Drip Irrigation Design

101

- Know, Know, Know
  - 1 Know your water supply
  - 2 Know your system components
  - 3 Know your limits
- Install the Drip Irrigation System

Know your supply

- Pressure – (Pounds per Square Inch) PSI
  - At the start point of the drip system
  - Most municipal water systems range from 30 to 60 PSI
  - Domestic with well -30-50 PSI adjustable pressure switch
    - Can go over 100 PSI
  - Elevation change affects pressure


Milton
CHICAGO ILL.
60639
200
180
140
120
100
80
60
40
20
0

Know your supply

- Volume
  - –Flow rate in Gallons Per Minute (GPM)
  - –Available during tree watering time
    - Do you want to water trees during daylight hours
    - Will there be other demands on the system at that time

      Household use, watering yard, watering livestock

- Gallons/seconds X 60 = GPM
- i.e. 5 gal in 45 seconds
- 5/45 X 60 = 6. 66 Gallons per minute
- 6.66 GPM X 60 min/hr = 399 gallons per hour

Know your Supply

- Water quality
  - –Suspended solids
    - Sand or rust particles
  - –Plug emitters
  - –Can be removed by filter

Know your System Components

- Filters
- Regulators
- Tubing
- Valves
- Emitters
- Fittings

System Components

- THIS INFORMATION IS PROVIDED AS A PUBLIC SERVICE AND CONSTITUTES NO ENDORSEMENT OF ANY SERVICE, SUPPLY, OR EQUIPMENT LISTED.
- There are several manufacturers and dealers that sell drip irrigation supplies.
- Know what is available.

Filters

- Recommend 200 mesh
- Various types of filters
  - Inline - Lower Flow rate
    - Hard to clean
  - Canister – Higher flow rate
    - Flush to clean
    - Freeze and crack
    - Pipe thread


API
Agricultural Products
USE ONLY TEFLON
THREAD SEALER

Regulators

- Used to reduce excessive pressure
  - Most drip components have maximum pressure rating of 50 PSI
  - If fittings are coming apart or emitters are blowing out of tubing may need a regulator
  - Available in 6 to 30 PSI
  - Directional installation

Tubing

Polyethylene blank tubing

-Many different sizes from 1/16 to 2 inch

-Also in metric sizes

-1/2 inch is .700 OD X .600 ID

- 3/4 inch is .935 OD X .818 ID

Micro or spaghetti tubing to deliver water to individual plants

POLYETHYLENE BLANK TUBING

SWISH POLYETHYLENE TUBING

Part No.	Model No.	Description	O.D.	I.D.	Price
SW-455-100	455P40-1C	3/8" Poly x 100'	0.455"	0.375"	$11.44
SW-455-500	455P40-5C	3/8" Poly x 500'	0.455"	0.375"	$57.12
SW-700-100	700P50-1C	1/2" Poly x 100'	0.700"	0.600"	$20.68
SW-940-100	935P62-1C	3/4" Poly x 100'	0.935"	0.811"	$32.50

BOWSMITH POLYETHYLENE TUBING

Part No.	Model No.	Description	O.D.	I.D.	Price
9444	625P50-1M	16mm Poly x 1000'	0.625"	0.525"	$124.00
9411	700P50-5C	1/2" Poly x 500'	0.700"	0.600"	$75.00
9433	700P50-1M	1/2" Poly x 1000'	0.700"	0.600"	$141.00
9435	720P48-1M	16mm Poly x 1000'	0.720"	0.625"	$136.00
9439	835P52-1M	5/8" Poly x 1000'	0.835"	0.730"	$178.00
9414	935P62-5C	3/4" Poly x 500'	0.935"	0.811"	$125.00
9438	935P62-1M	3/4" Poly x 1000'	0.935"	0.811"	$221.00
9443	3/4P50-1M	3/4" Poly x 1000'	0.935"	0.818"	$221.00
9441	1195P72-5C	1" Poly x 500'	1.195"	1.050"	$173.00

