Perc-Rite® Drip Dispersal

Design Manual

Rhode Island

OAKSON

YOUR DRIP DISPERSAL EXPERT IN NEW ENGLAND

RHODE ISLAND

PERC-RITE®
DRIP DISPERSAL
DESIGN GUIDE

For systems using septic tank effluent or pre-treated effluent as allowed by
Perc-Rite® Drip Dispersal Approval issued February 10, 2015

This Design Guide contains:

1. INTRODUCTION

The Perc-Rite® Drip Dispersal system is a non-invasive, flexible and environmentally sensitive means of wastewater dispersal. As the only drip dispersal brand approved for both septic tank and treated effluent in New England, Perc-Rite® interest and installations continue to increase every year.

Oakson is the New England distributor of the Perc-Rite® Drip Dispersal system: your source for assistance with design, installation and operation. Contact information, technical specifications and other valuable resources can be found on Oakson's website at www.Oakson.com.

We are proud to share that each Perc-Rite® Drip Dispersal system is assembled in the United States, contains a number of innovative and patented components, and each system is factory-tested before shipment to assure proper operation at start-up. Additionally, the components are covered by a manufacturer-provided one year product warranty.

This Design Guide will assist you in specifying a Perc-Rite® Drip Dispersal System. This technology has an approval letter issued by the Rhode Island Department of Environmental Management (RI DEM) allowing use with septic tank or pre-treated effluent. A copy of this letter is available on Oakson's website www.Oakson.com.

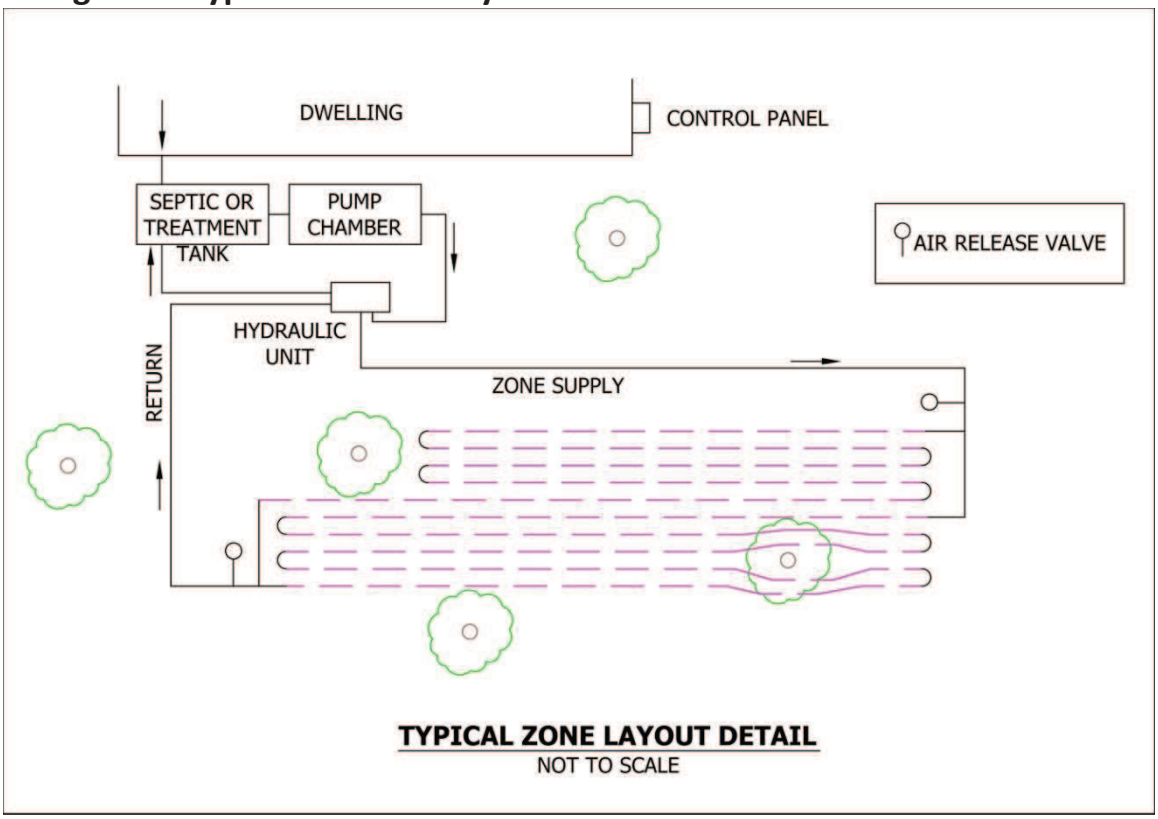
This Design Guide focuses on smaller systems typically seen on a residential scale such as a single family house or a small apartment unit. Since flows of under 1,000 GPD are most common, the information in this Design Guide is targeted to that type of project. Please consult directly with Oakson for design assistance with larger-sized Perc-Rite® Drip Dispersal System projects or aspects of your design which might not fit within this basic Design Guide.

2. PERC-RITE SYSTEM OVERVIEW AND KEY COMPONENTS

a. System Overview

Perc-Rite® Drip Dispersal is a pre-engineered, packaged system which incorporates timer-based dosing of drip tubing with filtration to protect the drip tubing from clogging. The pump is capable of handling a range of distances and elevations and the emitters are evenly spaced along the tubing at 2-foot intervals. Small doses are applied into the soil throughout a 24-hour cycle to provide effective treatment, disposal and management of the effluent.

Figure 1: Typical One Zone System



The example shows all the typical components of a one zone system. This schematic has ten runs of tubing that are fed by two laterals coming off the single supply pipe. In addition to the major components described above, the image also shows air release valves (these are placed in an irrigation box below the ground surface at a point along the supply and return lines and allow for prompt draining of the manifold at the end of the pump cycle), a return line (used to automatically flush out the tubing to keep it in peak operating condition), and an electronic controller (to receive signals from the floats and determine when to turn on the pump). The placement of trees in this image is representative, and designs need to comply with 10' tree setback requirement or seek appropriate variances.

