OAKSON, INC.

Innovative Drip Dispersal, Water Re-Use, and Wastewater Products

MASSACHUSETTS PERC-RITE DESIGNER'S GUIDE FOR PRE-TREATED EFFLUENT

This Designer's Guide for Massachusetts Pre-treated 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. It 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.

These drip dispersal 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. There are almost no visible indications that the site is being used for dispersal purposes after the installation is complete.

Challenging sites, 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 is as shallow as 2' can also be accommodated. Using this 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 results 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 Drip Dispersal System Flow Diagram

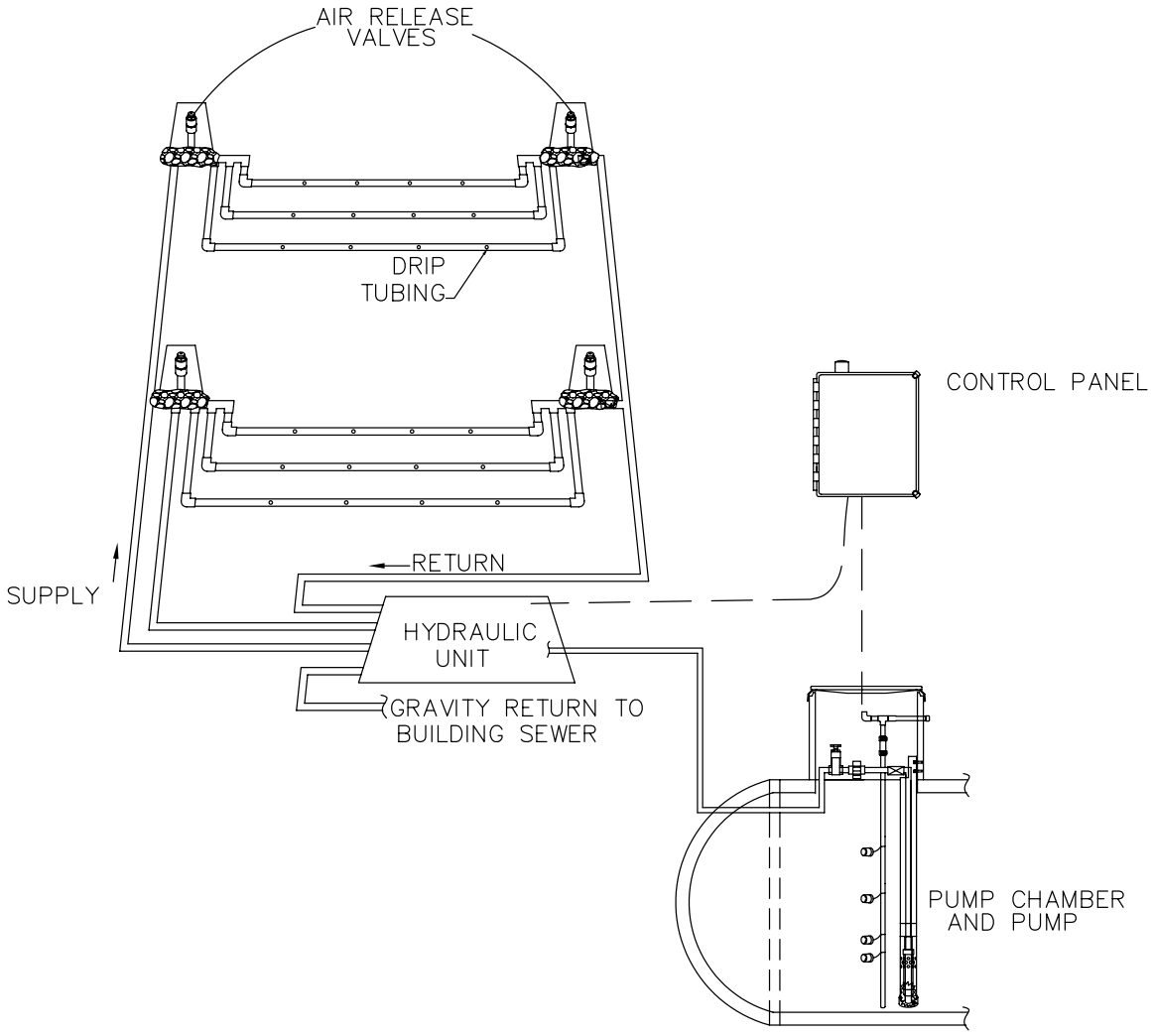


Figure 1: Typical Drip Dispersal System Flow Diagram

System Components and Definitions

Control Panel — A state-of-the-art control panel, activated by standard float switches located in a pump tank. The controller enables the dispersal cycles to function on a timer-controlled basis. The controllers are available in many arrangements depending upon the number of zones in the design.