NETAFIM™ POLYETHYLENE TUBING

Part No.	Model No.	Description	O.D.	I.D.	Price
40510-000002	14037045	3/8" Poly x 1000'	0.455"	0.375"	$88.80
40510-000003	14052062	16mm Poly x 1000'	0.620"	0.520"	$129.62
40510-000005	14060070	1/2" Poly x 1000'	0.700"	0.600"	$142.76
40510-000036	14060070-05	1/2" Poly x 500'	0.700"	0.600"	$71.38
14070080	14070080	20mm Poly x 1000'	0.800"	0.700"	$159.88
14072084	14072084	5/8" Poly x 1000'	0.840"	0.720"	$190.50
40510-000018	14082094	3/4" Poly x 500'	0.940"	0.820"	$106.56
14082094-1000	14082094-1000	3/4" Poly x 1000'	0.940"	0.820"	$213.10
40510-000020	14106120	1" Poly x 500'	1.200"	1.060"	$178.10

JAIN® POLYETHYLENE TUBING

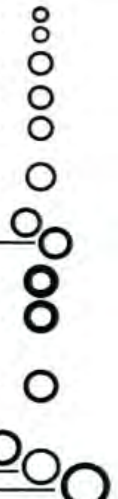
Part No.	Model No.	Description	O.D.	I.D.	Price
11190529	455X375-100PE	3/8" Poly x 100'	.455	.375	$13.90
11190531	455X375-500PE	3/8" Poly x 500'	.455	.375	$63.14
11200002	700X600-100PE	1/2" Poly x 100'	700	600	$20.42
11200061	620X520-100PE	16mm Poly x 100'	0.620"	0.520"	$17.74
11200064	620X520-500PE	16mm Poly x 500'	0.620"	0.520"	$70.88
11200067	620X520-1000PE	16mm Poly x 1000'	0.620"	0.520"	$143.86

Our Polyethylene Tubing is extruded exclusively from virgin linear low density polyethylene (LLDPE) base resin and combined with a suitable virgin carbon concentrate compound to provide a minimum of 2% carbon black, which is blended, mixed and dispersed into the finished product for maximum UV protection. Strict quality control procedures followed during the extrusion process ensure the highest uniformity and product quality. Because the tubing is a vital and integral part of your irrigation system, we will only distribute the highest quality, most reliable and dependable premium drip irrigation tubing available in the market.

MICRO TUBING

SMALL DIAMETER VINYL & POLYETHYLENE (P.E.) TUBING

Part No.	Model No.	Description	O.D.	I.D.	Price
11190661	125X063-3500PE	1/8" P.E. Micro Tube x 3500'	0.125"	0.063"	$131.40
11190663	128X076-3500PE	1/8" P.E. Micro Tube x 3500'	0.128"	0.076"	$126.06
SW185-100	SW-185-100PE	1/8" SWISH STIK™ P.E. Tube x 100'	0.185"	0.125"	$4.54
SW185-1000	SW-185-1000PE	1/8" SWISH STIK™ P.E. Tube x 1000'	0.185"	0.125"	$45.30
11190149	187X125-100PE	.187" x .125" P.E. Micro Tube x 100'	0.187"	0.125"	$8.40
11190589	187X125-1000PE	.187" x .125" P.E. Micro Tube x 1000'	0.187"	0.125"	$60.98
11190593	188X128-3000PE	.188" x .128" # 3 Chapin P.E. Micro Tube x 3000'	0.188"	0.128"	$154.40
11190255	220X160-100PE	.220" x .160" P.E. Micro Tube x 100'	0.220"	0.160"	$9.26
11190595	220X160-1000PE	.220" x .160" P.E. Micro Tube x 1000'	0.220"	0.160"	$63.38
11190042	220X160-100V	.220" x .160" Vinyl Tube x 100'	0.220"	0.160"	$7.54
11190597	220X160-1000V	.220" x .160" Vinyl Tube x 1000'	0.220"	0.160"	$57.02
11190609	225X155-2500PE	.225" x .155" # 4 Chapin P.E. Micro Tube x 2500'	0.225"	0.155"	$147.10
558	245X160-1250PE	.245" x .160" P.E. Micro Tube x 1250'	0.245"	0.160"	$100.24
SW-250-100	RXO-250H-100	.250" x .125" Hydraulic Tubing x 100'	0.250"	0.125"	$7.50
SW-250-1000	RXO-250H-1000	.250" x .125" Hydraulic Tubing x 1000'	0.250"	0.125"	$63.02
SW-250-3000	RXO-250H-3000	.250" x .125" Hydraulic Tubing x 3000'	0.250"	0.125"	$189.04
607	250X140-1000V	.250" x .140" Vinyl Micro Tube x 1000'	0.250"	0.140"	$244.12
DRXO-250-100	RXO-250-100	.250" x .170" Relax-O Micro Tube x 100'	0.250"	0.170"	$7.88
DRXO-250-1000	RXO-250-1000	.250" x .170" Relax-O Micro Tube x 1000'	0.250"	0.170"	$63.02
11190334	250X170-100PE	.250" x .170" P.E. Micro Tube x 100'	0.250"	0.170"	$10.96
11190601	250X170-2000PE	.250" x .170" P.E. Micro Tube x 2000'	0.250"	0.170"	$146.02
11190351	250X170-100V	.250" x .170" Vinyl Micro Tube x 100'	0.250"	0.170"	$9.84
11190602	250X170-1000V	.250" x .170" Vinyl Micro Tube x 1000'	0.250"	0.170"	$77.88
11190614	272X188-1500PE	.272" x .188" # 4.5 Chapin P.E. Micro Tube x 1500'	0.272"	0.188"	$127.78
11190616	275X210-1500PE	.275" x .210" # 5 Chapin P.E. Micro Tube x 1500'	0.275"	0.210"	$109.52
11190621	350X250-500PE	.350" x .250" P.E. Micro Tube x 500'	0.350"	0.250"	$69.38

