.

"PERC-RITE®"

DESIGNER'S GUIDE

MASSACHUSETTS PRETREATED DRIP SYSTEMS

This ***Perc-Rite® Drip System Designer's Guide for Massachusetts Pretreated Drip Systems*** is intended to simplify the design of the dispersal system. The ***Perc-Rite® Drip System*** is a unique fluid handling process for dispersal of wastewater into the soil, which incorporates filtration, time and level controlled application along with ultra low rate drip distribution. The drip dispersal process can be installed to dispose of effluent from any type of pretreatment device that is approved for Remedial Use in Massachusetts.

Perc-Rite® Drip Systems create virtually no site disturbance during installation of the field distribution lines. The installation of the system has very little site impact, even in established lawns or park areas, which means there are almost no visible indications that the site is being used for dispersal purposes.

Challenging sites can be accommodated such as those with as little as 2' of naturally occurring soil, or those where offset from ground water to the bottom of the drip tubing needs to be as shallow as 2'. Using the Perc-Rite® Drip System on these tough sites can result in decreased or eliminated mounds and reduced construction costs.

Use of the A, B and C soil horizons can be accommodated which can result in effluent being dispersed in the more aerobic upper soil horizons. This can reduce the cost of fill material being brought to the site and result in improved wastewater filtration and treatment in the soil column.

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TYPICAL PERC-RITE® SYSTEM FLOW DIAGRAM

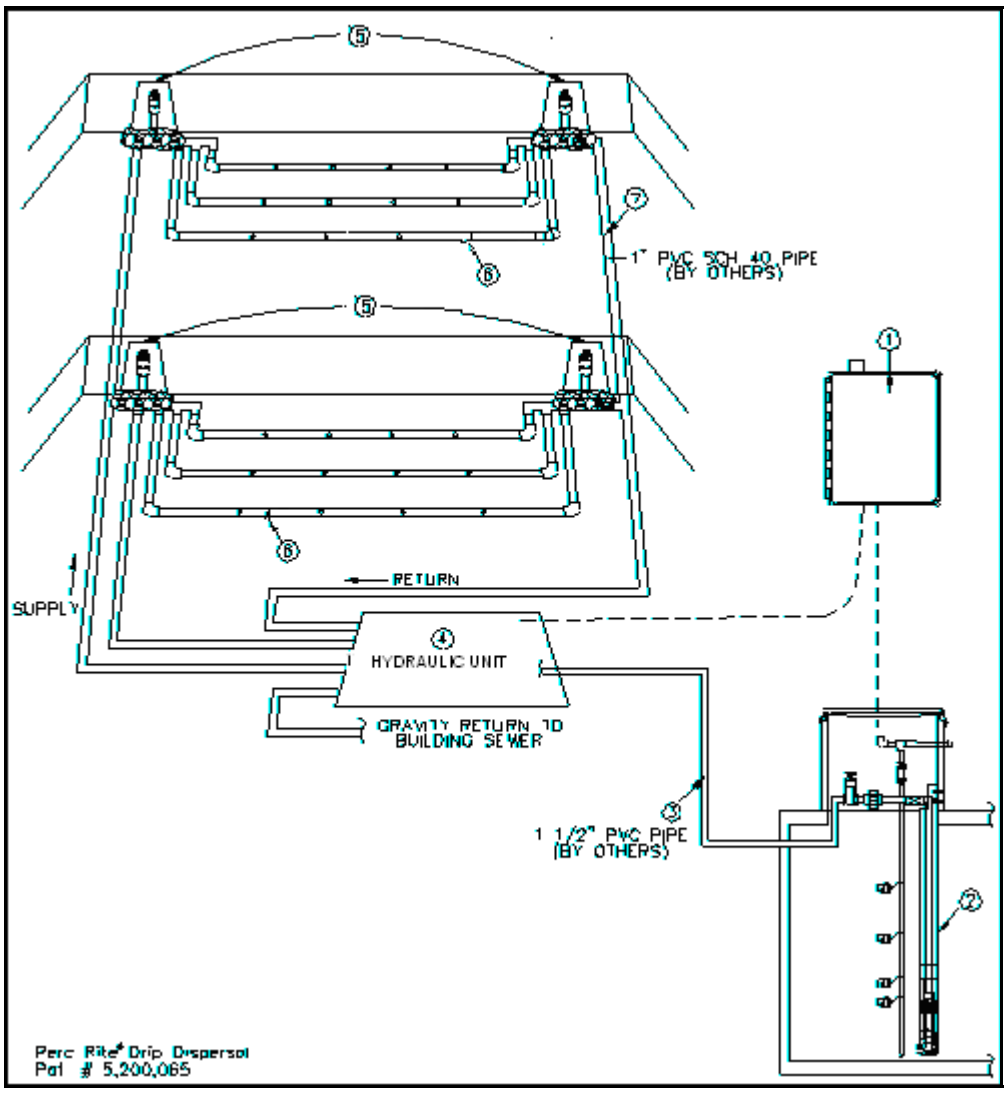


Figure 1: Typical Perc-Rite® System Flow Diagram Z231

1) Control Panel.
2) Cool-Guide™ and Pump. Located in pump chamber, pumps treated wastewater to the Hydraulic Unit.
3) Supply line. Transmits the effluent to the Hydraulic Unit from the pump chamber.
4) Hydraulic Unit. Filters treated wastewater from the pump chamber, disperse to drip tubing and regulates return (flushed) effluent back to the inlet of the septic tank.
5) Air Release Valves. Ensure even dispersal and drainage of all pipes and tubing.
6) Drip Tubing. Provides uniform dispersal of effluent into the soil.
7) Return line. Transmits the return from the dispersal tubing through the Hydraulic Unit to the septic tank inlet.