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. High pressure operation in the tubing keeps roots from intruding.

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 allows for easy electrical connection to the control panel.

Lateral — Comprised of runs, originates from the zone supply line and terminates at the lateral return line. A lateral typically has 1-12 runs.

Manifold System — A rigid pipe delivery system to provide quick and even application of effluent to the drip tubing. The manifolds are provided with air release valves to prevent drain down of upper laterals in the zone to lower laterals in the zone after the pump shuts off.

Pump System — The pump, Cool Guide for mounting the pump and the float switches are installed in the pump chamber. The 15 gpm pump is suitable for most residential installations. Flows for large systems can easily be accommodated.

Run — One length of drip tubing, placed along a contour and installed generally level.

Zone — Made up of laterals, a design may have 1-4 zones.

Zone Detail — Image showing the runs, laterals, and zones for a particular application.

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.

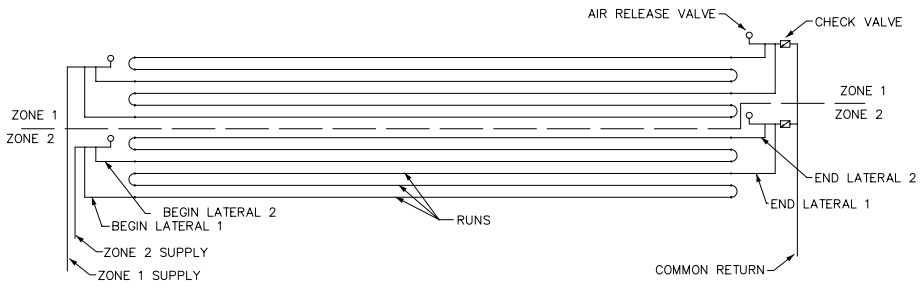


FIGURE 2: ZONE DETAIL OF Z223.

The example shows a two-zone detail with two laterals per zone and three runs per lateral.

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 drip dispersal system. This design guide uses the standard tubing spacing of 2' on-center but other configurations are easily designed to accommodate many types of 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 on-site wastewater 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 and 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 2' on-center but to avoid trees or other obstructions, the on-center distance may vary. 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 following Standard Zone Selection Table and obtain the appropriate Zone Detail.

   ➔ Note that odd numbers of runs require the supply and return manifolds to be constructed at opposite ends of the dispersal zone.

   ➔ If the appropriate box in the table is blank, choose the next largest detail. This may have the same or a shorter length parallel with the contour.

   ➔ Runs up to 300' are allowed and no vent is required.

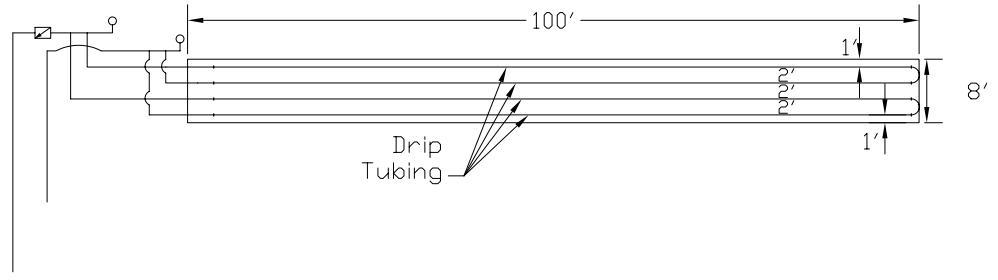
Standard Zone Selection Table
(Based on 2′ o.c. Tubing Spacing)

Length Parallel to Contour → / Sq. Ft. of SAS Required ↓	50′	75′	100′	125′	150′	200′	225′	250′	300′
800	Z124 Z142		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	
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						

Standard Zone Selection Table, Continued
(Based on 2′ o.c. Tubing Spacing)

Length Parallel to Contour → / Sq. Ft. of SAS Required ↓	50′	75′	100′	125′	150′	200′	225′	250′	300′
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	
6400			Z442			Z441			
6750		Z353					Z351		
7200		Z344 Z434	Z343 Z433		Z342 Z432		Z441		Z341 Z431
8000			Z452	Z442		Z451		Z441	
9600			Z443		Z442				Z441

Note that the effective leach area extends one foot beyond the outermost drip tube, as shown in the example below. This information is provided to you as a reference and does not impact the area calculations or the zone detail selection process.