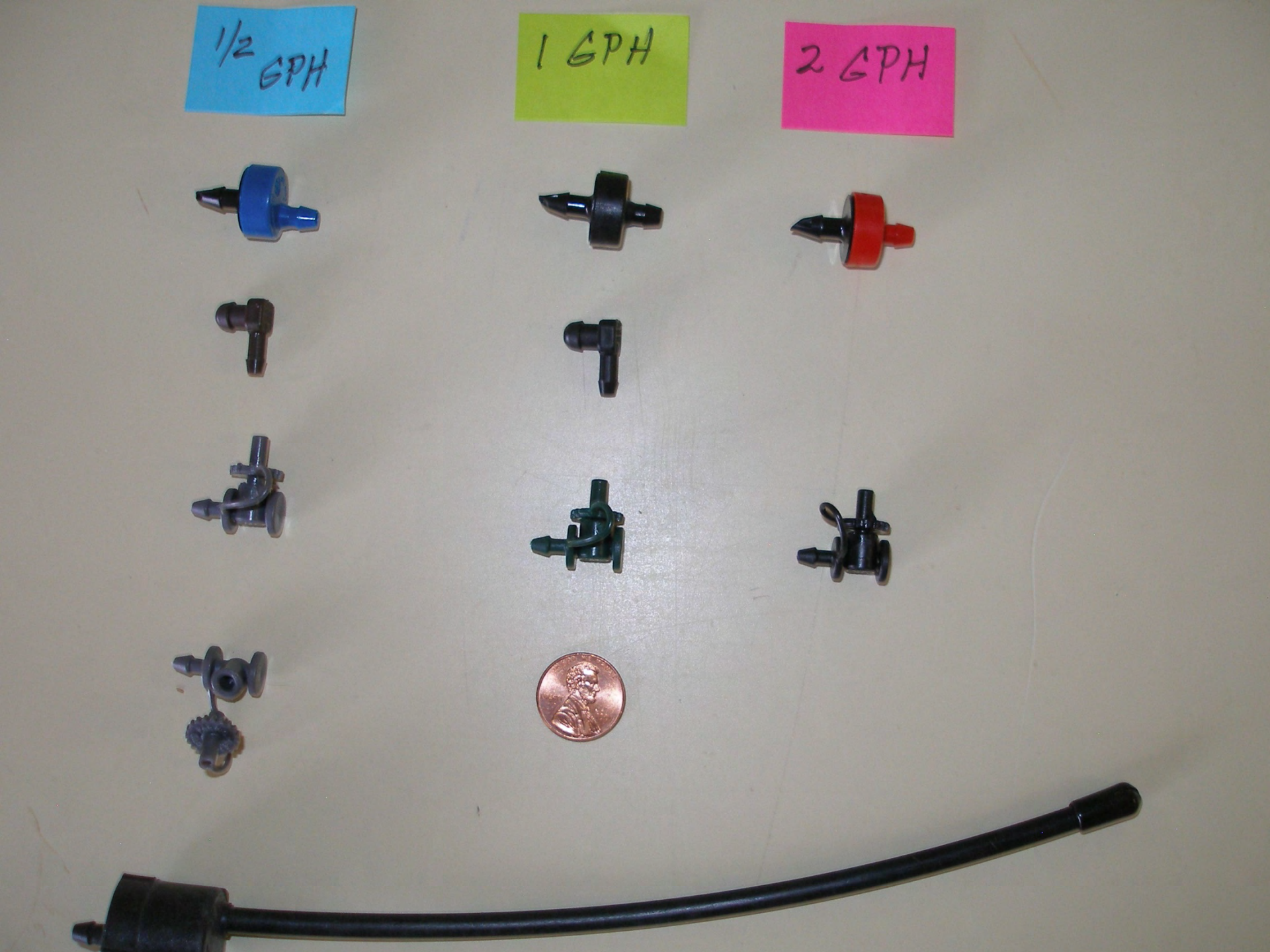


Tubing

- Available in 100, 250, 500 and 1000 foot rolls
- Allow 10% extra length to allow for contraction and expansion with temperature changes.
- Snake it back and forth rather than laying it out straight.
- Emitters can crawl away from trees.
- 50 PSI is maximum pressure

Emitters

- Various manufacturers
- Flow rates of 1/2, 1 and 2 GPH
- Some are pressure compensating
- Some have self-piercing tip
- Some require punched hole to install
- All recommended for above ground use.


1/2 GPH
1 GPH
2 GPH

Fittings

- Wide selection of fittings to do about any layout you need
- Compression or Hose Thread
- Adapters to go to pipe thread

Know your limits

- Once you know your water supply and system components we will try to bring it all together
- Every situation is different so evaluate to see if you have and can deliver required water amount to end points

Know your limits

- Friction loss for water flowing in the tubing is a function of volume, length and inside diameter of the tubing.
- Higher flow rates, longer lengths and smaller diameters require more pressure

DRIP IRRIGATION DESIGN

Name: _____ Date: _____

Location: _____ Designed By: _____

Drip Irrigation Design using Hazen Williams Equation

C = 140

Row #	Species	Spacing Ft	Row Length	# Trees / Emitters	Emitter Output / GPH	Flow Required GPM	Hose ID	Hose Length	Elevation Change + or -	PSI
1	tree	8	1550	195	0.5	1.62	0.58	1705		**28.63**
2	tree	9	1700	190	0.5	1.58	0.58	1870		**29.96**
3	tree	10	1800	181	0.5	1.51	0.58	1980		**29.03**
4	tree	8	1000	126	1	2.10	0.58	1100		**29.77**
5	tree	9	1075	120	1	2.01	0.58	1182.5		**29.44**
6	tree	10	1150	116	1	1.93	0.58	1265		**29.37**
	TOTAL			**812**		**8.82**		**7837.5**		

Comments:

600 emitters @ 0.5 gph = 5 gpm

300 emitters @ 1 gph = 5 gpm

Know your limits

- General guidelines for 1/2 inch tubing
  - –Do not exceed 3 GPM
  - –Do not exceed 1500 feet length
  - –Not exact values

Know your limits

- General guidelines for 3/4 inch tubing
  - –Do not exceed 5 GPM
  - –Do not exceed 1500 feet length

Know your limits

- Lets play some what if to see how this works.