SYSTEM COMPONENTS AND DEFINITIONS

1. The **PERC-RITE® DRIP SYSTEM CONTROLLER** - A state-of-the-art control panel, activated by standard float switches located in a pump tank downstream from the pre-treatment process. The controller enables the dispersal cycles to begin functioning on a timer-controlled basis. The controllers are available in many arrangements depending upon the number of zones in the design.

2. **HYDRAULIC UNIT** - Disc filter(s), automatic control valves, solenoid activated diaphragm valves and a flow meter are housed in a heated enclosure. A labeled wire harness provides for easy electrical connection to the control panel.

3. **PUMP SYSTEM** - The pump, Cool Guide™ for mounting the pump, and the float switches are installed in the pump chamber. The pump is a turbine 15 gpm pump and is suitable for most residential installations.

4. **DRIP TUBING** – Polyethylene drip tubing containing pressure-compensating emitters specifically designed for wastewater application. The tubing delivers a nominal 0.65 gallons per hour (+/- 5%) of wastewater per emitter to the soil and can operate between 7 to 60 psi.

5. **MANIFOLD SYSTEM** - Top feed manifolds are located at the highest point in the drip zone and are provided with air release valves to prevent drain down of upper laterals in the zone to lower laterals in the zone. This prevents saturation of the lower laterals after the pump shuts off.

6. **RUN** - One length of drip tubing, placed along a contour and installed level.

7. **LATERAL** - Comprised of runs, originates from the zone supply line and terminates at the lateral return line. A lateral typically has between 1-12 runs.

8. **ZONE** - Made up of laterals, a design may have between 1-4 zones.

PERC-RITE® DRIP DISPERSAL
MASSACHUSETTS DESIGN PROCEDURES

By following these guidelines, a designer can complete the site layout and system selection needed for the approval and proper installation of the Perc-Rite® drip dispersal system. This design guide uses the standard tubing spacing of 2' on-center but other configurations are available if necessary to accommodate site conditions.

I. SITE ASSESSMENT

A. Perform site evaluation including soil and percolation tests as indicated in Title 5. Soils typically used in drip dispersal are located higher in the soil profile than other systems and attention should be paid to properly classifying and assessing the upper layers.
B. Perform site survey as needed for septic system design.

II. AREA CALCULATIONS

A. Determine design flow in gallons per day in accordance with 310 CMR 15.203.
B. Determine loading rate from Title 5 (where appropriate, use pressure distribution loading indicated in 310 CMR 15.242). For sites with percolation rates between 60-90 minutes per inch use a loading rate of 0.1 gpd/sq. ft.
C. Determine # of sq. ft. of dispersal area as if a field or bed were being designed (bed bottom only, no sidewall credit is to be used). No credit or Local Upgrade Approval can be taken for reducing the size of the soil absorption system.
D. Determine minimum # of linear feet of drip tubing required. Since tubing is typically placed 2 feet on-center, the # of sq. ft. of the dispersal area required is divided by 2 to obtain the # of linear feet of drip tubing required. Note that the minimum length of drip tubing on any site is 400'. This correlates generally to 800 sq. ft. of dispersal area.

III. DISPERSAL SYSTEM DESIGN

A. Lay out the drip dispersal area. For ease of installation, selecting a long and narrow configuration following the contour of the land is recommended. There is no need to lay out and depict each drip tubing run on the design plan as long as the appropriate area is available. Note that runs are typically placed at 2' on-center but to avoid trees or other obstructions the on-center distance may vary between 1'-3'. This variation in drip tubing spacing will generally be best determined in the field by the installer and need not be depicted on the site plan.
B. Determine maximum length parallel to the contour for the drip line run.
C. Refer to the Standard Zone Selection Table below and obtain the appropriate Zone Detail number. Note that odd numbers of runs require the supply and return manifolds to be constructed at opposite ends of the dispersal zone. Selecting a Zone Detail number using the same maximum length parallel to the contour but using a greater sq. ft. of SAS is acceptable.

Zone Detail Numbering System - Each zone is designated by a "Z" indicating it is a Zone Detail Designation followed by three numbers: the first is the number of zones; the second is the number of laterals per zone; the third is the number of runs per lateral.

The example below shows a two-zone detail with three laterals per zone and three runs per lateral = Z223. The runs are typically installed 2 feet on-center.

