY SIDE FOR ESTABLISHMENT) EVERY DAY**
- WATER EVERY DAY FROM JULY TO EARLY AUGUST UNTIL PLANTS START ROOTING (4-6 WEEKS)
- REDUCE CROP FACTOR FROM **"TREE"** TO **"SHRUB"** ($K_c = 1.00$) AND RECALCULATE TO AUGUST **PET**

OF $3.80 / 31 = 0.123$ INCHES PER DAY:

NEW RUN TIME = 9 MINUTES DAILY ($0.123/0.83 \times 60$)

AFTER THAT WATER A TOTAL OF 9 MINUTES **ONCE EVERY DAY** AND READJUST FOR

SEPTEMBER'S **PET** AND REPEAT STEPS TO DETERMINE SEPTEMBER PROGRAM

NEXT SEASON: JULY-DAILY **PET** OF 0.144 INCHES PER DAY $\times 7 = 1.00$ IN./WK. **WATER 4 DAYS/WEEK FOR 72 MINUTES TOTAL** ($1.00/0.83 \times 60$) AS FOLLOWS:

72 MINUTES/4 DAYS = 18 MINUTES TOTAL RUN TIME FOUR DAYS PER WEEK

TWO CYCLES 9 MINUTES EACH AT LEAST 2 HOURS APART ON THE FOUR CHOSEN DAYS

TECHLINE CV® Flow per 100 Feet

Emitter Spacing	0.26 GPH Emitter		0.4 GPH Emitter		0.6 GPH Emitter		0.9 GPH Emitter	
	GPH	GPM	GPH	GPM	GPH	GPM	GPH	GPM
12"	26.4	0.44	42.3	0.71	60.8	1.01	92.5	1.54
18"	17.6	0.29	28.2	0.47	40.5	0.68	61.6	1.03
24"	13.2	0.22	21.2	0.35	30.4	0.51	46.2	0.77

ADDITIONAL CHARTS

MAXIMUM PRECIPITATION RATES (inches per hour)

Soil Texture	0% to 5% Slope		5% to 8% Slope		8% to 12% Slope		12% to 20% Slope	
	Covered	Bare	Covered	Bare	Covered	Bare	Covered	Bare
Coarse Sandy Soil	2.00	2.00	2.00	1.50	1.50	1.00	1.00	1.00
Coarse Sandy Soil Over Compact Sub Soil	1.75	1.50	1.25	1.00	1.00	0.75	0.75	0.40
Light Sandy Loam	1.75	1.00	1.25	0.80	1.00	0.60	0.75	0.40
Light Sandy Loam Over Compact Sub Soil	1.25	0.75	1.00	0.50	0.75	0.40	0.50	0.30
Uniform Silt Loam	1.00	0.50	0.80	0.40	0.60	0.30	0.40	0.20
Silt Loam Over Compact Sub Soil	0.60	0.30	0.50	0.25	0.40	0.15	0.30	0.10
Heavy Clay / Clay Loam	0.20	0.15	0.15	0.10	0.12	0.08	0.10	0.06

Note: The above average values are for reference purposes. Data may vary with respect to actual soil and site conditions. Data from USDA.

TECHLINE CV® Maximum Length of a Single Lateral (feet)

Emitter Spacing			12"				18"				24"	
Emitter Flow Rate (GPH)			0.26	0.4	0.6	0.9	0.26	0.4	0.6	0.9	0.6	0.9
Inlet Pressure (psi)		20	331	242	190	144	468	344	270	204	342	260
		25	413	302	238	180	584	429	338	257	430	326
		30	471	345	272	206	668	491	387	293	492	374
		35	518	380	299	227	737	540	426	323	542	412
		40	559	410	223	244	794	584	459	348	584	444
		45	594	436	343	260	845	620	489	371	622	472
		50	626	459	361	274	890	654	515	390	656	498
		55	655	480	378	287	932	684	539	410	686	522
		60	681	500	393	298	969	713	561	426	716	544