Scenario 1 3 GPM 30 PSI

One row of shrubs 500' long 4 foot spacing

Total tubing length 550 ft

500'/4'=125 emitters

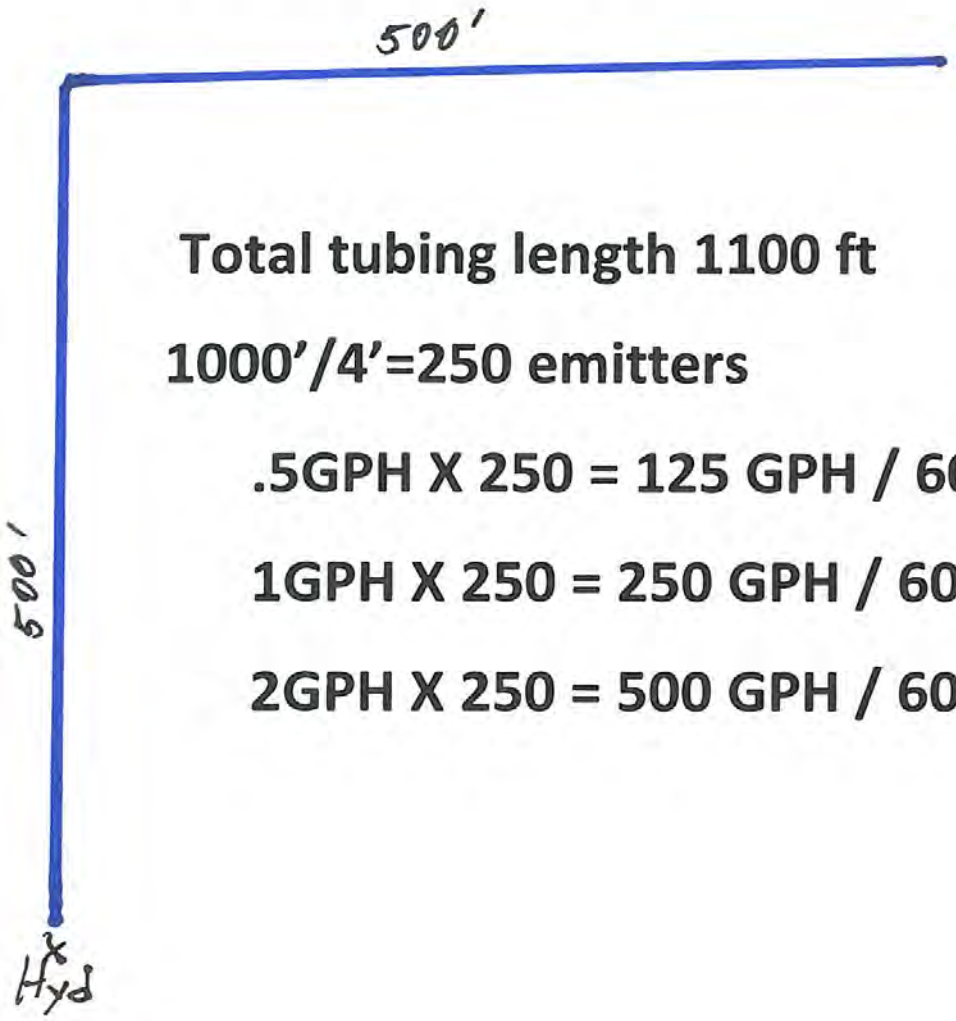
.5GPH X 125 = 62.5 GPH / 60 min/hr = 1.04 GPM OK