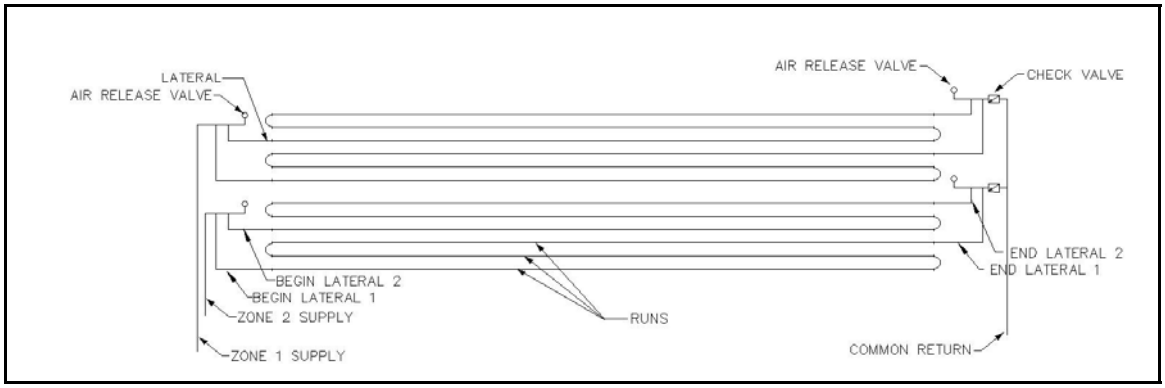


Figure 2: Detail of Z223

PERC-RITE® STANDARD ZONE SELECTION TABLE

(Based on 2' o.c. Tubing Spacing)

Length Parallel to Contour	50'	75' – 99'	100'	125'	150'	200'	225'	250'	300'
Sq. Ft. of SAS Required									
800	Z124 Z142	Z123 Z132	Z122 Z141			Z121			
900	Z133	Z123 Z132			Z131		Z121		
1000	Z125 Z152		Z151	Z122 Z141				Z121	
1200	Z126 Z134 Z143	Z124 Z142	Z123 Z132		Z122 Z141	Z131			Z121
1250				Z151					
1350		Z133					Z131		
1500	Z135 Z153	Z152		Z132	Z151			Z131	

Length Parallel to Contour	50’	75’ – 99’	100’	125’	150’	200’	225’	250’	300’
1600	Z144 Z224 Z242		Z142 Z222 Z241			Z141 Z221			
1800	Z136 Z233	Z134 Z143 Z223 Z232	Z133		Z132 Z231		Z141 Z221		Z131
2000	Z145 Z225 Z252		Z251	Z142 Z222 Z241				Z141 Z221	
2400	Z226 Z234 Z243	Z224 Z242	Z223 Z232		Z222	Z231			Z221
2500				Z251					
2700		Z233					Z231		
2800	Z272		Z271						
3000	Z235 Z253	Z252		Z232	Z251			Z231	
3200	Z244		Z242			Z241			
3600	Z236 Z326	Z234 Z324	Z233 Z323		Z232 Z322	Z331	Z241		Z231 Z321
3750				Z351					
4000	Z254		Z252	Z242		Z251		Z241	
4050		Z333					Z331		
4200	Z372		Z371						
4500	Z335	Z253 Z352		Z332	Z351		Z251	Z331	
4800	Z246 Z344	Z244 Z424	Z243 Z342 Z423		Z242 Z422	Z341 Z431			Z241
5000				Z451					
5400		Z334 Z434	Z333		Z332		Z341 Z431		Z331
5600			Z471						
6000		Z452	Z352	Z342 Z432	Z451	Z351		Z341 Z431	

Length Parallel to Contour	50’	75’ – 99’	100’	125’	150’	200’	225’	250’	300’
6400			Z442			Z441			
6750		Z353					Z351		
7200		Z344 Z434	Z343 Z433		Z342 Z432		Z441		Z341 Z431
8000			Z452	Z442		Z451		Z441	
9000							Z451		
9600			Z443		Z442				Z441

D. Confirm the maximum allowable feet of drip tubing per lateral does not exceed lengths depicted in table below.

Maximum Allowable Feet of Drip Tubing Per Lateral					
2-Lateral System	3- Lateral System	4- Lateral System	5- Lateral System	6- Lateral System	7- Lateral System
300' max	300' max	300' max	240' max	165' max	100' max

E. Once selected, the Zone Detail image is to be inserted as a separate detail on the design plan. It need not be inserted or depicted on the topographic contours.

F. Locate the pump chamber and Hydraulic Unit within 30’ of each other and with no more than an 8 feet difference in elevation from the off float in the tank to the base of the Hydraulic Unit. If this can not be accomplished, please contact American Manufacturing or their local representative for technical assistance.

G. Confirm adequacy of standard pump:
   I. Determine maximum static lift from the pump chamber off-float level to highest point in any zone. Note: if there is a negative static lift please contact dealer for design assistance.
   II. Determine longest length of pipe between Hydraulic Unit and the farthest zone (supply or return length).
   III. Confirm maximum static lift complies with the Lift and Distance Table below. Note that large flow systems may require supply and return pipes larger than the standard 1” size or non-standard pumps that will require manual calculation of acceptable head losses. Please contact American Manufacturing or their local representative for technical assistance with those calculations.

