Subsurface Drip Dispersal and Reuse

Design, Installation and Maintenance Guidelines

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INTRODUCTION

Geoflow's WASTEFLOW®[1] drip system disperses effluent below the ground surface through ½" pressurized pipes. It is designed using the grid concept with supply and flush manifolds at each end of the dripline creating a closed loop system. The grid design provides a complete subsurface wetted area.

The objective with effluent dispersal is usually to disperse the effluent using the minimum area as quickly and safely as possible at an approximately uniform rate throughout the year. If the main purpose of the Geoflow system is to irrigate, then please use the standard irrigation manual for landscape available from Geoflow, Inc.

Subsurface drip is a highly efficient method to dispose of effluent. Small, precise amounts of water are uniformly applied under the soil surface from multiple points.

The main advantages of Geoflow's subsurface drip system for effluent dispersal are:

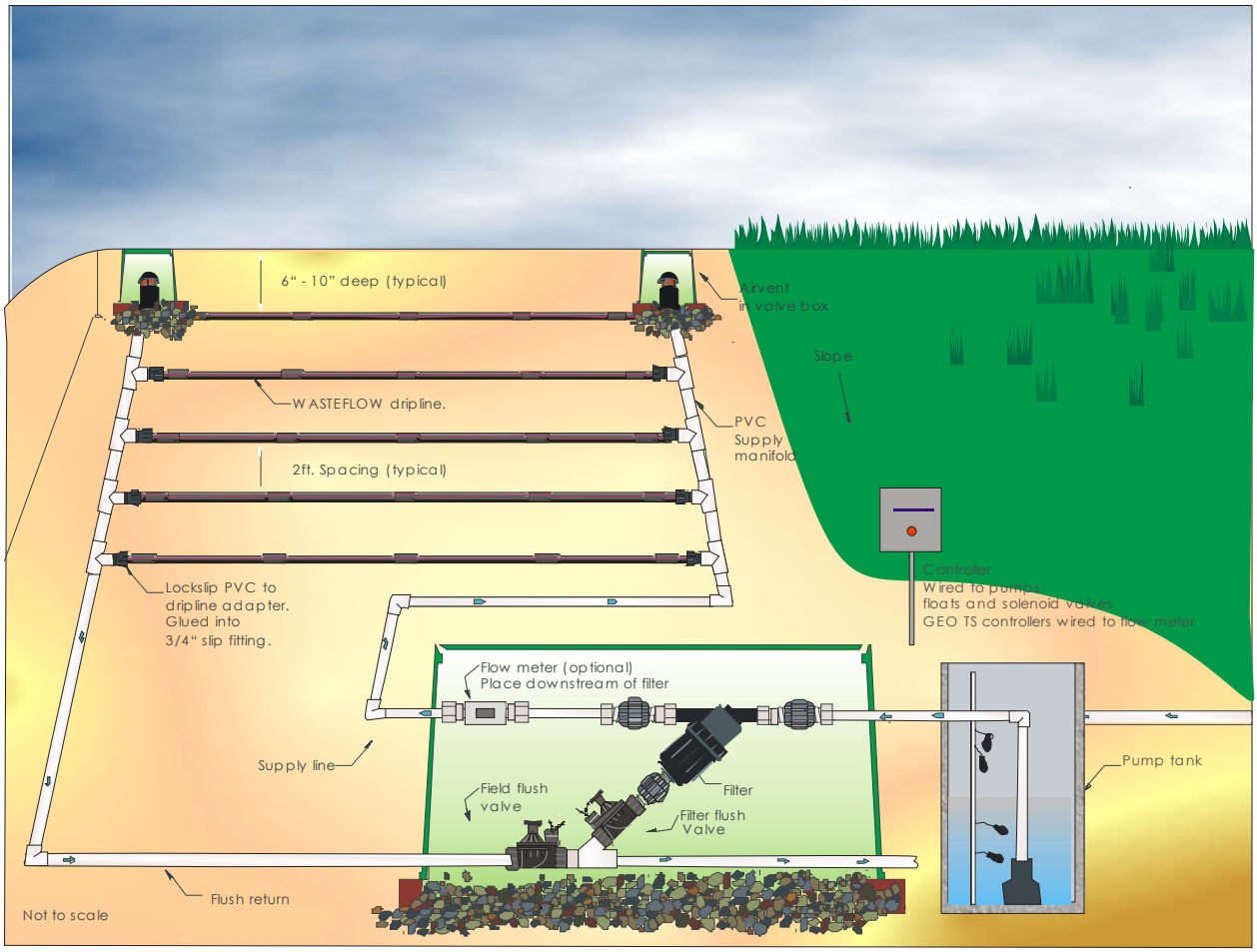
- Human and animal contact with effluent is minimized, reducing health risks.
- Correctly designed systems will not cause puddling or runoff.
- It can be used under difficult circumstances of high water tables, tight soils, rocky terrain, steep slopes, around existing buildings, trees or other vegetation, and on windy sites.
- Disposal of water is maximized by means of evapotranspiration.
- The system requires no gravel. It is easy to install directly into indigenous soils and the natural landscape can be maintained.
- Minimizes deep percolation.
- Consumption of nitrates by the plant material is increased.
- Invisible and vandal proof installations.
- Fifteen-year warranty for root intrusion, workmanship and materials. Systems are durable with a long expected life of approximately 30 years.
- Non intrusive. It allows use of the space while operating.
- Easily automated.
- Effluent can be re-used for irrigation.

NOTES

- These guidelines are for secondary treated effluent. When using primary treated effluent, Geoflow recommends automating all the self flushing valves, and increasing the number of emission points in the dispersal field. For more information on septic tank dispersal, please check our website at www.geoflow.com or telephone Geoflow at 800-828-3388.
- Please follow your State and County Regulations for onsite wastewater dispersal. These guidelines are intended to be a guide to users of the Geoflow drip system and should be used only as a supplement to your local regulations.
- Occasionally, in forested area, the dripline is placed on the surface and covered with mulch.

1 WASTEFLOW® is a registered trademark of A.I.Innovations.

Diagram 1: Typical Dripfield layout



SYSTEM COMPONENTS

See Diagram 1 on page 3.

A typical drip system installation will consist of the elements listed below:

1. WASTEFLOW® DRIPLINE

(See product sheet for specification)

WASTEFLOW dripline carries the water into the dispersal/reuse area. The dripline is connected to the supply and return manifolds with Compression or Lockslip fittings. Typical spacing between each dripline and between drip emitters is 24" on center.

Twelve-inch spacing is used regularly for soils with very low or high permeability. Dripline is usually buried 6"-10" below ground. Standard coil length is 500-ft. Rolls of alternative lengths, diameters and dripper spacings may be special ordered.