1GPH X 125 = 125 GPH / 60 min/hr = 2.08 GPM OK

2GPH X 125 = 250 GPH / 60 min/hr = 4.16 GPM NO

Scenario 2 3 GPM 30 PSI

One row of shrubs 1000’ long 4 foot spacing



Total tubing length 1100 ft

1000’/4’=250 emitters

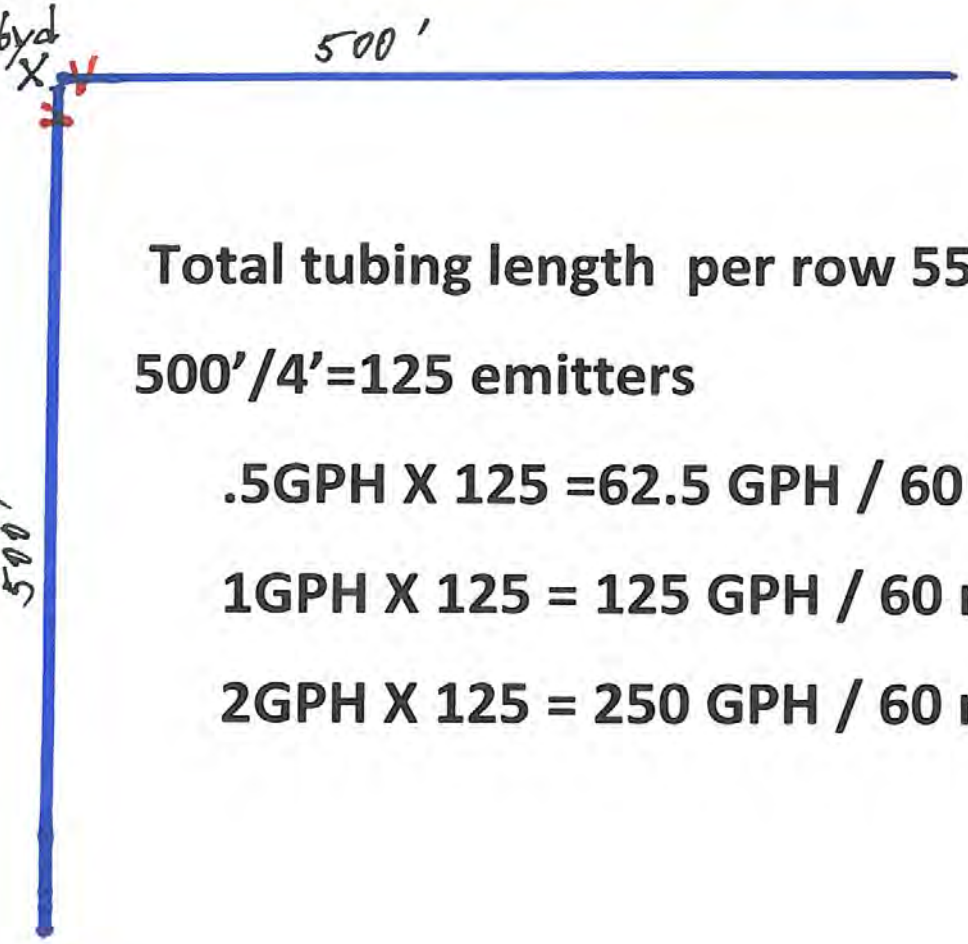
.5GPH X 250 = 125 GPH / 60 min/hr = 2.08 GPM OK

1GPH X 250 = 250 GPH / 60 min/hr = 4.16 GPM NO