The general flow pattern is as follows: a pump sends the wastewater through a filtering device (the Hydraulic Unit) and then a force main conveys the effluent to the drip field. Within the drip field the effluent is supplied to one or more zones of tubing. Within a zone, the tubing is fed through a manifold system custom selected for each site to assure uniform distribution.

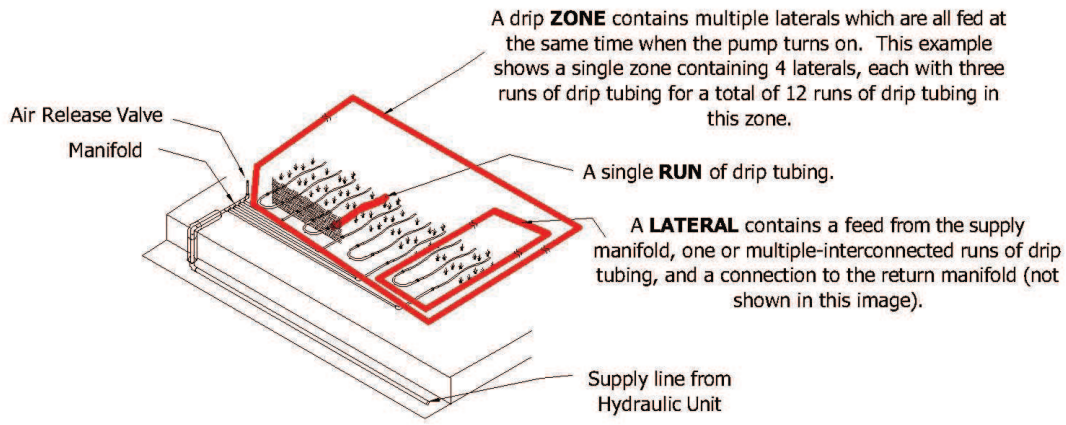
b. Key Components

- A key component of the Perc-Rite® Drip Dispersal System is the **Hydraulic Unit**. This device is used on all systems and serves two purposes: final filtering to protect the drip tubing and, for multi-zone systems, allowing feeding into the different zones. There are two general lines of Hydraulic Units – the ASD line which is designed to accommodate septic tank effluent, and the WD line which is designed to accommodate pre-treated effluent.

  Within the ASD and WD Hydraulic Unit lines are different models which can be used depending on the design flow for the project and the amount of drip tubing needed. The ASD-15 and WD-15 are used for flows up to about 2,000 GPD, the ASD-25 and WD-25 are usually used for flows between 2,000 to 6,000 GPD, and the ASD and WD models 40 through 250 are for flows larger than 6,000 GPD. Oakson offers assistance with selection of the proper Hydraulic Unit.

- The **supply manifold** ensures even and instantaneous feeding of the drip tubing when the pump turns on and provides for drainage of effluent into the soil upon shut-down. The supply manifold divides the tubing into sections called **laterals.** A lateral will feed no more than 300' of tubing from the manifold. Once the manifold configuration is determined for the supply line, an identical manifold is made for the return line. A return line collects the effluent and brings it back to the Hydraulic Unit during periodic automatic flushing of the drip tubing.

Figure 2: Drip Dispersal System Zone, Lateral and Run



ISOMETRIC VIEW OF ZONE, LATERAL AND RUN (TOP FEED MANIFOLD)
(NOT TO SCALE)

- The supplied **pump** sits inside a standard pump tank/wet well. The high head pump is very energy efficient in its operation and can overcome many distance and elevation challenges with ease.

- Another key component is the drip dispersal **tubing** itself which uses specialized emitters to assure equal distribution throughout the drip field, regardless of elevation or distance from the dosing tank.

- Lastly, a **control panel** with a simple timer-based logic programmer will turn on and off the pump depending on the volume of water in the tank, and will emit an audible and visual signal in the event of an operational problem.

3. DESIGN

a. General Design Principles

- Either septic tank effluent or pre-treated effluent can be discharged into the Perc-Rite® Drip Dispersal system. A standard septic tank sized per Rhode Island code, or any approved pre-treatment system, can be selected for use prior to the Perc-Rite® Drip Dispersal system.

- Drip dispersal tubing can be pulled into the existing ground surface or placed on a bed of ASTM C33 sand to whatever height or depth is specified by the designer, and then backfilled.

- Required vertical separations to groundwater, ledge and impervious soils are the same as needed for other types of wastewater dispersal systems, and reductions are similarly allowed when using pre-treated effluent. Measurements to limitations are taken from the drip tubing and needs to be 3’ to water table and 5’ to impervious material with septic tank effluent, and 2’ to water table and 4’ to impervious material with pre-treated effluent.

- The drip tubing can be placed following the land contours, rather than in a level bed configuration, more closely echoing the underlying water table usually found at a sloping site. This often results in a disposal system that fits more naturally with the original site topography.

- Individual runs of drip tubing are generally level with themselves, but each run may be placed at varying elevations from the tubing run above or below it. The manifold system will assure equal flow distribution throughout.

b. Rhode Island-Specific Design Requirements

- The drip field size is determined using appropriate loading rates provided in Table 1. The designer simply needs to calculate the area of the disposal field in accordance with the existing formulas in the RI DEM regulations and use that same footprint area for the drip dispersal field. For ease of reference, Table 1 in the Design Guide reflects these loading rates for both septic tank and pre-treated effluent. Within the drip field footprint the tubing spacing might vary from one project to another, but will not be closer than 1' on center.

- There is a minimum 5' horizontal separation from any location that is lower in elevation than the lowest run of drip tubing. To overcome this, fill may be brought in as necessary with the adjacent side slope to be maintained less than 3:1 for a 25' distance. Note that due to the low application rate of effluent applied to each emitter in the drip dispersal field, this 5' horizontal separation has been reduced from the standard 10'.

- Separation distances from the drip tubing are 3' to water table and 5' to impervious material with septic tank effluent, and 2' to water table and 4' to impervious material with pre-treated effluent when using a RI DEM-approved technology.

- The drip dispersal tubing may be placed in Native A, B or C soils. Placement in the upper soil horizons is desired where pollutant removal is of concern since placement in the aerobic and biologically active zone can significantly reduce bacteria, nitrogen, phosphorous and other typical wastewater constituents of concern.