Example with the tubing placed two feet on center, 4 runs of tubing, 1′ effective area around tubing yields 8′ x 100′ or 800 s.f.

D. For systems greater than 1,000 gpd, confirm that the maximum allowable feet of drip tubing per lateral does not exceed the 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' difference in elevation from the off-float in the tank to the base of the Hydraulic Unit. If this cannot be accomplished, please contact Oakson Inc. for technical assistance.

G. Confirm adequacy of standard pump:

- ➔ 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 Oakson Inc. for design assistance.
- ➔ If distance from pump to drip field is greater than 100 ft., determine longest length of pipe between Hydraulic Unit and the farthest zone (supply or return length) and confirm that the maximum static lift complies with the Lift and Distance Table below. If the distance is less than 100', go to section IV. 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 Oakson Inc. for technical assistance with those calculations.

Lift And Distance Table

Maximum Static Head Which Can Be Provided Between The Pump And The Highest Drip Zone

	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 On-Site Treatment And Dispersal System Plan

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

A. Location of septic tank and treatment unit.

B. Location of pump chamber and Hydraulic Unit.

C. Indicate the footprint of the SAS in which the tubing is to be installed and depict any limiting setbacks that may exist such as property lines, wells, etc.

D. Indicate the depth of tubing installation. Note that this may be influenced by the following site variables:

- ➔ Separation from drip tubing to estimated seasonal high groundwater (ESHGW) needs to remain at 2'(3' when percolation rate is <2 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.
- ➔ Types of vegetation or other cover material and the exposure to sunlight of the drip field. Installation depths of 12" – 18" are preferred for unprotected and shaded areas and may be as shallow as 6" in more protected sites.
- ➔ Thickness of soil layers and the need to have the drip tubing placed in a particular soil horizon.

E. Indicate the route of the supply and return pipes.

F. Provide appropriate details for:

- ➔ Building sewer.
- ➔ Septic tank and treatment unit.
- ➔ Piping (location of piping to and from the hydraulic unit and the dispersal field.)
- ➔ *Pump chamber details including Cool Guide and pump, float distances, and manhole to grade. The required daily design flow for the system should be provided between the alarm and drip enable floats if the volume is available. Note the pump float settings are to be provided as follows:

    1. *Alarm float should be set at distance from drip enable float to provide a full day of design flow capacity or to maximize storage capacity.*
    2. *Peak float to be set at ½ the distance between the alarm float and the enable float.*
    3. *Drip enable float to be set at 18" up from the bottom of the pump chamber.*
    4. *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