Lift and Distance Table *Maximum Static Head Which Can Be Provided*						
	2-Lateral System	3-Lateral System	4-Lateral System	5-Lateral System	6-Lateral System	7-Lateral System
Supply or Return Pipe Length (feet). Select longest of either the supply or return lines.						
100	98’	88’	75’	74’	79’	77’
150	96’	84’	69’	66’	70’	68’
200	94’	81’	63’	58’	61’	59’
250	92’	77’	57’	51’	52’	49’
300	90’	73’	50’	43’	44’	40’
350	88’	70’	44’	35’	35’	31’
400	86’	66’	38’	27’	26’	21’
450	84’	63’	32’	19’	17’	
500	82’	59’	26’	12’		
550	80’	55’	20’			
600	78’	52’	14’			
650	76’	48’	8’			
700	74’	45’	2’			
750	72’	41’				
800	70’	37’				
850	68’	34’				
900	66’	30’				
950	64’	27’				
1000	62’	23’				

IV. PREPARE ONSITE TREATMENT AND DISPERSAL SYSTEM PLAN

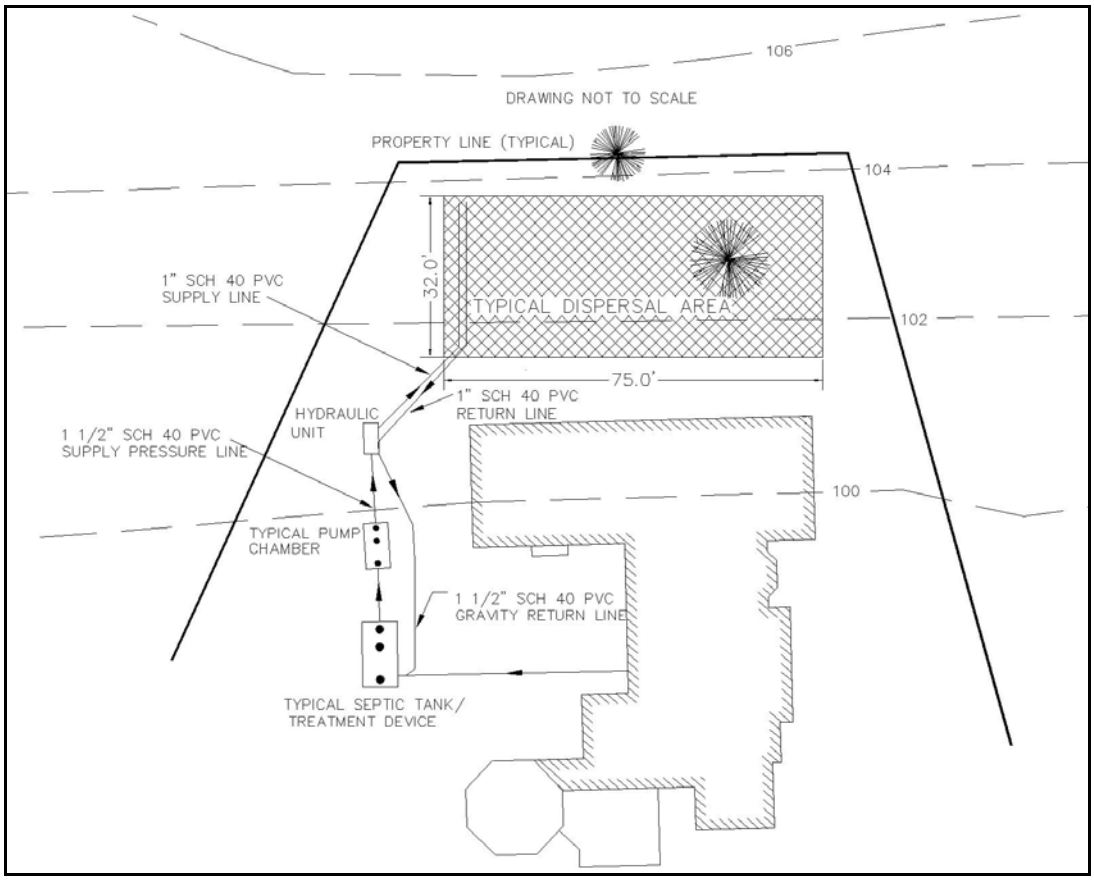
Prepare standard design plan for submission to local Board of Health. On the design plan show:

1. Location of septic tank and treatment unit
2. Location of pump chamber and Hydraulic Unit

3. Indicate the footprint of the SAS in which the tubing is to be installed
4. Indicate depth of tubing installation. Note that this may be influenced by the following site variables:
   - Separation from drip tubing to EHGW needs to remain at 2'(3' when percolation rate is <5 mpi) if 4' of naturally occurring soil is present or 4' (if less than 4' of naturally occurring soil is present) unless a variance is obtained
   - Type of vegetation or other cover material and the exposure to sunlight of the drip field so that greater depth is provided at locations with less protection. Installation depths of 12" – 18" are preferred for unprotected and shaded areas
   - Thickness of soil layers and the need to have the drip tubing placed in a particular soil horizon.
5. Indicate the route of the supply and return pipes.
6. Indicate control panel as being able to accommodate: 2 zones or 4 zones, as appropriate. The panel must be installed in a location accessible to the operator. If system is greater than 2000gpd, control panel must be equipped with remote monitoring capabilities.
7. Provide appropriate details for:
   - Building sewer.
   - Septic tank and treatment unit.
   - Piping (standard piping requirements are 1-1/2" SCH 40 PVC from the pump tank to the Hydraulic Unit, 1" SCH 40 PVC supply and return pipes, and 1-1/2" SCH 40 PVC gravity return from the Hydraulic Unit to the septic tank inlet. Other pipe sizes may be used if site conditions require).
   - Pump chamber details including Cool Guide™ and pump, float elevations, control panel and manhole to grade. Note the pump float settings are to be provided as follows: The required daily design flow for the system needs to be provided between the alarm and drip enable floats. The peak enable float is set half way between the alarm and drip enable floats.
     - Alarm float- to be set at distance from drip enable float to provide a full day of design flow capacity,
     - Peak enable float- to be set at ½ the distance between the alarm float and the enable float,
     - Drip enable float- to be set at 18" up from the bottom of the pump chamber, and
     - Off float- to be set at 14" up from the bottom of the pump chamber.
   - Air Release and Check Valve
   - Manifold
   - Typical Manifold Connection
   - Typical Drip Loop Connection
   - Zone Detail
   - General Notes
   - Cold Climate Installation Notes
8. Submit plans to American Manufacturing or their local representative for confirmation of design parameters
9. Submit plans to Board of Health and if required to DEP with appropriate fees, etc.

DESIGN EXAMPLES

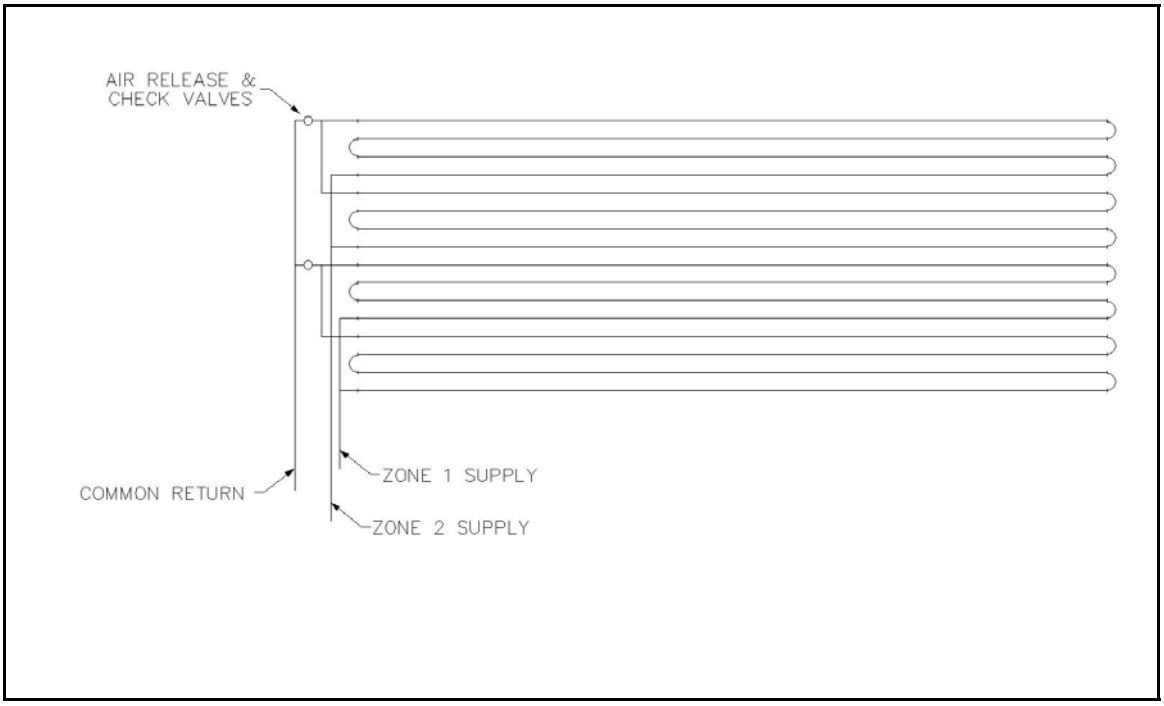
Example 1: Typical residential site, tree to be avoided.