- There is no stone needed beneath the tubing and there is only a 6" minimum bury depth, which provides a significant reduction in finished

height compared to more traditional disposal systems.

- The maximum bury depth is 24”.

- Dosing tanks for residential use are sized at twice the daily design flow, unless there is upstream flow equalization provided such as in some pre-treatment systems and some screened vault pump tanks.

- The maximum grade for the drip field site is 30%.

- Trees and brush in the drip field area need not be removed however the drip tubing shall be adjusted to maintain compliance with the required 10’ separation to trees.

- No filter fabric is required above the drip tubing.

- All design plans must be reviewed by Oakson until a designer is certified to work independently.

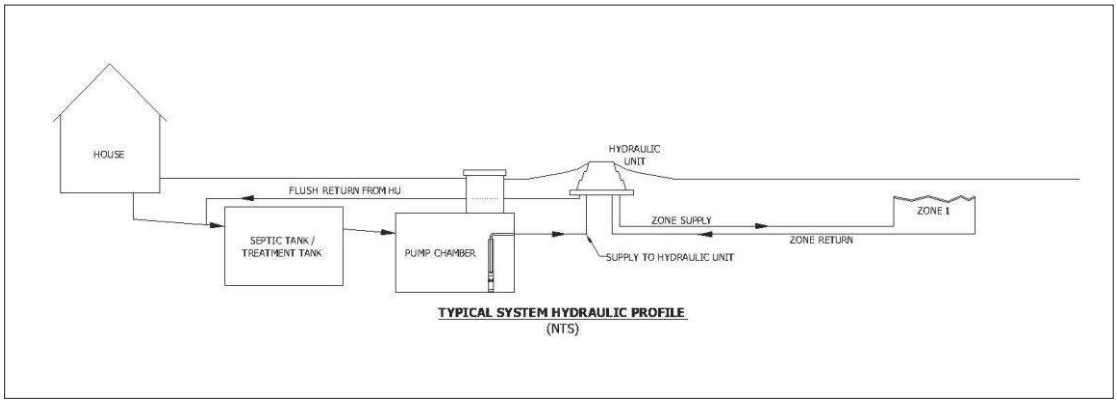
- Special requirements for systems with more than seven bedrooms or 700 gallons per day:
    - Oakson review of design plan

- Special requirements for high strength wastewater and residential projects over 2,000 GPD:
    - Oakson review of design plan
    - Dosing tank to be sized at twice the design flow, twice the average daily flow, or 1.5 times the peak flow, whichever is greater

- Special requirements for projects over 2,000 GPD using septic tank effluent:
    - Remote telemetry

- Special requirements for sites designs for commercial uses and for with loading rates greater than or equal to 0.4 gal/sq. ft/day:
    - Oakson review of design plan

Figure 3: Typical Perc-Rite Drip Dispersal System Hydraulic Profile



4. PERC-RITE® DRIP DISPERSAL DESIGN PROCEDURES

1. Calculate the Drip Field Size

Determine the loading rate in the RI DEM regulations for the type of system being used – either septic tank effluent or pre-treated effluent – and the square footage of area needed.

TABLE 1

Loading rates shall be based upon texture, structure, and consistence of the most restrictive horizon within 1.5 feet below the proposed base of the Perc-Rite® Drip System.

Soil Category [1]	Soil Texture	Soil Structure	Soil Consistence In-Hand Using Soil Clods	Perc-Rite® Loading Rate *Septic Tank* Effluent (gal/ft^2/day)	Perc-Rite® Loading Rate *Pre-Treated* [2] Effluent (gal/ft^2/day)
1 (1m)	cos lcos s, ls cosl, fs	structureless- single grain subangular blocky	loose friable	0.70 (0.61)	2.3
2	vfs, lvfs	structureless- single grain	loose	0.61	2.7
3	ls sl l	granular, subangular blocky	very friable to friable	0.70	3.5
4 (4m)	lfs, fsl lvfs, vfs	granular, subangular blocky	very friable to friable	0.61 (0.70)	3.1
5	vfsl sil, si	subangular blocky	very friable to friable	0.52	2.7
6 (6m)	lcos, ls lfs cosl, sl, l	structureless massive	very friable to friable	0.61 (0.70)	2.3
7 (7m)	vfs fsl, vfsl sil, si	structureless- massive	very friable to friable	0.52 (0.61)	2.1
8 (8m)	all textures	structureless-massive	firm to very firm	0.46 (0.48)	1.9
9 (9m)	all textures	platy, structureless- massive	firm to very firm	0.40 (0.43)	1.5
10	all textures	platy, structureless- massive	extremely firm	Not Allowed	Not Allowed

Notes:

1 "m" means soil has gravelly or channery coarse fragment modifiers.

2 RIDEM A/E treatment technology, which achieves a minimum treated effluent quality of TSS and BOD of 30 mg/L each and FOG of 5 mg/L.

2. Determine Tubing Length & Spacing

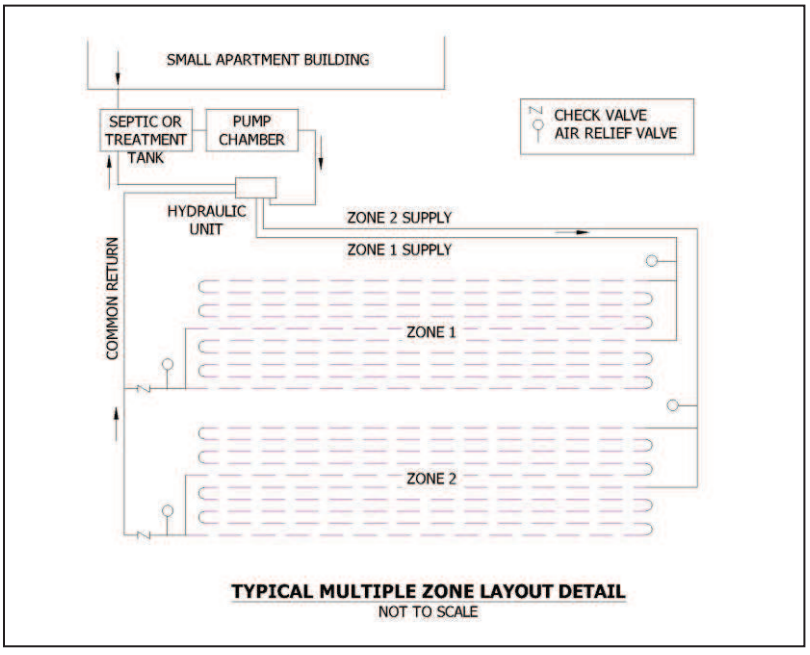
Once the footprint area of the drip field has been determined, and the length and width are calculated, simply use Oakson's website design tool. This device will select the optimum tubing spacing within the drip field

footprint area. Simply input the length and width of the drip field and Oakson's tool calculates the total tubing length and the spacing between the runs of tubing. In general, the minimum number of feet of drip tubing required is the drip field area divided by two.