WASTEFLOW dripline features:

a.) nano-ROOTGUARD®[2]

In 2008 Wasteflow dripline will have new nano-ROOTGUARD which has an extended expected life of 30 years. The risk of root intrusion with an emitter slowly releasing nutrient rich effluent directly into the soil is well known to anyone who has observed a leaking sewer pipe. All Geoflow drip emitters are guaranteed to be protected against root intrusion with nano-ROOTGUARD. This patented process fuses the root-growth inhibitor, TREFLAN®[3] into each drip emitter during manufacturing. Treflan is registered with the United States EPA for this application. The nano-ROOTGUARD technology holds Treflan for extended time inside the plastic, slowly releasing it in minute quantities to prevent root cells from dividing and growing into the barrier zone. It is chemically degradable, non-systemic, and virtually insoluble in water (0.3 ppm). nano-ROOTGUARD carries a **15-year warranty** against root intrusion.

b.) *Geoshield™[4]* protection

Geoflow's WASTEFLOW has an inner lining impregnated with an antimicrobial, Tributyl tin maleate, to inhibit adhesion of biological growth on the inside walls of the tube and on the emitters. It does not have any measurable biological effect on the effluent passing through the tube. This minimizes the velocity required to flush WASTEFLOW dripline. The velocity only needs to move out the fine particles that pass through the 130 micron filter that, if not flushed, will ultimately accumulate at the distal end of each lateral. It is not necessary to scour growth off the inside wall of WASTEFLOW tubing. Since all pumps deliver more volume given less resistance to flow, just opening the flush valve will usually achieve this degree of flushing. When a minimum flushing velocity is requested by regulators, 0.5 feet per second is used with Wasteflow dripline to get the settled particles at the bottom of the pipe back into suspension. This equates to 0.375 gpm per dripline when using standard WASTEFLOW dripline (0.55"ID)

c.) Turbulent Flow Path

WASTEFLOW drip emitters are pre-inserted in the tube usually spaced 6", 12", 18", or 24" apart with 24" being the most popular. Angles in the emitter flow path are designed to cause turbulence in order to equalize flow between emitters and keep the emitters clean. Geoflow emitters boast large flow paths, which, coupled with turbulent flow, have proven over the years to be extremely reliable and dependable.

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2 nano-ROOTGUARD is a registered trademark of A.I.Innovations
3 Treflan is a registered trademark of Dow Agro Sciences
4 Geoshield is a registered trademark of A.I.Innovations

d.) Wasteflow Classic and Wasteflow PC Dripline

Both WASTEFLOW Classic and WASTEFLOW PC have turbulent flow path emitters with nano-ROOTGUARD and *Geoshield* protection.

The WASTEFLOW PC has the added element of a silicone rubber diaphragm that moves up and down over the emitter outlet to equalize flows regardless of pressure between 7 and 60 psi. To ensure a long life the recommended operating range is 10 to 45 psi.

For Wasteflow Classic, the flow rate delivered by the emitter is a function of the pressure at the emitter. The Classic dripline has the advantage of no moving parts or rubber that may degrade over time. Also, when minimum flushing velocities are required, the flows during a dosing cycle and flushing cycle are very similar with the Wasteflow Classic because when the flush valve is opened, the pressure is reduced, causing the flows from the emitters to decline. PC dripline requires significantly higher flow for flushing than dosing as the emitter flow does not go down during the flushing cycle.

We generally recommend using WASTEFLOW Classic, unless the economic advantages to using PC is substantial.

i. Wasteflow PC can run longer distances than Wasteflow Classic.

ii. Steep slopes. Systems should be designed for the dripline lateral to follow the contour. When this is practical, the extra cost of installing pressure regulators required for Wasteflow Classic would likely be less than the incremental cost of Wasteflow PC.

iii. Rolling terrain. If the difference in height from trough to peak exceeds six feet then Wasteflow PC should be used. Vacuum relief valves must be placed at the top of each rise.

2. Controllers

(See product sheet for specification)

Controllers are used for time dosing and time flushing of the filter and dripfields. GEO controllers include a programmable logic controller to increase flexibility and reliability in the field. They can be used on systems ranging in size from one to eight zones at the time this manual was printed. All controllers include a surge arrestor, elapsed time meter and counter. In 2007 Geoflow added a new controller with a touchscreen interface. It can vary dose times in each zone, monitor flow, ultraviolet, blower, and other optional inputs.

3. Pumps, Pump Tanks & Floats

Wasteflow dripfields depend on pumps to dose effluent under pressure to the field. These must be sized according to flow and pressure requirements. Look for submersible effluent pumps from a dependable source. Geoflow does not endorse a single manufacturer, but does advocate you use a pump that is readily serviced in your area. Two (duplex) pumps may be used. These will normally alternate at each signal from the control panel and are often used on commercial or large drip systems. Pump tanks should be sized according to your local rules and regulations. Geoflow controllers are set-up for 4 floats with the lowest one in the tank being the *redundant off float*. The *primary timer on/off float* is second from the bottom, followed by the *secondary timer float* third from the bottom and the *high level alarm float* on the top.

4. Filters

(See product sheet for specifications)

Geoflow systems require 120 mesh or 130 micron filtration to keep any oversized upstream contaminants from entering the dripline. Geoflow offers a full range of drip filters, with the tried and true Vortex screen filters for small commercial and residential systems, BioDisc filters with anti bacterial protection, and GeoVac suction cleaning filters for larger commercial and industrial systems.

5. Supply Manifold and Line

This carries the water from the dosing tank to the dispersal area. Rigid PVC schedule 40 is usually used. Schedule 80 is at times used to either avoid dips in the line that can collect water and freeze, or if pressure of at least 20 psi is required to pump water from the dose tank to the dripfield. To prevent water from freezing, the pipes should slope back to the pump tank, be buried below frost depth and/or be insulated. Refer to the PVC pipe sizing chart in the appendix to determine the best diameter for your application.

6. Return Manifold and Line

In order to help clean the system, the ends of the drip lines are connected together into a common return line, most often made of rigid PVC. This line will help equalize pressures in the system. Flushing should be done frequently during the installation period. Periodic flushing will help to keep the manifolds clean. Many designers use the same size return line as they do the supply line for simplicity, or some down size the return line since return flow is lower than supply. To prevent water from freezing, the pipes should slope back to the pump tank, be buried below frost depth and/or be insulated.

7. Pressure Regulator

(See product sheet for specification)

Pressure regulators fix the inlet pressure at a given rate. Under normal operating conditions, pressure in the drip lines should be 10 psi to 45 psi. With WASTEFLOW Classic it helps to know exactly what the pressure is in the dripline, so system flow can be easily calculated. With all dripline it is prudent to have a pressure regulator to avoid oversized pumps from blowing out fittings.