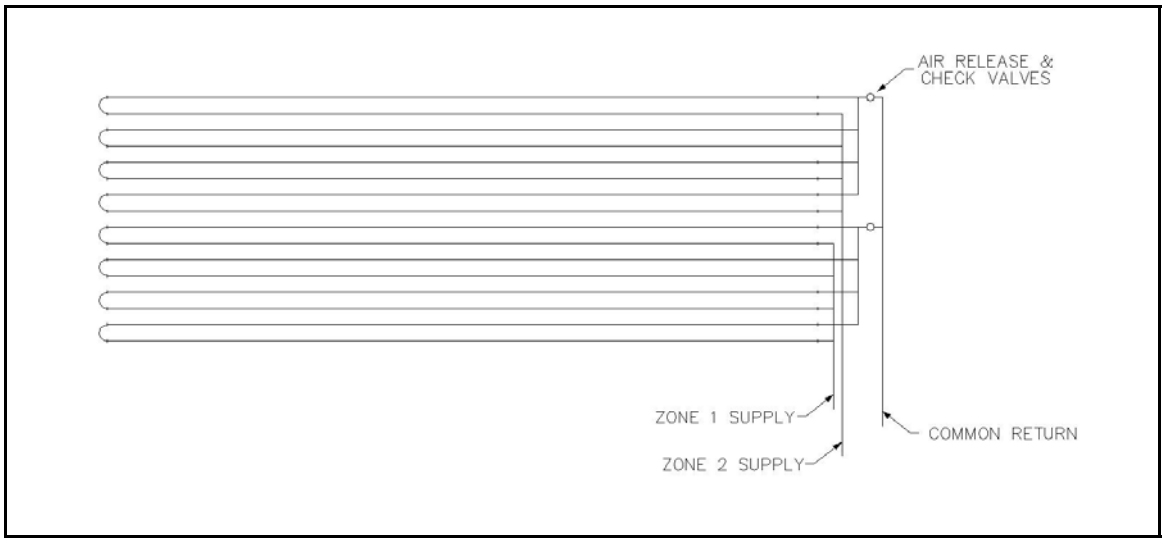
- Assume a design flow of 960 gallons per day,
- Assume a Long-Term Acceptance Rate (LTAR) of 0.4 gal/day/sq.ft.,
- 960 gal/day/0.40gal/day/sq.ft.= 2,400 sq. ft. of dispersal area required,
- Divide 2,400 by two to determine the linear feet of drip tubing required. 2,400/2= 1,200 LF,
- From the site plan above, the length parallel to the contour is 75 feet. Since 2,400 sq. ft. of dispersal area is required the length perpendicular to the contour is 32 ft.,
- From the ***Standard Zone Selection Table*** it can be found that detail #Z224 is suited for a run length of 75 feet and providing 2,400 sq. ft. of equivalent leaching area. Also appropriate would be a Z242. The model with the most suitable # of runs and laterals to be selected by the designer depending on site lay out.

- During actual field installation, on-center spacing may be reduced to a distance of no less than 1'. This will allow the same 1,200 LF of tubing to be installed while avoiding the tree in the dispersal area.