In the event that the amount of tubing calculated exceeds the minimum required, tubing runs are simply placed closer together within the same required drip field area, rather than expanding the drip field area. For example if there is a 100' long drip field and it is determined that a minimum of 550' of drip tubing is needed, the calculator will round that number of tubing to 600' so there are even lengths of tubing for effective disposal. The calculator will not allow tubing calculations to result in less than 1' on center spacing. Note that there is no cost increase for lengths of tubing required by the Perc-Rite® Drip Dispersal system beyond the regulated minimum length in those instances.

To provide the correct pressure and flow rate the tubing is divided into one or more **zones**. For example, a one-zone system will have all the tubing fed at the same time when the pump turns on while a two-zone system will alternate the feeding of zones. Most single family house projects use a one-zone configuration, while a small apartment building might have two-zones.

Figure 4: A two-zone system



3. Select Manifold Arrangement

The designer needs to select the manifold position (same or opposite side of drip field) and the manifold designations for the drip field: the number of zones, laterals and runs of tubing. This can be output from Oakson's website design tool or calculated manually.

Drip dispersal systems with an even number of tubing runs will have the supply and return lines start and end on the same end of the drip field, allowing for both manifolds to be placed on the same side. Where there is an odd number of tubing runs the manifolds will be on opposite ends. Often, it is advantageous to add one extra tubing run so that the manifolds can be placed on the same side of the drip field.

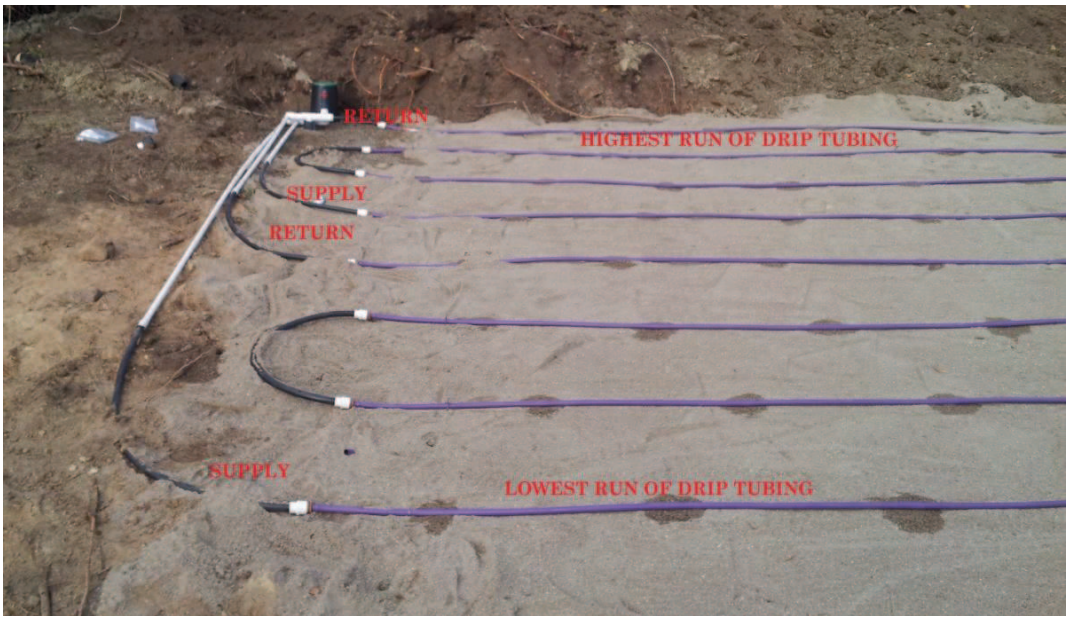
Manifold systems are assembled at the site and for flat sites (slopes less than 3%) are slightly different than manifolds for sloping sites:

- On flat sites there is a force main located below the drip field with risers coming up to feed sections of drip tubing (laterals). This manifold configuration is called a **side feed manifold** which is similar to a manifold used for a pressure distribution system.
- On sloping sites a force main comes up at one point located above the highest point in the drip field and then has feeders which supply to the sections of drip tubing (laterals). This manifold configuration is called a **top feed manifold**. The photograph below shows a Top Feed Manifold

If the manifold is determined in accordance with the procedures provided in this Design Guide and Oakson's website, the configuration of zones, laterals and tubing runs will, with certainty, provide the needed flushing velocity to keep the tubing clean. CAD details for both side feed and top feed manifolds for most common configurations are on the Engineering Support tab of Oakson's website. Use these, or assistance from Oakson, to select the proper manifold configuration and depict it on the design plan.

Selecting the manifold is the part of the design most unique to using Perc-Rite Drip Dispersal. Please contact us by phone or email for any needed assistance.