8. Air Vacuum Breaker

(See product sheet for specification)

Air vacuum breakers are installed at the high points, above dripline and below grade to keep soil from being sucked into the emitters due to back siphoning or backpressure. This is an absolute necessity with underground drip systems. They are also used for proper draining of the supply and return manifolds in sloping conditions. One is used on the high end of the supply manifold and one on the high point of the return manifold. Additional air vents may be required in undulating terrain. Freezing conditions require the air vacuum breaker be protected with insulation.

9. Filter Flush Valves

(See product sheet for specifications)

Used to flush debris from the filter cleanout port back to the pretreatment or dosing tank, this can be an electronically activated solenoid valve or a manual valve. If manual, it should be opened for a full flushing at least every six months and left cracked open slightly to flush continuously. Cracking open a manual valve may be used to increase flow through the system to be within the efficient flow rate of the filter and/or pump, if necessary. Certain States may require automated electronic flushing. Please refer to your State codes.

10. Field Flush Valves

(See product sheet for specifications)

Used to flush out fine particles that have passed through the filter and accumulated on the bottom of the tube at the end of each lateral, the field flush valve can be manual or electronic. If manual, it should be opened for full flushing at least every six months and left cracked open slightly to flush continuously and provide for drainage of the flush line in freezing conditions. Cracking open a manual valve can also be used to; increase the flow through the system to be within the efficient flow rate of the filter and/or pump, or to set system pressure instead of a pressure regulator. Certain States do require automated electronic flushing. Please refer to your State codes.

11. Zone Valves

Used to divide single dispersal fields into multiple zones, these can be hydraulically activated index valves or electrical solenoid valves. Index valves are hydraulically operated, while solenoids use electricity.

12. Wasteflow Headworks

(See product sheet for specifications)

WASTEFLOW Headworks is a pre-assembled unit including the filter, valves and pressure gauge in a box or on a skid. It is installed between the pump and the field. Be sure to insulate the box in freezing climates.

DESIGN PARAMETERS

1. Select area

Select the area with careful consideration of the soil, the terrain and your State and County regulations. Be sure the field is not in a flood plain or bottom of a slope where excessive water may collect after rain. Surface water should be directed away from the proposed field area.

2. Water Quality

Determine the quality of the water entering the system. Is it secondary treated or primary treated? If using primary treated effluent, please refer to Geoflow's article for direct septic. Be aware of water conditions intrinsic to the area. If iron or iron bacteria are prevalent, please be sure to eliminate it upstream of the drip system with ozone, ultraviolet or chemical treatment. Iron can be recognized as orange stain on plumbing fixtures and may be treated prior to entering the facility.

3. Soil Application Design

Note: This section is based on Subsurface Trickle Irrigation System for On-Site Wastewater Disposal And Reuse by B. L. Carlile and A. Sanjines. The basis of the information is from the Texas Health Department regulations. The rules in your County and State may vary.

The instantaneous water application rate of the system must not exceed the water absorption capacity of the soil. A determination of the instantaneous water absorption capacity of the soil is difficult, however, since the value varies with the water content of the soil. As the soil approaches saturation with water, the absorption rate reduces to an equilibrium rate called the "saturated hydraulic conductivity." Wastewater application rates should be less than 10 percent of this saturated equilibrium.

Even though the trickle irrigation system maximizes the soil absorption rate through the low rate of application, thus keeping the soil below saturation, there will be times when the soil is at or near saturation from rainfall events. The design must account for these periods and assume the worst case condition of soil saturation. *By designing for a safety factor of 10 or 12, based on the saturated hydraulic conductivity, the system will be under-loaded most of the time but should function without surface failure during extreme wet periods.*

By applying wastewater slowly for a few hours daily, particularly if applied in "pulses" or short doses several times per day near the soil surface where the soil dries the quickest would keep the soil absorption rate at the highest value and minimize the potential of water surfacing in poor soil conditions.

As stated previously, this design criterion will under-load the system at all times except when the soil is at or near saturation from rainfall. If designing for an efficient irrigation system, the water supply may not be sufficient to meet the demands of a lawn or landscaped area during peak water demand months. This problem can be overcome by either of two solutions: add additional fresh-water make-up to the system during the growing season to supply the needed water for plants in question; or split the system into two or more fields with necessary valves and only use one of the fields during the peak water demand months and alternate the fields during winter months or extremely wet periods, or use both fields simultaneously if the pump capacity will so allow.

Table 1 shows the recommended hydraulic loading rates for various soil conditions, using a safety factor of at least 12 with regard to the equilibrium saturated hydraulic conductivity rate of the soil. These loading rates assume a treated effluent with BOD and TSS values of less than 30 mg/l is produced in the pre-treatment system and that any anomalies such as iron bacteria have been removed prior to dosing.

Table 1.

Minimum Surface Area Guidelines to Dispose of 100 gpd of Secondary Treated Effluent

Soil Class	Soil Type	Soil Absorption Rates		Design Hydraulic Loading Rate (gal / sq. ft. per day)	Total Area Required sq. ft./ 100 gallons per day
		Est. Soil Perc. Rate minutes/in	Hydraulic Conductivity inches/hr		
I	Coarse- sand	<5	>2	1.400	71.5
I	Fine sand	5-10	1.5-2	1.200	83.3
II	Sandy loam	10-20	1.0-1.5	1.000	100.0
II	loam	20-30	0.75-1.0	0.700	143.0
III	Clay loam	30-45	0.5-0.75	0.600	167.0
III	Silt-clay loam	45-60	0.3-0.5	0.400	250.0
IV	Clay non-swell	60-90	0.2-0.3	0.200	500.0
IV	Clay - swell	90-120	0.1-0.2	0.100	1000.0
IV	Poor clay	>120	<0.1	0.075	1334.0

Dispersal field area calculation:
Total square feet area of dispersal field = Design flow divided by loading rate

NOTES:

1) The above chart is provided as a guide only. States and Counties may have regulations that are different. Check your State guidelines and consult with your local health department.
2) Problems with drip dispersal fields occur when soils are misinterpreted. If in doubt, choose the more restrictive soil type from the table above.
3) "Soil type" should be based on the most restrictive layer within two feet of the dripline. In many soils 1-ft. vertical separation from the limiting layer has proven successful with secondary treated effluent. Geoflow recommends you follow State and Local guidelines.
4) Table 1 above, with only minor modifications over the years, has served us well since 1990 with tens of thousands of systems operating successfully based upon this data. However, thanks to work by Jerry Tyler and his associates at the University of Wisconsin-Madison soil structure has become better understood and can now be used as a comprehensive tool to determine optimal hydraulic loading rates as seen in Table 2.