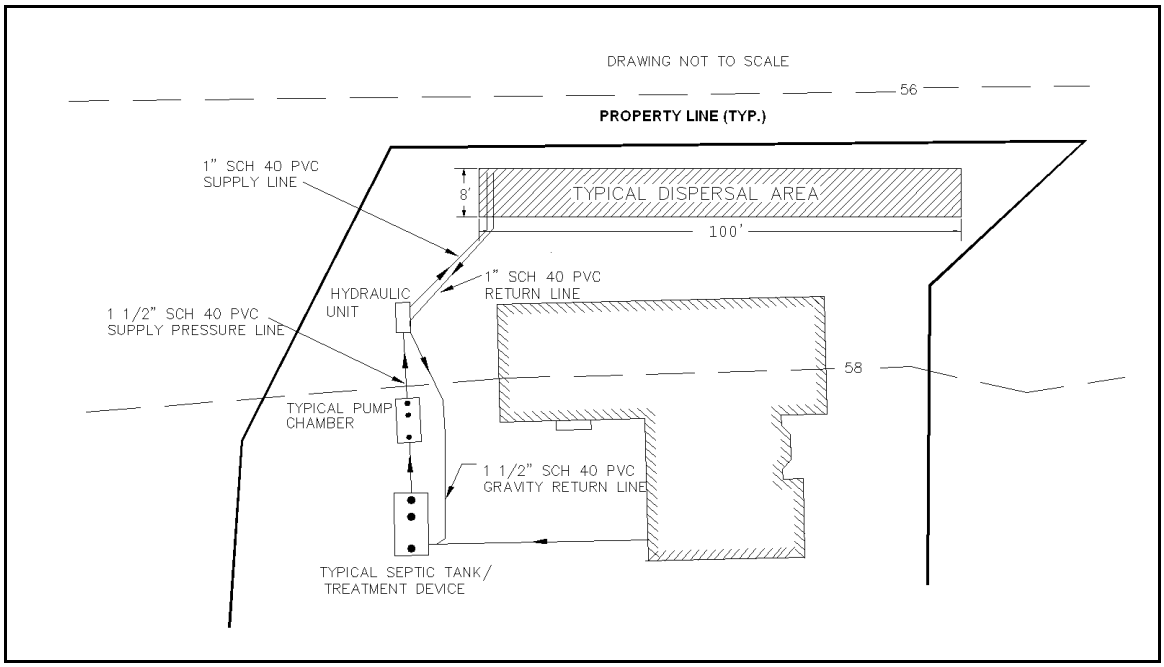
Z224



Z 242

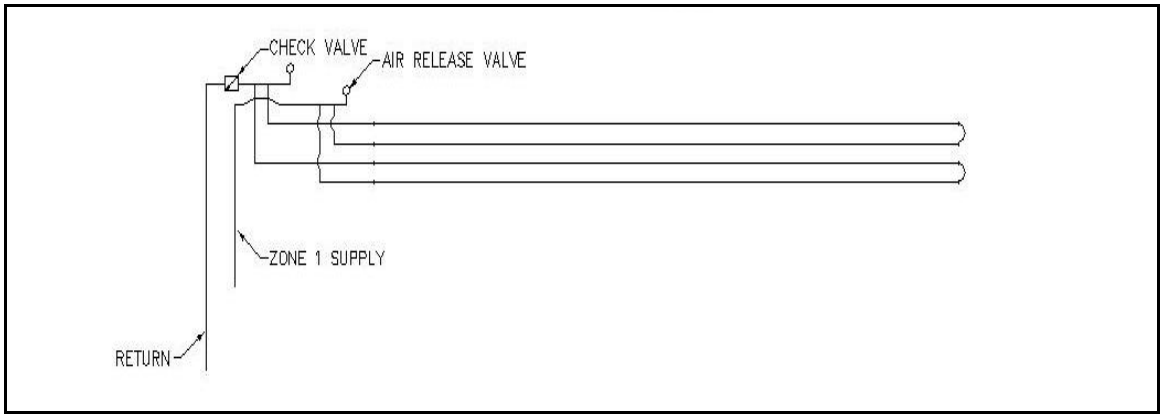


Example 2: Typical residential site, tubing required does not meet the Manufacturer's recommendations for minimum length.

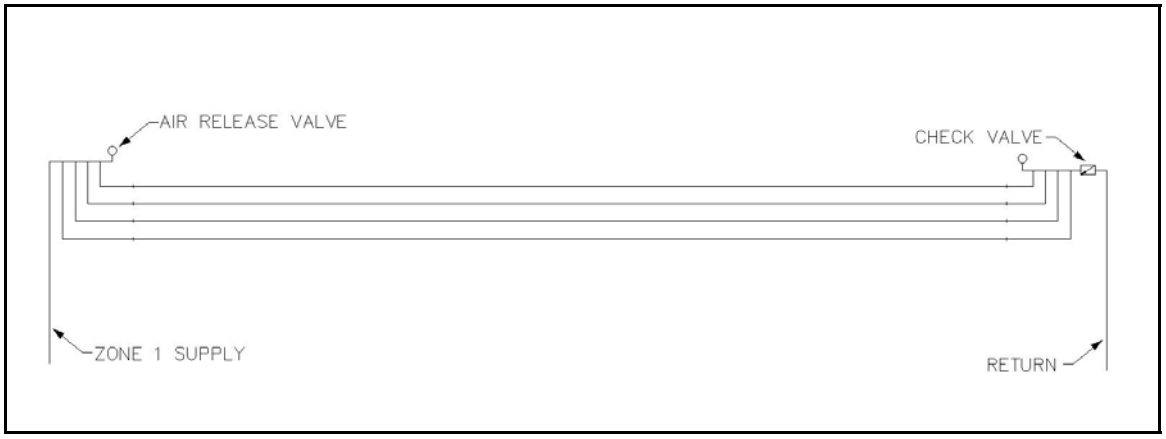


- Assume 4 bedrooms- 4 bed. x 110 gal./day/bed. = 440 gal/day,
- Assume 0.60 gal/day/sq.ft. for a LTAR,
- 440 gal/day/0.60gal/day/sq.ft.= 733.3 sq.ft./2 ft= 367 LF **THE MINIMUM AMOUNT OF DRIP TUBING TO BE INSTALLED ON ANY SITE IS 400 LINEAR FEET,**
- From the site plan above, the length parallel to the contour is 100 feet. Since 800 sq. ft. of dispersal area is required the length perpendicular to the contour is 8 ft.,
- With a contour length of 100' it can be seen from the ***Standard Zone Selection Table*** that either a Z122 or a Z141 may be used. Note that the Z122 has supply and return lines on the same end of the drip field while the Z141 has supply and return lines on opposite ends of the drip field.