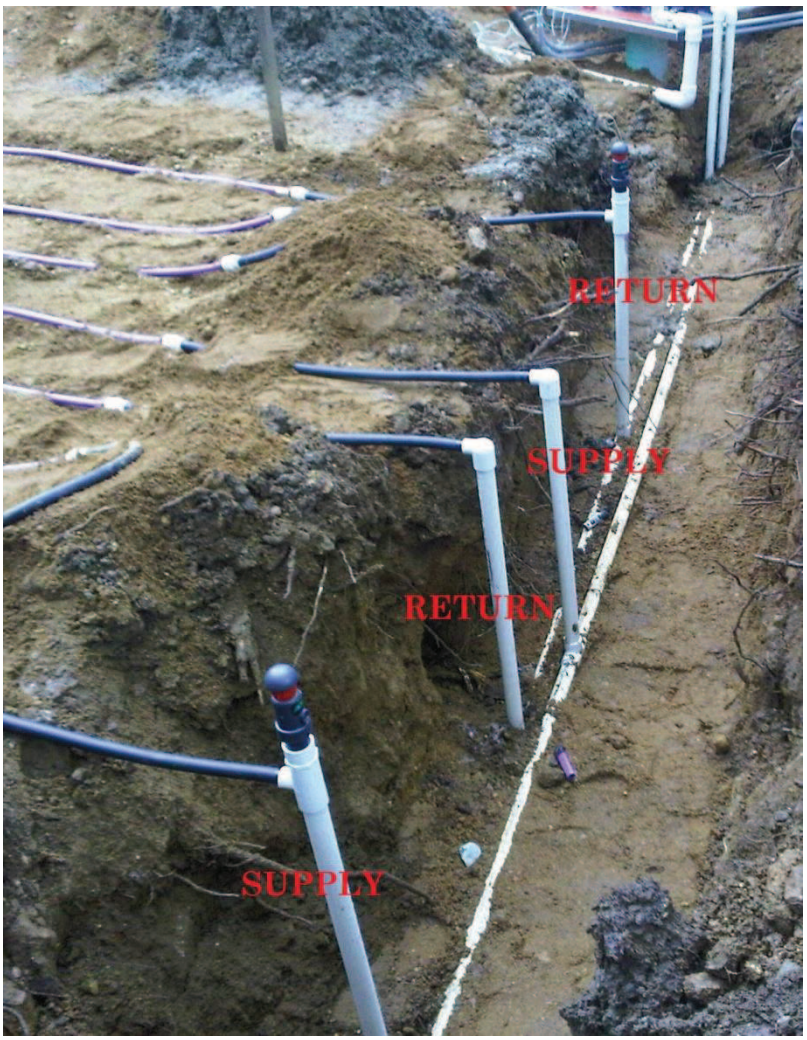
Figure 5: One-zone, two-lateral, four-run system with Top Feed supply and return manifolds



With a Top Feed manifold, the supply pipe from the pump chamber is located below the frost line (not shown in this photo) and has an elbow to bring a riser up to a spot near the highest point in the drip field. In this photo, the purple drip tubing is supplied in two locations through a top feed manifold, with a return manifold located adjacent. The manifold splits into two supply lines, each feeding four interconnected runs of tubing in this example.

The same manifold configuration that is selected for the supply side of the drip field is used for the return manifold.

Figure 6: One-zone, two-lateral, four-run system with Side Feed supply and return manifolds



In a Side Feed manifold, a force main pipe comes down from the Hydraulic Unit, parallels the ground surface in a location below frost depth, and then has risers coming up to feed the drip tubing. In this example, the return manifold is placed in the same trench as the supply manifold because there is an even number of tubing runs.

4. *If needed, repeat steps above for multi-zoned systems*

If the amount of drip tubing is more than 1,200 linear feet with a typical ASD-15 or WD-15 Hydraulic Unit, then a two zone system will be used to spread the wastewater out and ensure proper operation. Typically two equal-sized zones are used but drip dispersal affords great flexibility in this regard. If zones are different in size, simply repeat the steps above to determine the tubing amount, spacing and manifold needed for each zone.

5. *Select and Place Hydraulic Unit*

The Hydraulic Unit supplied with the Perc-Rite® Drip Dispersal system provides for final filtering to protect the drip tubing.

Specify the location of the Hydraulic Unit on the design plan. Note that the unit sits in the ground within an irrigation box with an access cover that is flush to the ground surface. For the ASD-15 and WD-15 systems, the Hydraulic Unit is typically placed on top of the septic tank or pump chamber unless site grading is not suitable for the 18" high irrigation box, in which case the Hydraulic Unit can simply be placed to the side. Larger Hydraulic Units are often in an above ground irrigation box or inside the treatment plant building.

The Hydraulic Unit must be placed to allow for a gravity return line to flow to the septic tank inlet.

Pre-treated effluent uses the WD series of Hydraulic Units while septic tank effluent uses the ASD series. Systems with flows up to about 2,000 GPD will use the ASD-15 or the WD-15 Hydraulic Unit. Contact Oakson for assistance selecting units for larger systems.

6. *Note Piping Size*

Specify the pipes and their dimensions on the plan to provide for clarity during construction. The Hydraulic Unit and pump are plumbed for SCH 40 but suitable transition couplings can be used to allow SDR 26, HDPE or other allowable piping.

The pipe from the pump to the Hydraulic Unit will be 1.5" diameter, as is the return pipe which flows from the Hydraulic Unit to the septic tank inlet. The pipe (or pipes, if it is a multi-zone drip dispersal system) leaving the Hydraulic Unit to the drip field supply manifold will be 1" diameter, as is the return line (from the drip field return manifold to the Hydraulic Unit). All other piping will be per RI DEM requirements.

7. *Confirm Adequacy of Standard Pump*

The high-head pump that is provided with the Perc-Rite® Drip Dispersal system will suit most typical configurations and feed the drip tubing at the proper pressure. There is no need for the designer to perform head loss calculations as they have been already factored into the system.

For the ASD-15 and WD-15, the components are known to function as intended when the Hydraulic Unit is located within 30' horizontally and 10' vertically of the pump. This is often achieved by simply having the Hydraulic Unit placed on top of the septic tank or pump chamber.

When pumping uphill and the drip dispersal field is located within 100' of the Hydraulic Unit we know that almost any head differential can easily be met. Situations with greater distances or head are easy to custom design with assistance from Oakson.

The system components have been pre-engineered with the provided pump so detailed calculations or pump curves are not necessary.