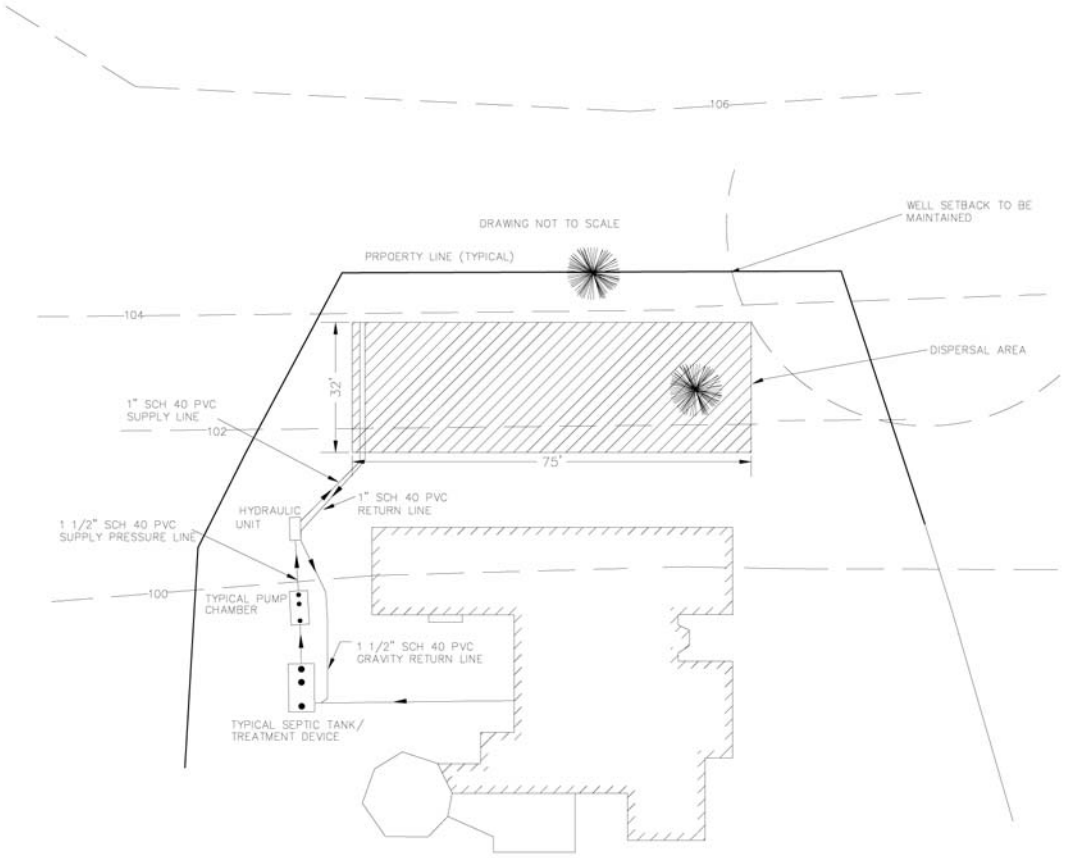
**These details provided in AutoCAD format on the "Detail Sheet" on our web site www.oaksoninc.com.*

G. Submit plans to Oakson Inc. for confirmation of design parameters.

H. Submit plans to Board of Health and if required to the Massachusetts Department of Environmental Protection (DEP) with appropriate fees, etc.

Design Examples

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



➔ Assume a design flow of 880 gallons per day.

➔ Assume a Long-Term Acceptance Rate (LTAR) of .37 gal/day/sq.ft.

➔ 880 gal/day/0.37gal/day/sq.ft.= 2,400 sq. ft. of dispersal area required

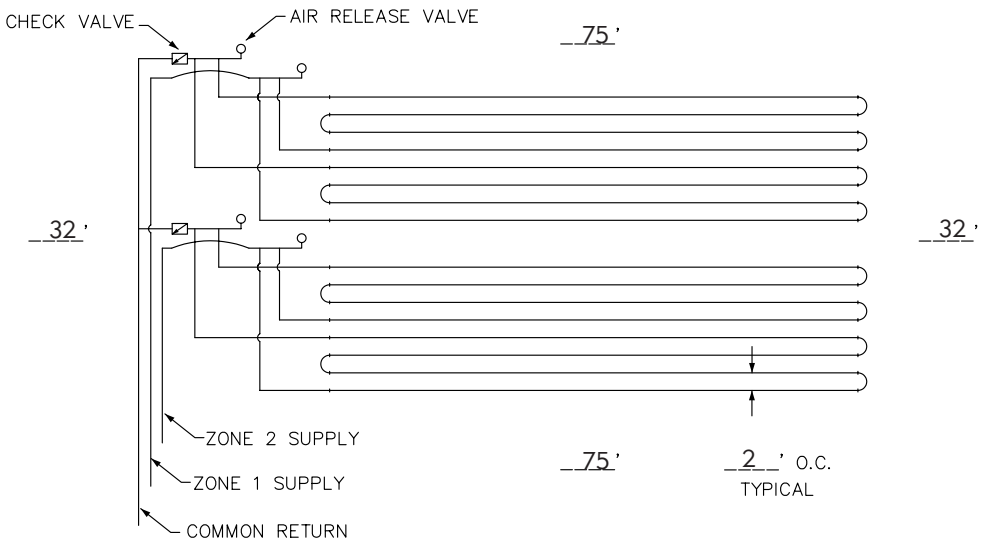
➔ Divide 2,400 by two to determine the linear feet of drip tubing required. 2,400/2= 1,200 LF.