Table 2

Drip Loading Rates Considering Soil Structure.

Table 2 is taken from the State of Wisconsin code and was prepared by Jerry Tyler.

Soil Textures	Soil Structure	Maximum Monthly Average BOD_5<30mg/L TSS<30mg/L (gallons/ft^2/day)
Course sand or coarser	N/A	1.6
Loamy coarse sand	N/A	1.4
Sand	N/A	1.2
Loamy sand	Weak to strong	1.2
Loamy sand	Massive	0.7
Fine sand	Moderate to strong	0.9
Fine sand	Massive or weak	0.6
Loamy fine sand	Moderate to strong	0.9
Loamy fine sand	Massive or weak	0.6
Very fine sand	N/A	0.6
Loamy very fine sand	N/A	0.6
Sandy loam	Moderate to strong	0.9
Sandy loam	Weak, weak platy	0.6
Sandy loam	Massive	0.5
Loam	Moderate to strong	0.8
Loam	Weak, weak platy	0.6
Loam	Massive	0.5
Silt loam	Moderate to strong	0.8
Silt loam	Weak, weak platy	0.3
Silt loam	Massive	0.2
Sandy clay loam	Moderate to strong	0.6
Sandy clay loam	Weak, weak platy	0.3
Sandy clay loam	Massive	0.0
Clay loam	Moderate to strong	0.6
Clay loam	Weak, weak platy	0.3
Clay loam	Massive	0.0
Silty clay loam	Moderate to strong	0.6
Silty clay loam	Weak, weak platy	0.3
Silty clay loam	Massive	0.0
Sandy clay	Moderate to strong	0.3
Sandy clay	Massive to weak	0.0
Clay	Moderate to strong	0.3
Clay	Massive to weak	0.0
Silty clay	Moderate to strong	0.3
Silty clay	Massive to weak	0.0

4. Depth and Spacing

WASTEFLOW systems usually have emitter lines placed on 2 foot (600 mm) centers with a 2 foot emitter spacing such that each emitter supplies a 4 sq. ft (0.36 m^2) area. These lines are best placed at depths of 6-10 inches (150 - 250 mm) below the surface. This is a typical design for systems in sandy and loamy soils with a cover crop of lawn grass. Closer line and/or emitter spacing of 12 inches is used on heavy clay soils or very coarse sands where lateral movement of water is restricted. Using closer spacing should not reduce the size of the field.

5. Soil Layers and Types

The shallow depth of installation is an advantage of the subsurface dripfield since the topsoil or surface soil is generally the most biologically active and permeable soil for accepting effluent. The topsoil also dries the fastest after a rainfall event and will maintain the highest water absorption rate. The quality and homogeneity of the soil may present a problem. If the soil was not properly prepared and there are pieces of construction debris, rocks and non-uniform soils, it is very difficult to obtain uniform water spread. In many cases, particularly if the soil is compacted, soil properties can be greatly improved by ripping and disking.

6. Adding Fill to the Dispersal Field

Some dispersal sites require additional soil be brought in for agronomic reasons or to increase separation distances from the restrictive layer. Restrictive layers stop or greatly reduce the rate of downward water movement, as a result surfacing may occur during part of the year. In soils with high water tables treatment is minimized due to a lack of oxygen.

Placing drip lines in selected fill material above the natural soil provides an aerated zone for treatment. Dispersal however still occurs in the natural soil and the field size must be based on the hydraulic capability of the natural soil to prevent hydraulic overload.

Any time fill material is to be used, the area to receive the fill should have all surface grasses and other organic material removed or it must be incorporated into the natural soil to prevent an organic layer from forming and restricting downward water movement. Removal must be performed under dry conditions. Divert surface and subsurface water prior to adding fill.

Soils to be used should be determined by a soils expert. Uniform soil material with good structure should be chosen. Avoid platy or massive materials with no structure. Do not use topsoil.

The fill material should be applied in shallow layers with the first 4 to 6 inches incorporated into the natural soil to prevent an abrupt textural interface. Placement of fill should be uniform so preferential bypass flows do not occur. Soil should not be compacted. Continue this process until all fill has been incorporated.

The fill area should be left crowned to shed surface water and may need diversion ditches or some other devices to prevent surface water from infiltrating. The entire fill area should have a vegetative cover to prevent erosion. If possible, allow the fill to set at least seven to ten days before installing WASTEFLOW dripline.

It is generally agreed that fill should not be used on slopes greater than 20% unless means for controlling erosion, such as netting, are used. Consult a soils engineer on a case by case basis.

7. Slopes or Hilly Sites

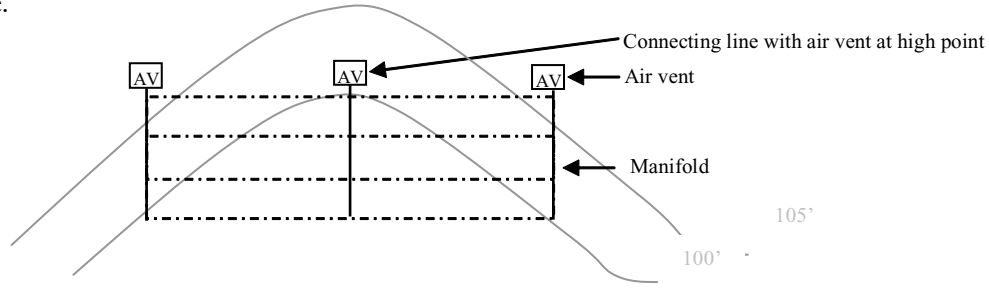
a.) High Points and siphoning

A potential problem with buried drip lines is siphoning dirt into the emitters when the pump is switched off. For this reason:

i) At least one vacuum breaker should be installed at the highest point in each zone. It is best practice to install one at the high point of the supply and one at the high point of the return manifold.

ii) Drip lines should be connected at the end to a common return line with a flush valve.

iii) Run dripline along a contour if at all possible. Avoid installing lines along rolling hills where you have high and low points more than 3 ft. off contour along the same line. If the dripline is installed over a ridge, as shown below, connect all the high points together and install a vacuum breaker on the connecting line.



b.) Dripline Pressure Tolerances

As water travels through a manifold or uphill, pressure decreases, or conversely, if water moves downhill pressure increases, which can affect the flow variation between the first dripline and the last dripline on the manifold.