8. Determine Float Settings

There are four floats which will be located inside the pump chamber/wet well and the designer will need to specify the distances between them to assure proper operation of the timer-based dosing system. A description of the floats follows:

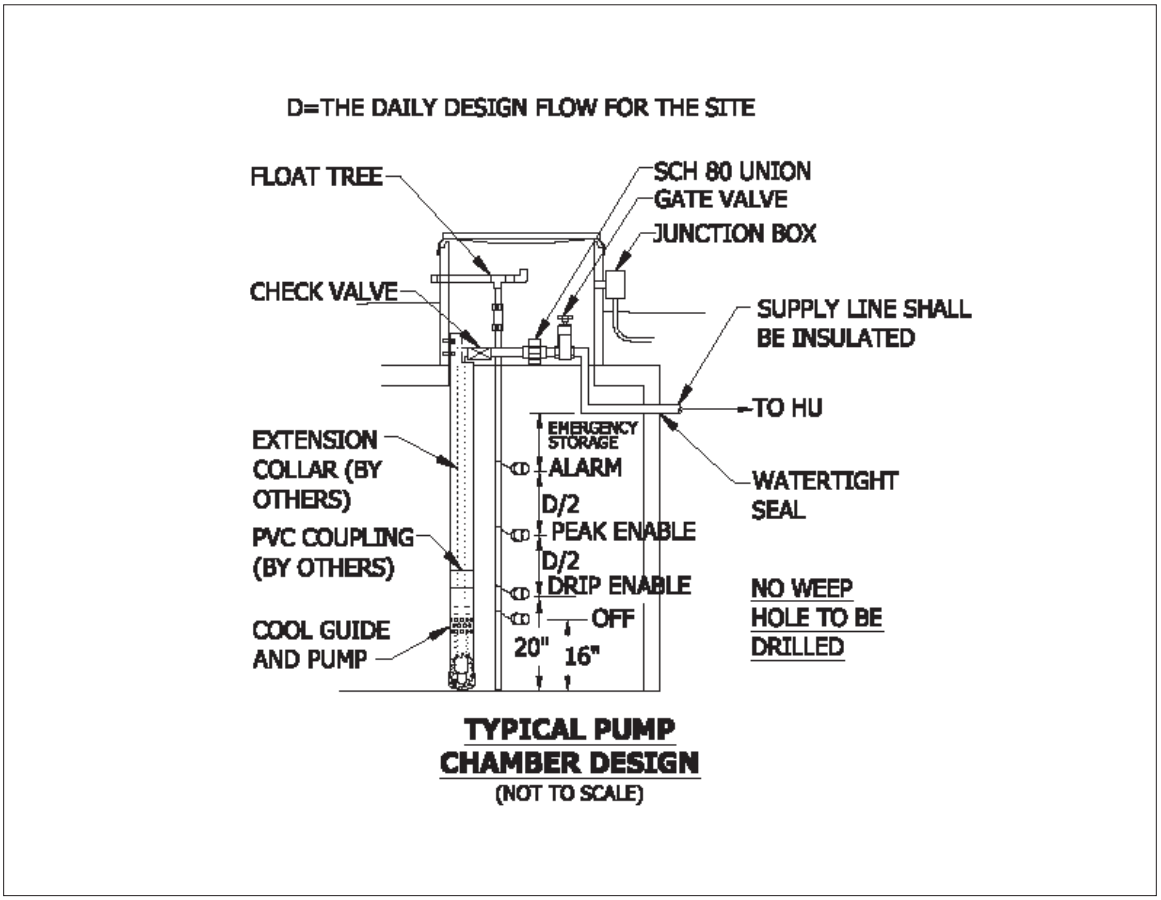
- The bottom '**off float'** prevents pump burnout if the water level drops in the tank.
- The second one up, '**timer enable float**,' engages the timer to go into the normal operating mode.
- If triggered, the third one up, '**peak enable float**,' engages the timer to go into a more frequent pump operating mode to overcome surges of water.
- The highest float, the '**alarm float**,' signals an audible and visual alarm on the control panel in the event of a malfunction.

The lowest two floats are factory-set at 16" and 20" off the tank bottom. For the position of the other floats, first determine the height of the alarm float. To set the alarm float height, simply calculate one day's worth of design flow in inches, add 20", and set the alarm float at that height. Once

the height of the alarm float is established, the third float (the peak enable float) is then simply set at half the distance between the drip enable float and the alarm float.

Capacity in the pump tank is needed for the required emergency storage above the alarm float. The exception is when a treatment system is provided which contains flow equalization and associated emergency storage.

Figure 7: Pump tank float positions



Dual alternating pumps can easily be configured when required such as for flows greater than 2,000 GPD.

9. Depict Method of Tubing Installation

Depending on the soil conditions and the water table at the site, the tubing will either be plowed into the existing ground or placed on or in a bed of sand fill. Like all sand fill, if needed it is to meet the specifications of RI DEM as ASTM C33. Typical profiles showing a plowed-in or a sand bed tubing placement are provided on Oakson's website and are recommended to be put on the design plan.

Figure 8: Profile of Perc-Rite Drip Dispersal in Plowed-In Configuration Using Septic Tank Effluent