2GPH X 250 = 500 GPH / 60 min/hr = 8.33 GPM NO

Scenario 3 3 GPM 30 PSI

One row of shrubs 1000’ long 4 foot spacing with Hydrant in middle and valves to water two 500 foot rows



Total tubing length per row 550 ft

500’/4’=125 emitters

.5GPH X 125 =62.5 GPH / 60 min/hr = 1.04 GPM OK

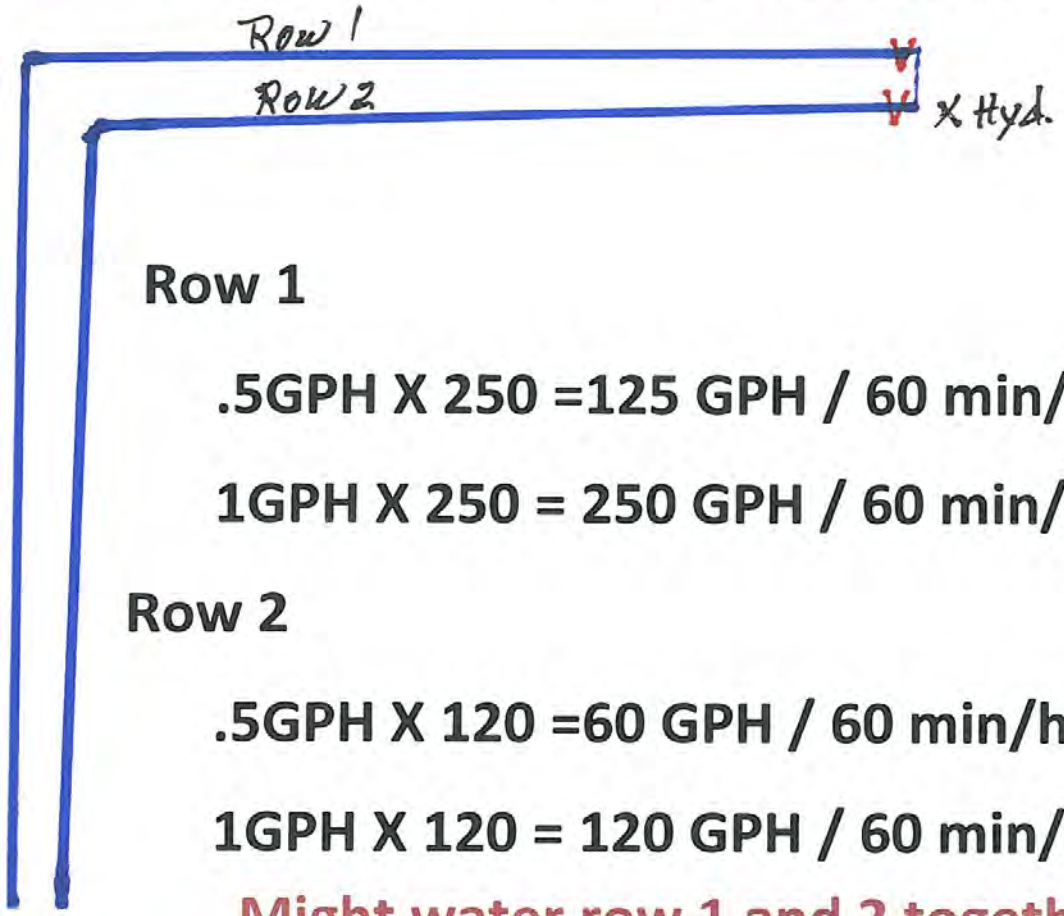
1GPH X 125 = 125 GPH / 60 min/hr = 2.08 GPM OK