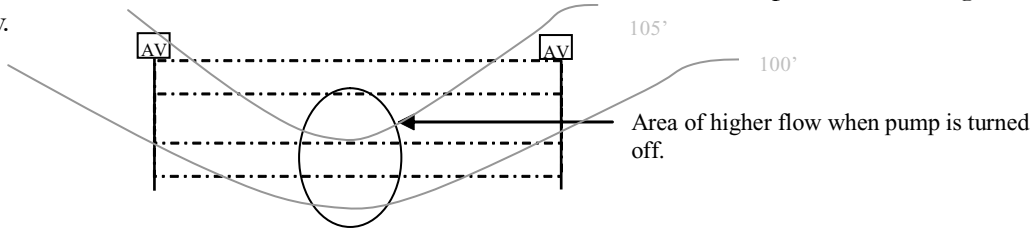
WASTEFLOW Classic: The Classic dripline can be operated in a range of 10 to 45 psi, however too wide a variance in the pressure in a single field will result in too high a variance in flow within that field. As a rule of thumb, if the level variation within a WASTEFLOW Classic zone exceeds six feet, individual pressure regulators should be placed for each six-foot interval.

WASTEFLOW PC: PC dripline can tolerate very large height variations provided the pressure remains within the 7 to 60 psi range, and preferably within 10 to 45 psi.

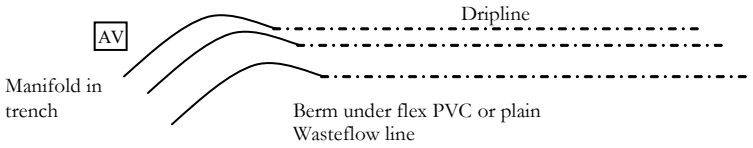
c.) Low Head Drainage

At the end of each dosing cycle, consideration must be taken for gravity. Where is the water going to drain when the pump shuts off? Water in the dripline will flow down to the lowest point within the drip zone. This is called "lowhead drainage." Use the following precautions to mitigate lowhead drainage.

i. The dripline should run along the contour if at all possible because water will run to the lowest point of the line every time the pump is turned off. If the lowest point in the line is in the middle of the lateral, there will be excess flow at this point. See Diagram below.



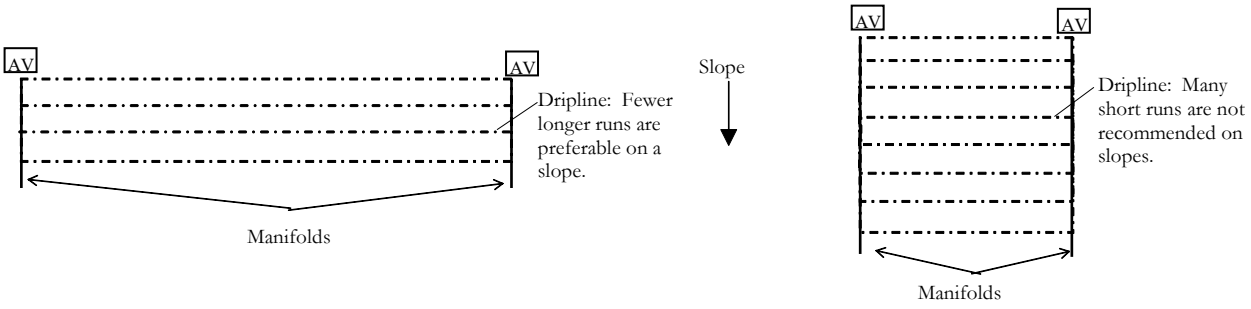
ii Have the dripline pass over an elevated berm between the manifold and beginning of the tubing to reduce gravity flow out of the lateral. In looped systems, elevating the loop will keep the effluent in its respective run.



iii. Use check valves or multiple zones to isolate the drip laterals. Check valves should only be used if there is no risk of freezing in the manifolds. They are placed on the supply and return manifolds coupled with an airvent on the downhill side. If unsure, as a rule of thumb, use a maximum of 1500 ft of Geoflow dripline within each zone or section.

iv. Install short manifolds with fewer longer dripline runs.

v. Slope the supply and return manifolds down to the pump tank so the effluent drains back down to the tank when the pump is turned off. Open the zone valves fully to drain the lines quickly.



Concentrate drip lines at the top of the hill with wider spacing towards the bottom. In the case of compound slopes consult a professional irrigation designer or engineer.

8. Multiple Zones

Drip dispersal fields can be divided into multiple zones or sections with solenoid valves or index valves for the following reasons:

a.) Steep slopes with a risk of lowhead drainage can be subdivided to distribute the water at system shut-down more uniformly in the field.

b.) Smaller zones reduce the required flow per minute which consequently reduces the size of the pump ,valves filters, supply and return lines.

c.) Subdividing the field is a tool used to achieve the optimum ranges required to efficiently operate the pumps, filters and valves.

d.) If the dispersal field is located in multiple areas on the property.

e.) To accommodate varying soils or vegetation on a single site.

Note. On multiple zones, a single Wasteflow Headworks can be used for filtration and flushing by placing zone valves downstream of the Headworks box. All zones would require a check valve on the individual flush lines upstream of each line joining a common flush line to keep flush water from one zone entering any other zone during the flush cycle. (See Geoflow Design Detail No. 588)

If the effluent has not been through secondary treatment, then each zone should have a dedicated filter or Wasteflow Headworks.

9. Winterization

Buried drip systems are not prone to frost damage because, in their design, vacuum release and drain valves are provided. The dripline itself is made of polyethylene and not susceptible to freezing. It drains through the emitters so it will not be full of water after pumps are turned off. Please follow these precautions:

a.) Manifolds, supply lines and return lines must be sloped back to their respective dosing or treatment tanks or buried below frost depth and or insulated. These lines need to drain rapidly. Be sure drain valve on flush line remains open long enough for entire field to drain.

b.) Remove the check valve at the pump.

c.) Insulate equipment boxes, including Headworks box or filter and field flush valve boxes as well as zone dosing valves, pressure regulator and air vacuum relief valves. Use closed-cell insulation such as Perlite in a plastic bag. Place metal pins near, or in, the boxes to help locate them when under snow.

d.) In severe freezing conditions, use heat tape or small heater in the Headworks box.

e.) When installing PVC supply and return lines and manifolds be sure there are no dips in the lines. This can be avoided by using large diameter pipes (over 2") or by using schedule 80 pipe.

f.) The top of air vacuum relief valves must be no higher than soil surface.

g.) If using an index valve to split field zones, be sure it is capable of self-draining.

h.) WASTEFLOW lines will self-drain through the emitters into the soil. If the cover crop over the dripfield is not yet adequately established, add hay or straw over the field for insulation.

i.) Mark the valve box with a metal pin so you can find it in the winter when covered in snow.

j.) If using manual filter flush valves or manual field flush valves, they should be left cracked open slightly to provide for rapid drainage of the flush line in freezing conditions.

k.) Fields dosed with relatively small quantities of effluent are more likely to freeze than those dosed with design quantities. If winter use is less than summer use, then only use proportional number of fields to maintain water application rates in the field being dosed.