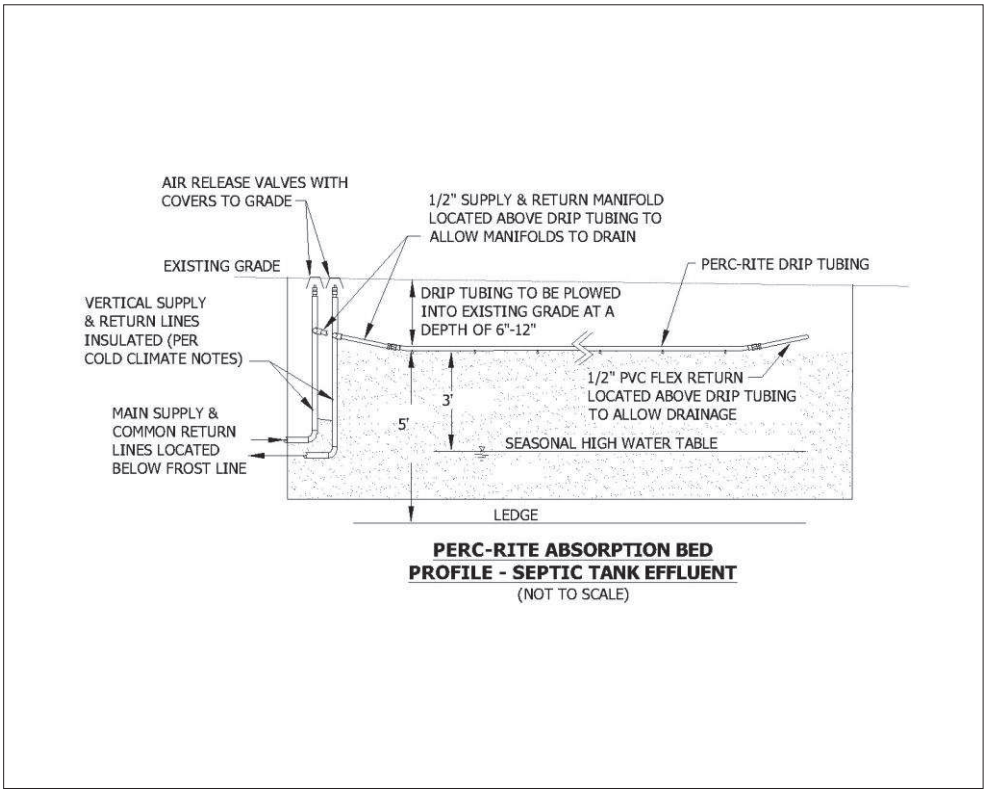


Figure 9: Profile of Perc-Rite Drip Dispersal in Plowed-In Configuration Using Pre-Treated Effluent

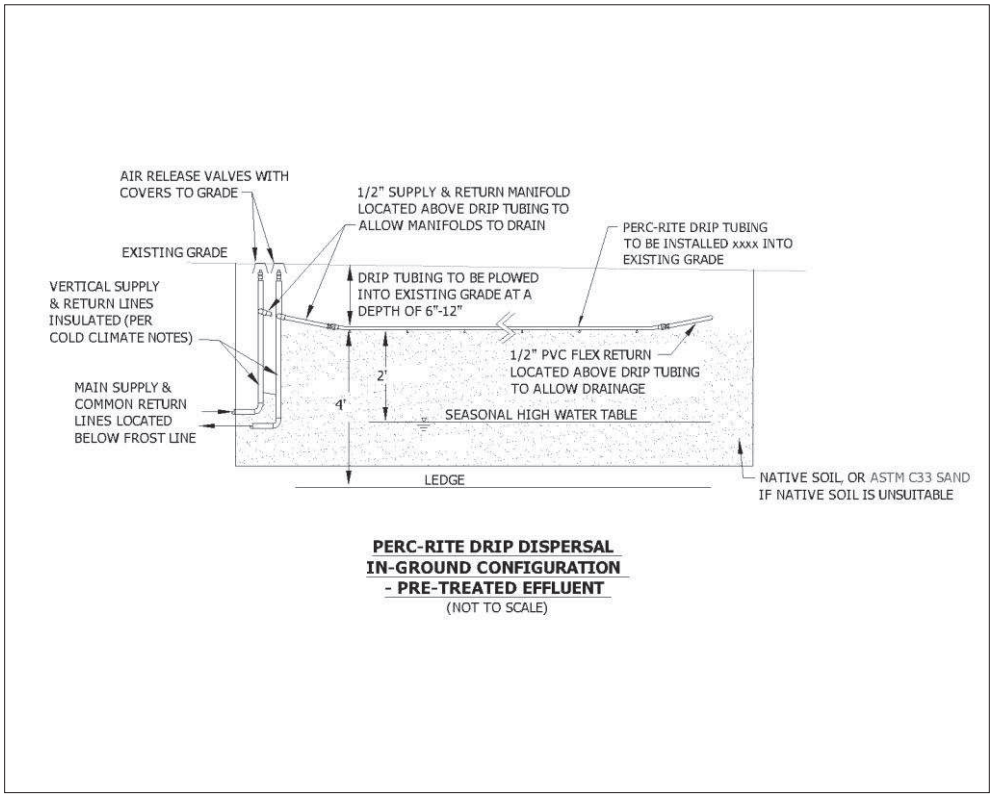


Figure 10: Profile of Perc-Rite Drip Dispersal in ASTM C33 Sand Mound Configuration Using Septic Tank Effluent