➔ 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. (2,400/75=32)

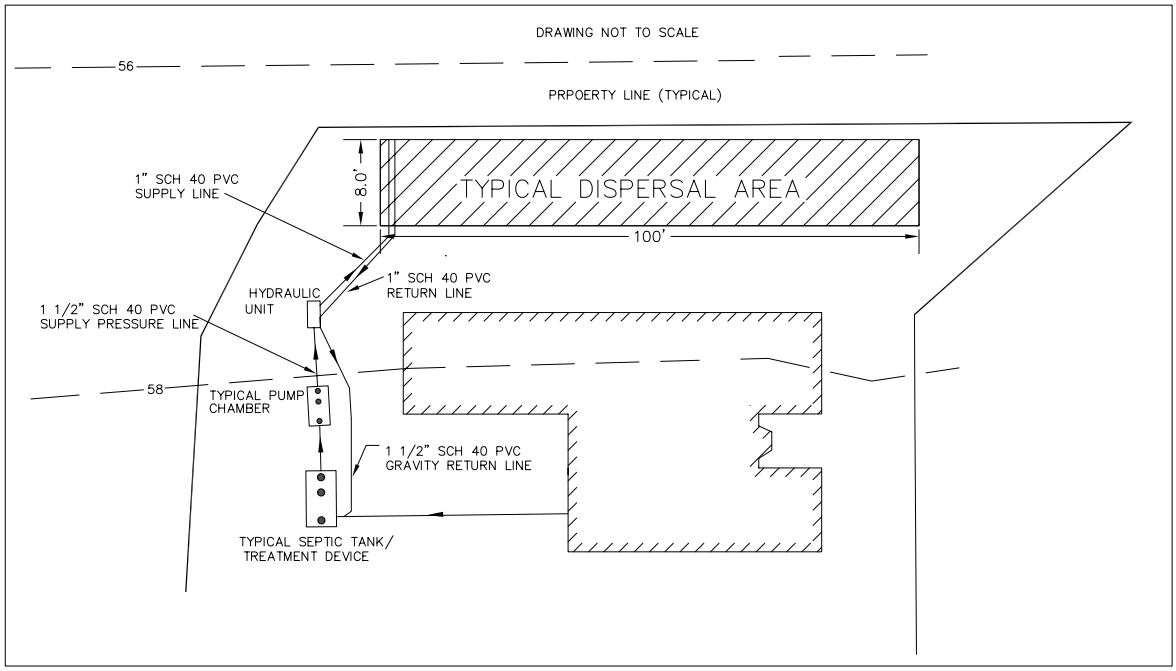
➔ From the Standard Zone Selection Table it can be seen that detail Z224 is suited for a run length of 75 feet with 2,400 sq. ft. of dispersal area.

➔ 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



Example 2: Typical residential site, tubing required does not meet the recommendation for minimum length.



➔ Assume 2 bedrooms- 2 bed. x 110 gal./day/bed. = 220 gal/day.

➔ Assume 0.30 gal/day/sq.ft. for a LTAR.

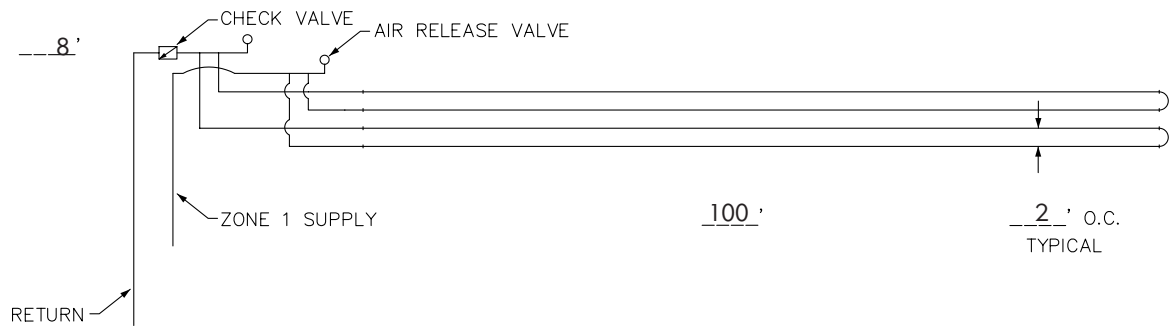
➔ 220 gal/day/0.30gal/day/sq.ft.= 733.3 sq.ft./2 ft= 367 LF.

➔ THE MINIMUM AMOUNT OF DRIP TUBING TO BE INSTALLED ON ANY SITE IS 400 LINEAR FEET.