10. Lightning Protection

A direct lightning strike on your valve, controller or wire is going to cause unpreventable damage. It is difficult to completely prevent electricity from spreading as it jumps across air, runs along electrical wires and may even travel along your water pipes. Power fluctuations can be prevented. The controllers are built to take some electrical surge and pass it through to the ground without damage. This requires a ground wire connected to a grounding stake driven deep into the ground. The best protection would be to use a separate ground wire or rod, do not rely on the third ground wire in the building's electrical wiring circuits. If you are installing this system in an area with frequent lightning storms, we advise you to install a separate grounding rod. Each field controller must have at least one eight foot copper clad steel ground rod 5/8" in diameter, driven all the way into the ground, as close as possible to the controller. This is to be connected to the grounding lug on the back-plate of the panel. If the rod can't be driven in all the way, cut if off and drive in the remaining piece 2-3' from the other rod and connect the rods together with 6 AWG solid copper wire. Follow local electrical codes. Inputs to the controller are more sensitive than outputs, so Geoflow offers a metal oxide varistor that protects the incoming power. It includes a metal strip for the controller power and relays for the floats. If hit, the metal or the relays are merely replaced. These are wired into the Geo controller.

11. Reuse for Irrigation

A good vegetative cover is an advantage to prevent erosion from the field and utilize water applied to the rooting zone. Sites should be planted or seeded immediately after installation. Grasses are particularly suitable for this application. Most lawn grasses will use 0.25" to 0.35" (6.3-8.9mm) of water per day during the peak growing season. This calculates to be about 0.16 to 0.22 gal/ft^2/day. By over-seeding lawns with winter ryegrass, this use efficiency can be continued through much of the year. For vegetation using 0.16 to 0.22 gal/ft^2/day by evapotranspiration, a sewage flow of 1000 gallons per day would supply the water needs of a landscaped area of 4600 to 6400 sq. ft. without having to add fresh water. For areas larger than this, the plants will suffer water stress during the hot months unless additional fresh water is applied.

12. Water Application Formula

To determine the rate of application for various drip irrigation designs, use the following formula:

Water application (inches per hour) = (231 x (emitter flow rate gph)) / ((Emitter spacing inches) x (dripline spacing inches))

Example: Dripline with 1.3 gph flow rate emitters spaced 24" apart and dripline spaced 24" apart.

Water application = (231x1.3)/(24x24) = 0.52 inches of water per hour.

WORKSHEET:

The following worksheet is a simplistic guideline and is available as an Excel spreadsheet. It can be downloaded from Geoflow's homepage at www.geoflow.com. If you would like a copy sent to you at no charge, phone 800-828-3388.

To calculate the area required for your drip dispersal system you must know:

1. the quantity of effluent to be disposed of (in gallons per day) and
2. the soil acceptance rate (i.e. gallons per day per square foot).

Make a sketch of the dispersal area with contour lines.

WORKSHEET 1 - DISPERSAL FIELD DESIGN FOR SINGLE ZONE SYSTEM

Worksheet Dispersal Field	Formula
A. Quantity of effluent to be dispersed per day _____ *gpd*	
B. Soil type or hydraulic loading rate _____ *loading rate (gal/sq. ft./day)*	*Based on soil analysis* *Refer to State or Local regulations. If none, refer to Table 1 and 2 on page 9 & 10*
C. Determine the total area required _____ *square ft*	*Divide gpd by loading rate. A/B*
D. Choose the spacing between each WASTEFLOW line and each WASTEFLOW emitter *i)*_____ *ft. between WASTEFLOW lines* *ii)*_____ *ft. between WASTEFLOW emitters*	*Standard spacing is 2 ft.*
E. How many linear feet of dripline in the total area?_____ *ft.*	*(Area / 2) for 2ft. line spacing. C/2.0 or* *(Area / 1) for 1 ft. line spacing.. C/1.0 or* *(Area / 1.5) for 1.5ft line spacing. C/1.5*
F. Calculate the number of emitters _____ *emitters*	*(Linear ft. of dripline / 2) for 2 ft emitter spacing. E/2 or* *(Linear ft. of dripline / 1) for 1 ft emitter spacing. E/1 or* *(Linear ft. of dripline /1.5) for 1.5 ft emitter spacing E/1.5*

Worksheet Dispersal Field	Formula
G. Choose pressure compensating or Classic dripline _____ *WASTEFLOW Classic dripline or* _____ *WASTEFLOW PC ½ gph dripline* _____ *WASTEFLOW PC 1 gph dripline*	*See page 4 and Appendix 1 for details*
H. Determine dripfield pressure _____ *psi*	*Standard pressure is 20 psi.* *WASTEFLOW Classic systems need between 15 and 45 psi (34.7 and 104 ft.) at the start of the dripfield.* *WASTEFLOW PC systems need between 10 and 45 psi (23.1 ft. to 104 ft.) at the start of the dripfield.*
I. Determine feet of head required at dripfield _____ *ft. of head*	*Multiply pressure by 2.31 to get head required.* *H x 2.31*
J. What is the flow rate per emitter? _____ gph / emitter	*See WASTEFLOW flow rates in Appendix 1.*
K. Determine total flow for the area _____ *gph* _____ *gpm*	*Number of emitters multiplied by the emitter flow rate at the design pressure.* *Gph = No of emitters (F) x gph per emitter (J)* *Gpm = gph/60*
L. Select pipe diameters for manifolds and submains _____inches	*Based on total flow from (K) above, in gpm. See schedule 40 friction loss charts at the back of the appendixes. Optimum velocity is between 2 and 5 ft. per second.*
M. Select Filter or WASTEFLOW Headworks _____ Filter _____ WASTEFLOW Headworks	*Based on total flow from (K) above, in gpm. See minimum and maximum flow recommendations for each filter in Appendix 2.*
N. Sketch a layout of the WASTEFLOW lines in the dispersal plot to make sure that the maximum lateral length of each WASTEFLOW line is not exceeded.	*See Maximum Length of Run table in Appendix 1.*