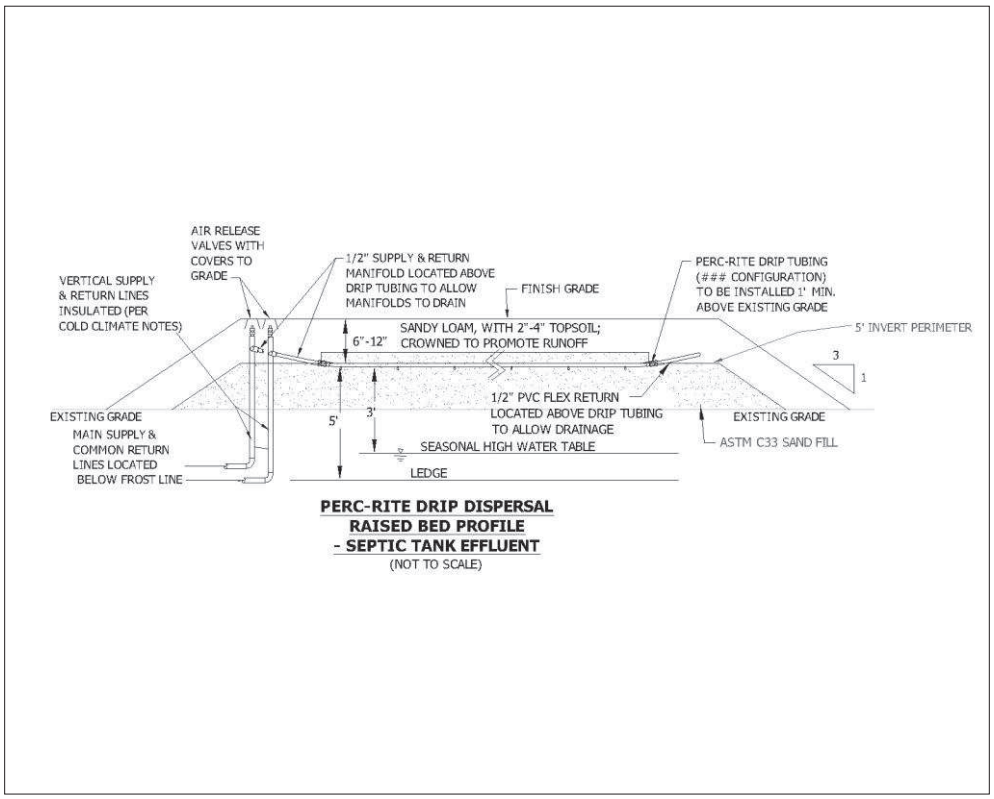
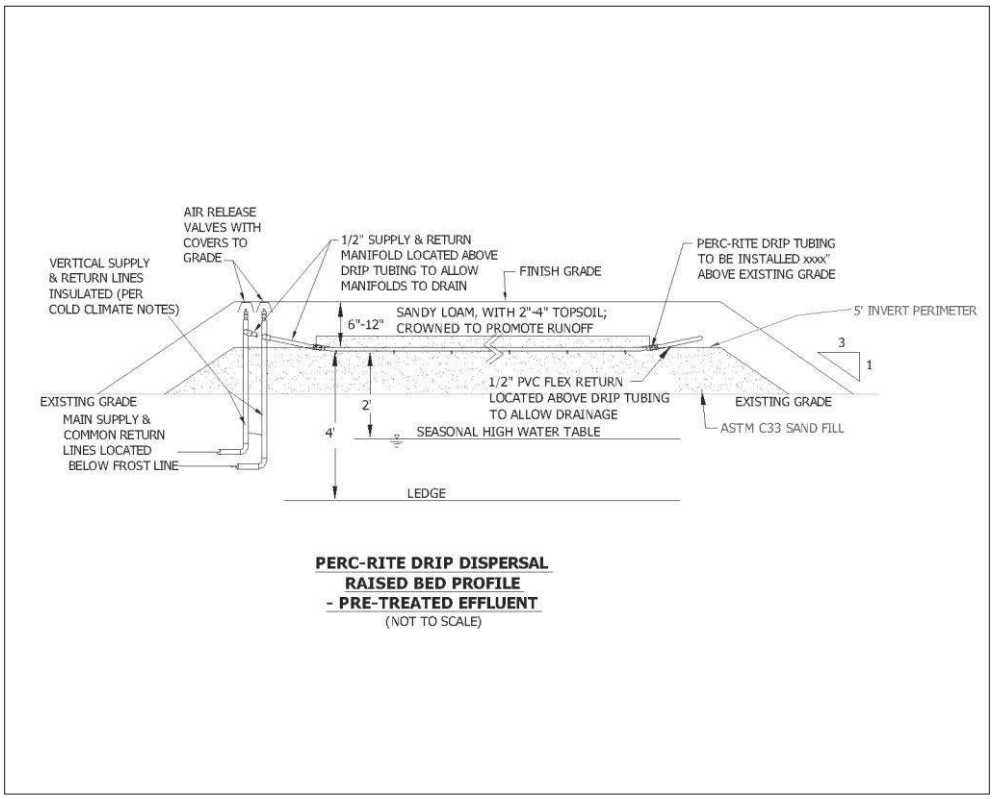


Figure 11: Profile of Perc-Rite Drip Dispersal in ASTM C33 Sand Mound Configuration Using Pre-Treated Effluent



10. Depict Final Grading

Depict proposed final grading on the site plan. If the drip field is built on a sand bed, it is typical to have the sand fill follow the existing contours (as the water table typically does the same) which will help reduce the needed volume of sand and the associated visual impact.

11. General Information to Consider

Soils

Acceptable soil conditions to place the drip dispersal system can include the A, B or C soil horizons as long as it is naturally occurring and suitable.

Cold Weather Design

Basic aspects of typical cold weather installation procedures include a temperature-sensitive heater strip located inside the Hydraulic Unit enclosure, locating the supply line below frost, placing insulation on feeder

pipes where they traverse the frost zone, draining of the manifold pipes into the drip tubing and allowing the drip tubing to empty into the soil after each pump cycle.

All installations in New England are designed and built with Perc-Rite® Drip Dispersal's cold weather procedures. Information with details and notes about these procedures are part of the standard details available on Oakson's website and should be included on the design plan.

Construction

Like prudent construction practice for any type of disposal area, equipment not needed to build the drip field should be kept off the disposal area to prevent undesirable compaction of the soil. Installation of the drip tubing is not to be initiated when the soil moisture content is high. To test, see if a fragment of soil from about 9" below the surface can easily be rolled into a wire. If so, the soil moisture content is likely too high for construction to occur.

Construction Inspection

A licensed designer shall inspect the system during critical stages of construction. Upon completion of construction of the drip field, flow rates are measured via a flow meter in the Hydraulic Unit and compared to the intended flow rate based on the number of orifices which exist so proper construction can be confirmed.

System Maintenance and Reporting

Like all non-traditional systems allowed in Rhode Island, there are requirements for routine preventative maintenance and for periodic reporting by trained personnel. These include system visits twice per year for flows under 2,000 GPD and quarterly visits plus remote telemetry for systems with larger flows. Contact Oakson for information on certified service providers in your area.

5. CONCLUSION

This Guide is intended to assist in the design process for a Perc-Rite® Drip Dispersal System. If you require additional assistance or just want someone to walk you through each step, an Oakson staff member will gladly help at no additional cost.

Oakson is committed to your project success and we are more than willing to review design plans before they are submitted, assist with laying out a drip field, or provide CAD details. Please feel free to share a draft or final design plan with us before submitting for permits.

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Or

info@oakson.com

Perc-Rite® Drip Dispersal Designer Checklist

- ☐ Drip field area calculated per RI DEM code and shown
- ☐ Manifold system selected and detail provided
- ☐ Tubing spacing calculated and shown
- ☐ Hydraulic Unit model selected and location shown
- ☐ Return line from Hydraulic Unit to septic tank inlet shown
- ☐ Pipe sizes labeled
- ☐ Float height and emergency storage calculations completed and shown on plan
- ☐ In-ground or above-ground detail provided, fill and cover specifications provided
- ☐ If desired, system flow profile, construction notes and other standard details from Oakson website added to plan
- ☐ Operation and maintenance documents prepared (by authorized O&M service provider)