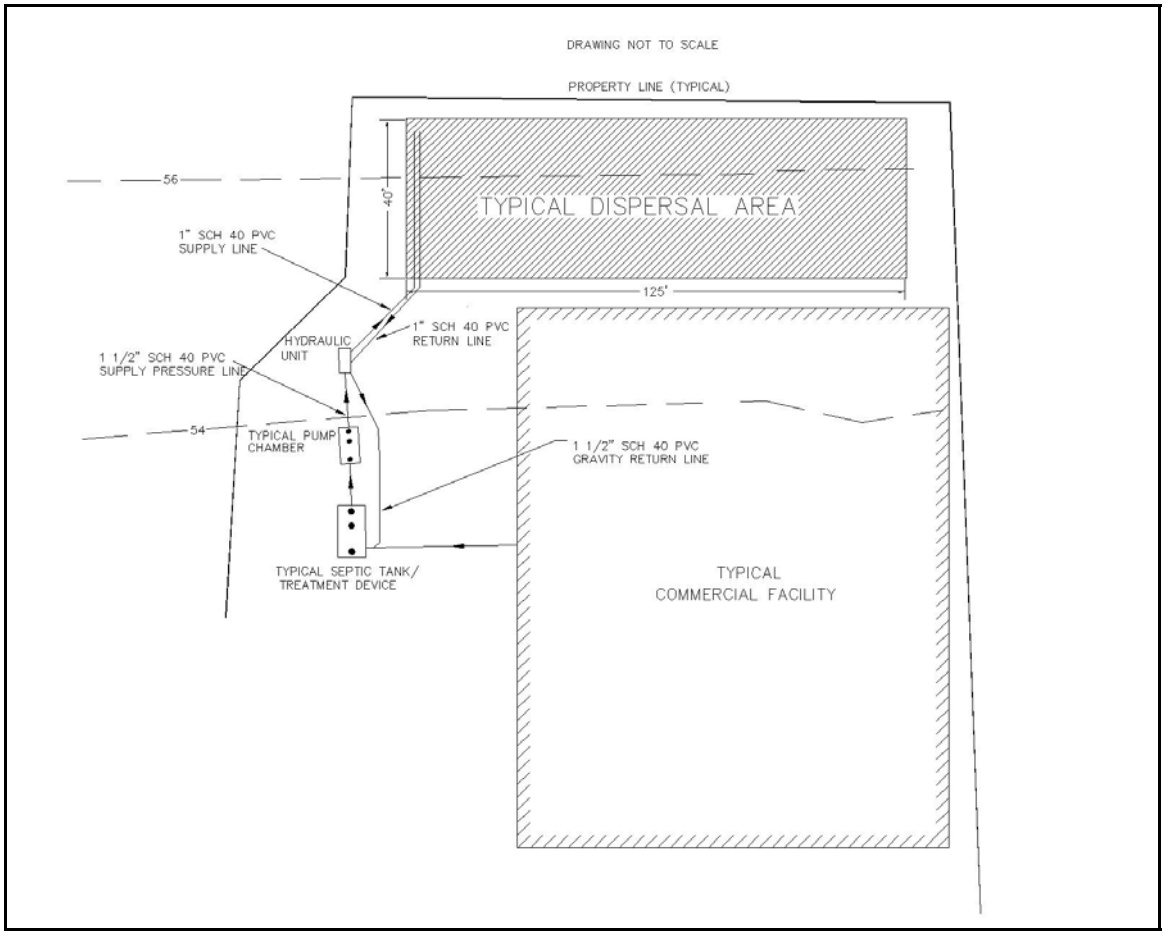
Z122


CHECK VALVE
AIR RELEASE VALVE
ZONE 1 SUPPLY
RETURN

Z141


AIR RELEASE VALVE
CHECK VALVE
ZONE 1 SUPPLY
RETURN

Example 3: Typical larger system design, round up to next largest system.

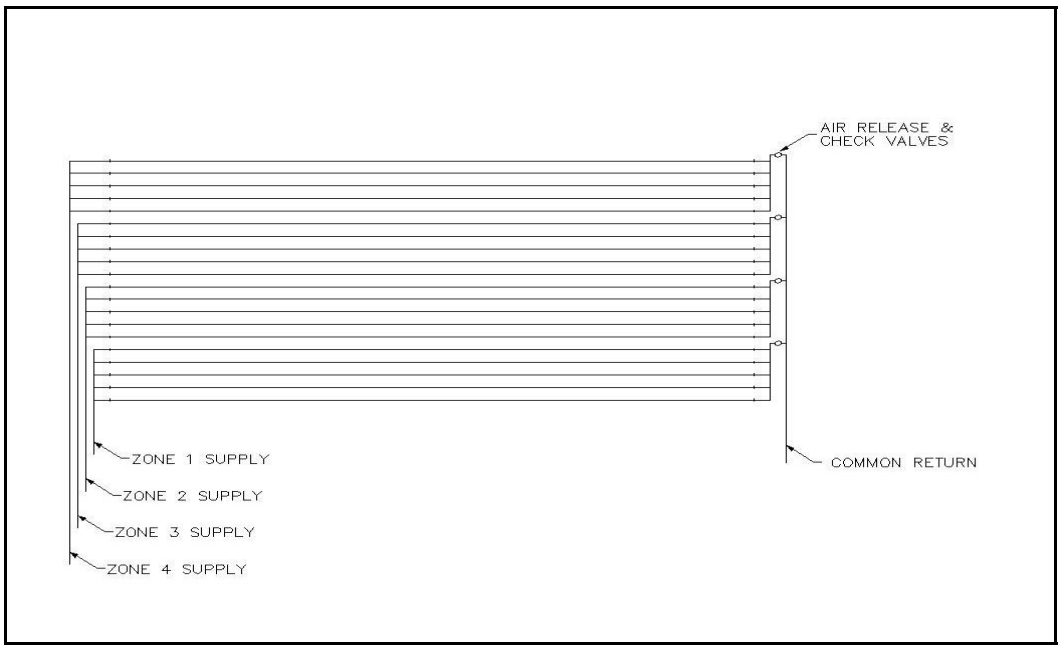


- Assume a design flow 2,600 gpd,
- Assume a LTAR = 0.56 gpd/sq. ft.,
- 2,600 gpd / 0.56 gpd/sq. ft. = 4,643 sq. ft. required,
- From the site plan above, the length parallel to the contour is 125 feet,

- From the ***Standard Zone Selection Table*** select the zone detail at the intersection of 125' contour length and 4,800 sq. ft. Since none exists at this intersection, move to the next largest acceptable area and select the zone detail at the intersection of 125' contour length and 5,000 sq. ft.

The zone detail selected could be:

Z	4	5	1
Z = Zone	# Zones	# Laterals	# Runs/Lat


AIR RELEASE &
CHECK VALVES
ZONE 1 SUPPLY
ZONE 2 SUPPLY
ZONE 3 SUPPLY
ZONE 4 SUPPLY
COMMON RETURN