Worksheet 2 - Select Pump

Worksheet - Pumps		Formula
O. Minimum pump capacity	_____ gpm	*From (K)*
P. Header pipe size	_____ inches	*From (L)*
Q. Pressure loss in 100 ft. of pipe	_____ psi	*Refer to PVC charts.*
R. Friction head in 100 ft. of pipe	_____ ft. of head	*Multiply psi from (Q) above by 2.31*
S. Static head		
i) Height from pump to tank outlet	_____ft.	*Number of ft.*
ii) Elevation increase or decrease	_____ft.	*Height changes from pump to dripfield*
T. Total static head	_____ft.	*Add (Si) + (Sii)*
U. Friction head		
i) Equivalent length of fittings	_____ft.	*Estimate loss through fittings – usually inconsequential for small systems.*
ii) Distance from pump to field. X 2	_____ft.	*Measure length of sub-main supply & return*
iii) Total equivalent length of pipe.	_____ft.	*Add (Ui) + (Uii)*
iv) Total effective feet.	_____ft.	*(Uii)/ 100 x (R)*
v) Head required at dripfield	_____ft.	*See line (I) in Worksheet 1 above.*
vi) Head loss through filter or Headworks	_____ft.	*See pressure loss for filters in Appendix or see pressure loss for Headworks box in Appendix Multiply pressure by 2.31 to get head loss.*
vii) Head loss through zone valves	_____ft	
V. MINIMUM Total friction head	_____ft	*Add (Uiv) + (Uv) + (Uvi) + (Uvii)*
W. MINIMUM Total Dynamic Head	_____ft.	*Add (T) + (V)From line item (O) above*
X. MINIMUM pump capacity NOTE: Some States and Counties require additional flow for flushing. Please check your local regulations. If you need help on flushing design, see Geoflow's flushing worksheet at www.geoflow.com or call Geoflow at 800-828-3388.	_____gpm	
Y. Choose the pump. _____ _____ model number _____ _____ Manufacturer		*Based on pressure from line (W) above and flow from line (X) above.*

SYSTEM INSTALLATION

1. Installation Guidelines

All Geoflow drip systems require:
- Filtration with 120 mesh/130 micron
- Filter flush valve
- Field flush valve
- 2 Air vents in each zone
- All Wasteflow Classic drip systems require pressure regulation

Handle your dripline and components with care. nano-ROOTGUARD® is temperature sensitive. To assure a long life, store the dripline out of direct sunlight in a cool place.

a) All dripfield construction shall be done in accordance with Local rules and regulations.

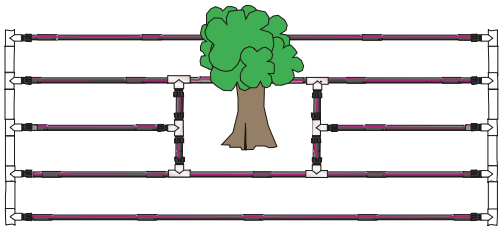
b) Protect the site prior to installation. Construction traffic and material stockpiling can change the soil profile. Fence off entire dripfield prior to any construction. No utilities, cable wire, drain tile, etc shall be located in dripfield.

c) System is not to be installed when ground is wet or frozen. When the moisture in the soil is near the plastic limit (soils will ribbon and not easily crumble), it will be prone to smearing.

d) Prior to construction note if any water is accessing the location of the dripfield. Dripfield should not be located at the low point of a site. Divert all downspouts and surface waters away from dripfield. If a curtain drain is to be used be sure it is serviceable and properly screened.

e) Excavation, filling and grading should have been finished prior to installation of the subsurface drip system. Be sure to minimize soil disturbance when clearing and grubbing the dripfield. Preserve as many trees as possible. Use light track equipment for tree removal and grind out roots to below dripline depth rather than fully removing the entire root.

f) Be sure you have everything required for the installation before opening trenches. Pre-assemble as many sets of components as practical above ground and in a comfortable place. Compression or Lockslip adapters should be glued to PVC tees, riser units should be pre-assembled, and the sub-main manifold with tees can be pre-assembled and used to mark the beginning and end of WASTEFLOW lines.



Loop dripline around trees

g) For particularly tough soil conditions, soil moisture the day before opening trenches or installing WASTEFLOW. Remember it is much easier to install the system in moist soil. The soil should be moist but still allow the proper operation of the installation equipment and not cause smearing in the trenches. The soil surface should be dry so that the installation equipment maintains traction.

h) Mark the four corners of the field. The top two corners should be at the same elevation and the bottom two corners should be at a lower elevation. In freezing conditions the bottom dripline must be higher than the supply and return line elevation at the dosing tank.

i) Install the dosing tank. It is critical that the tank is waterproof. If installing a riser, check that it is watertight, and the entry and exit ports are completely sealed. In freezing conditions the dosing tank should be at the lowest elevation of the entire system. Lid should be placed at grade and water should be able to shed over it.

j) Install zone valves; solenoid or hydraulic index valves.

k) Install the PVC supply line from the dosing tank, up hill through one lower and one upper corner stake of the dispersal field. Please refer to your State guidelines for depth of burial.

l) Paint a line between the two remaining corner stakes.

m) Install the Geoflow WASTEFLOW dripline from the supply line trench to the painted line, approximately 6" to 10" deep as specified. Upon reaching the painted line, pull the plow out of the ground and cut the dripline 1' above the ground. Tape the end of the dripline to prevent debris from entering. The tubing expands in warm temperatures and contracts in cold temperatures. If installing during the warmer months, be sure to allow some play in the tubing so it will not pull out of the fittings when it gets cold. Continue this process until the required footage of pipe is installed. Geoflow dripline must be spaced according to specification (2 ft. is standard). Depth of burial of dripline must be consistent throughout the field. Take care not to get dirt into the lines.

n) If the system is looped, install the looped ends with Geoflow plain tubing or flex PVC. If in a cold climate be sure to pitch these slightly so they do not hold water and freeze. The loops are to be installed on the outside of the measured field.

o) Install the supply header with tees lined up at each Geoflow line. Hook up the Geoflow lines to the supply header. Do not glue WASTEFLOW dripline.

Lockslip Fittings Installations

i. Hold the fitting in one hand and position the tubing with the other hand.
ii. Move the sleeve back, and push the tubing onto the exposed stem as far as possible.
iii. Push the sleeve out over the tubing and thread the sleeve onto tubing, as though tightening a nut to a bolt. Hand tighten. Do not use tools.
iv. Test the connection to make sure the sleeve threads have gripped the tubing tightly.

p) Install the filter headworks between the field and the pump tank on the supply line. Insulate the box in freezing conditions. When using an open bottom headworks box, place a rodent barrier down first. This can be made from bricks, paving stones, chicken wire, 3 layers of filter fabric or a 6" minimum depth of 1" gravel. Support the pipes entering and exiting the headworks with gravel.

q) If using a pressure regulator, install it downstream of the filter headworks, just ahead of the dispersal field, on the supply line. Although the pressure regulator can be buried directly into the soil, it is preferable to install it inside a small valve box for easy access. *Insulate the box in freezing conditions.

r) Install the floats in the dosing tank and wire up to the timer control. The timer control should be set to pump no more than the design flow, do not set to match the treatment capacity.

s) Install the pump. Fill the dosing tank with fresh water and turn on the pump. Check for flow out the ends of all of the Geoflow lines. Let the pump run for about five minutes to flush out any dirt. Shut off the pump and tape the ends of the lines.