2GPH X 125 = 250 GPH / 60 min/hr = 4.16 GPM NO

Scenario 4 5 GPM 30 PSI 1/2" tubing

Row 1 1000 feet shrubs 4 foot spacing = 250 emitters

Row 2 960 feet RMJ 8 foot spacing = 120 emitters



Row 1

.5GPH X 250 =125 GPH / 60 min/hr = 2.08 GPM OK

1GPH X 250 = 250 GPH / 60 min/hr = 4.16 GPM NO >3GPM

Row 2

.5GPH X 120 =60 GPH / 60 min/hr = 1.00 GPM OK

1GPH X 120 = 120 GPH / 60 min/hr = 2.00 GPM OK

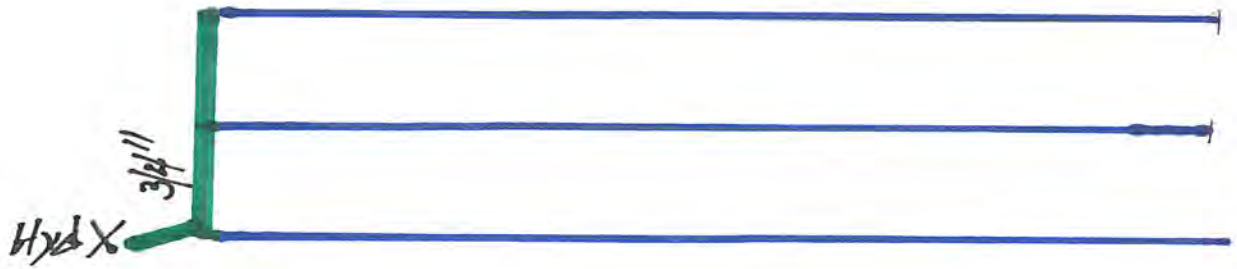
Might water row 1 and 2 together with .5 GPH emitters

Scenario 5 5 GPM 30 PSI 1/2" tubing with 3/4" manifold

Row 1 1000 feet shrubs 4 foot spacing = 250 emitters

Row 2 1000 feet RMJ 8 foot spacing = 125 emitters

Row 3 1000 feet PP 12 foot spacing = 83 emitters



Row 1

.5GPH X 250 =125 GPH / 60 min/hr = 2.08 GPM OK

Row 2

.5GPH X 125 =62.5 GPH / 60 min/hr = 1.04 GPM OK

1GPH X 125 = 125 GPH / 60 min/hr = 2.08 GPM OK

Row 3

.5GPH X 83 = 41.6 GPH / 60 min/hr = .65 GPM OK

1GPH X 83 = 83 GPH /60 min/hr = 1.38 GPM OK

2GPH X 83 = 166 GPH/60min/hr = 2.76 GPM OK

Do not exceed total of 5 GPM for all rows watering at same time.

Always sketch, measure and plan your windbreak or landscape design before installation to determine best options for the situation.

Water requirements

Seedling trees

- year 1 – 1 gal /week
- year 2 - 2 gal/10 days
- year 3 - 3 gal/ 14 days

Water requirements

Think ahead 10 – 20 years

D4 drought – how can you put on enough water to keep trees alive.

- Any answers?
- Or questions

- Marvin Watson
- USDA-NRCS
- Eads, CO
- 719 438-5851 X101