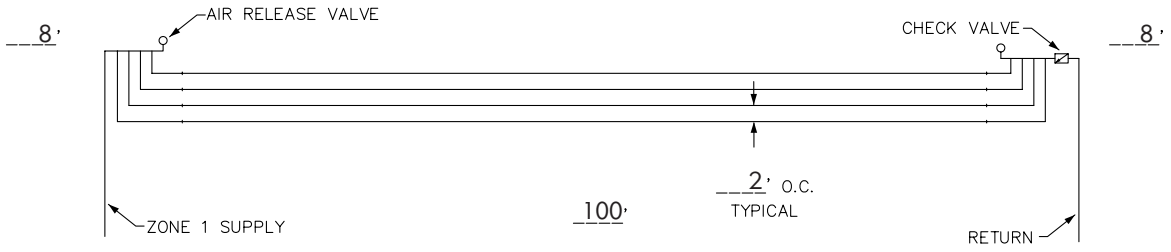
➔ From the site plan above, the length parallel to the contour is 100'. Since 800 sq. ft. of dispersal area is required the length perpendicular to the contour is 8'.

➔ 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.

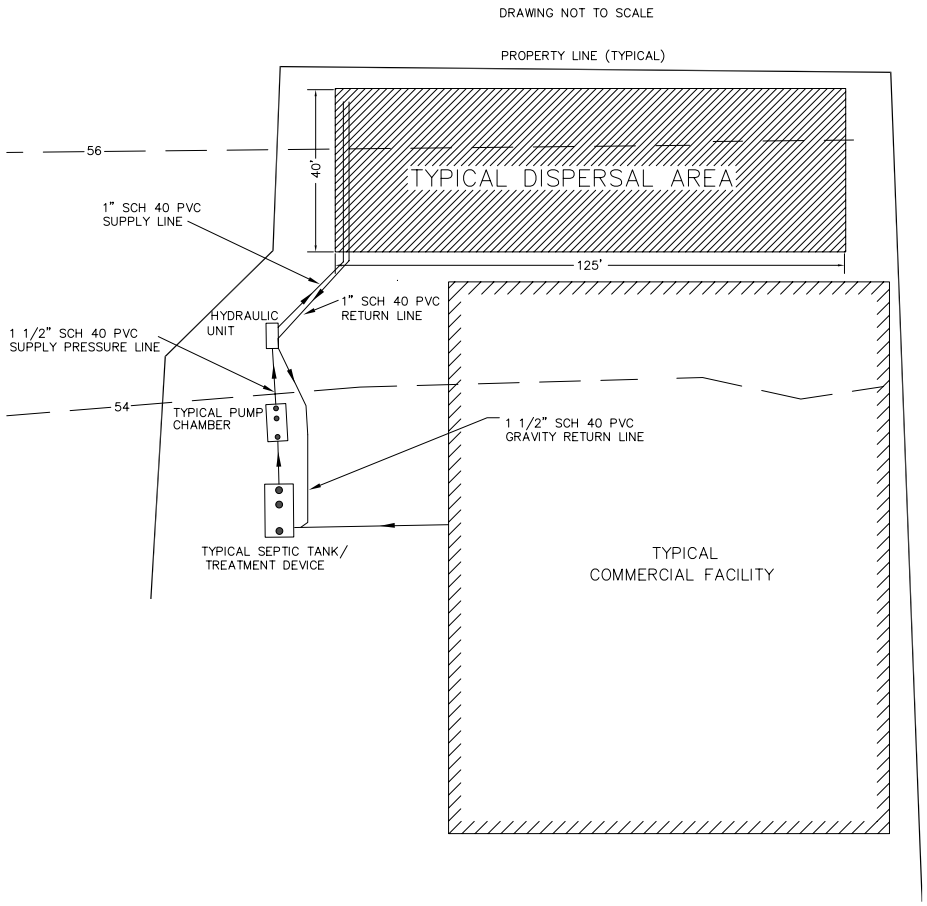
Z122



Z141



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



➔ Assume a design flow 1,300 gpd.

➔ Assume a LTAR = 0.28 gpd/sq. ft.

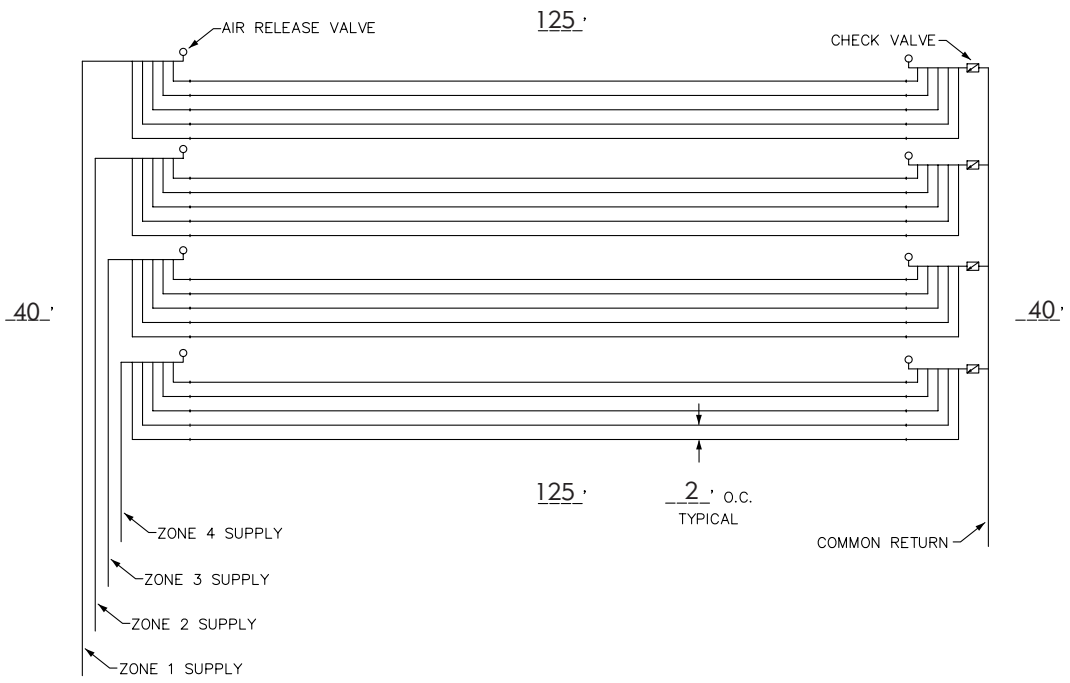
➔ 1,300 gpd / 0.28 gpd/sq. ft. = 4,643 sq. ft. required.

➔ From the site plan above, the length parallel to the contour is 125'.

➔ From the Standard Zone Selection Table select the zone detail at the intersection of 125' contour length and 4,800 sq. ft. Since no detail exists at this intersection, move to the next largest area and select the zone detail at the intersection of 125' contour length and 5,000 sq. ft., which would be a Z451.

➔ Alternatively, please note if the run length was shortened to 100' for 4,800 sq. ft., details Z243, Z342 or Z423 may be chosen.

Z451



Health Agent Checklist for the Perc-Rite Drip Dispersal System

Design Plan:

- ❑ Designer specified the linear footage of tubing
- ❑ Designer specified the depth or height above grade for the tubing to be installed
- ❑ Designer specified correct "Zone Detail" per Design Guide Table
- ❑ Designer specified where to acquire the drip system
- ❑ The Hydraulic Unit drains by *gravity* back to the inlet of the septic tank
- ❑ The Hydraulic Unit is no more than 30 ft. horizontal and 8 ft. vertical from the "off" float in the pump chamber
- ❑ There is a minimum of 400 linear feet of drip tubing specified on plan
- ❑ There is an operation an maintenance agreement in place

At Start-Up:

- ❑ Perc-Rite representative flushes out system (i.e. removes air release valve(s), turns on pump until clean fluid discharges, then reinstalls air release valve(s))
- ❑ Perc-Rite representative sets correct dose run times on the control panel
- ❑ Perc-Rite representative verifies dose times and field flushing rates
- ❑ During operation, no leaks are detected at pipe fittings or elsewhere
- ❑ Depths of tubing are verified

As-Built Plan:

- ❑ Extents of drip field shown (every length of drip tubing need not be depicted)
- ❑ Location of air release valve(s), check valve(s) (if applicable) and Hydraulic Unit are shown

Note: Even if the lengths of the runs of drip tubing exceed 50 ft., no vent is required. The system is aerobic by nature and needs no additional venting.

Oakson, Inc. is committed to excellence. Please feel free to contact us with questions regarding any issue.