t) Dig the return header ditch along the line painted on the ground and back to the pre-treatment tank. Start the return header at the farthest end from the dosing tank. The return line must have slope back to the treatment tank, septic tank or pump tank.

u) Install the return header and connect all of the Geoflow lines. Care must be taken not to kink the dripline.

v) Install air vacuum breakers at the highest points in the dispersal field. Use pipe dope or Teflon tape and hand tighten. Use a 6" minimum depth of 1" gravel below the boxes to keep rodents out. Insulate in freezing climates.

w) Install a ball or solenoid field flush valve on the return line to the pretreatment or pump tank unless a pre-assembled Wasteflow Headworks is being used. If a Headworks was installed on the supply line, connect the return line back through the Headworks box. Support the return pipe before it enters the Headworks with gravel. If using electric solenoid valves, connect the valve common and an individual output wire to the solenoid leads using watertight electrical connectors.

x) Allow glue fittings 1 – 2 hours to set. Open the field flush valve and turn on the pump to flush lines then close the valve and check the field and all piping and connections for leaks. Turn off the system

y) Check filters and valves for construction debris.

z) Turn on the pump and check:

i. Pressure at the air vacuum breaker(s) against design pressure. Check the pressure in the **WASTEFLOW HEADWORKS.** It should be five PSI or higher. If pressure gauges are on each side of the filter, noter these for benchmark differential pressure across the filter. If using a manual valve for field flushing, crack it open until at least on PSI is lost or design pressure is reached and leave in that position.

ii. Flow rates from flow meter or draw down on tank. Compare to design flow.

iii. Wet spots in the field. If any sections are particularly wet, determine if they are caused by faulty connections, drippers or shallow burial.

iv. Check that solenoid valves are functioning. Close the internal manual bleed after flushing the system. If solenoid will not close, first clean the solenoid with caution not to lose small spring, and if this fails, open the bonnet and clean the inside.

aa) Establish vegetation cover as specified.

bb) Provide owner with final as-built diagrams flow measurements and pressure readings at startup.

cc) Provide controller records at startup, including elapsed time meter, pump counts, secondary override counts, highwater counts and primary float counts.

dd) Solenoid Valve Installation and Operation

i. Wrap male adapters with 2 wraps of Teflon tape and thread the adapters into the valve inlet and outlet 1 turn past hand tight. CAUTION: over tightening may cause damage to the valve. The solenoid is located on the downstream side of the valve.

ii. Flush the laterals by opening the internal manual bleed lever on the downstream side of the solenoid. Turn the flow control stem fully open (counterclockwise) for flow control models.

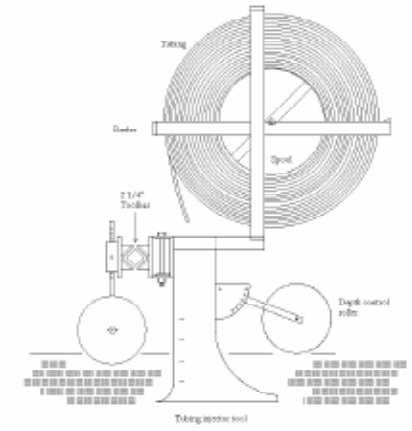
iii. Check that solenoid valves are functioning.

Table 3. Subsurface Drip Installation Methods

NOTE: Disturbing the soil may affect the pore structure of the soil and create hydraulic conductivity problems. Please consult with your soil scientist or professional engineer before making the installation technique decision.

INSTALLATION METHOD *	ADVANTAGES	DISADVANTAGES
a) Hand Trenching*	• Handles severe slopes and confined areas • Uniform depth	• Slow • Labor intensive • Disrupts existing turf and ground • Back fill required
b) Oscillating or vibrating plow . Use the type that inserts the dripline directly in place, not one that pulls the dripline through the soil.	• Fast in small to medium installations • Minimal ground disturbance • No need to back fill the trench	• Depth has to be monitored closely • Cannot be used on steeper slopes(>20%) • Requires practice to set and operate adequately • Tends to "stretch" pipe. Shorter runs are required
c) Trenching machine: Ground Hog, Kwik-Trench, E-Z Trench*	• Faster than hand trenching • May use the 1" blade for most installations • Uniform depth	• Slower, requires labor • Disrupts surface of existing turf • Back fill required
d) Tractor with dripline insertion tool - see diagram 2.	• Fast • Little damage to existing turf because of the turf knife • Minimal ground disturbance • Does not stretch drip line • Adaptable to any tractor	• The installation tool is designed specifically for this purpose.
e)Tractor mounted 3-point hitch insertion implement	• Fastest. Up to four plow attachments with reels • A packer roller dumps back soil on top of the pipe	• Suitable for large installations only

* Installation methods are left to the discretion of the contractor and/or the engineer. Other installation methods may be used as long as care is taken to protect the tubing and the soil.



Diag. 2 Installation Tool

Worksheet 3 - As Built System Description

1. Site name: _____
2. Site address including State: _____
3. Dripfield designed by: _____
4. Dripfield installed by: _____
5. Date of installation: _____
6. Daily design flow: _____ gpd.
7. Soil percolation rate: _____
8. Is there secondary treatment on this job site? _____Yes _____No

   If "Yes" to question 8 above, please name manufacturer and model number:_____

9. Number of zones in dripfield: _____ If more than 1 zone, circle the valve used Hydraulic or Solenoid
10. Amount of dripline installed in each zone:

    Zone 1_____ ft. Zone 2_____ ft. Zone 3_____ ft. Zone 4_____ ft.

11. Wasteflow dripline model number &/or description: _____
12. Flow rate per zone:

    Zone 1_____ gpm. Zone 2_____ gpm. Zone 3_____ gpm. Zone 4_____ gpm.

13. Depth dripline installed below grade: _____ inches
14. Pump manufacturer, model number and number of pumps:_____
15. Filter or Headworks model number &/or description:_____
16. Pressure in each zone:

    Zone 1_____ psi Location pressure measured:_____

    Zone 2_____ psi Location pressure measured:_____

    Zone 3_____ psi Location pressure measured:_____

    Zone 4_____ psi Location pressure measured:_____

17. Size of filter flush valve: _____ inches. Is the filter flush valve manual or automatic? _____
18. Size of field flush valve: _____ inches. Is the field flush valve manual or automatic?_____

If more than 1 zone, do the zones (a) share 1 flush valve or (b) does each zone have its own flush valve?

19. Was any fill material supplied on the dripfield? _____

If "yes" to 18 above describe fill quality and quantity added. _____ _____
_____

20. Please provide owner with as-built drawings, including but not limited to direction of drip lines, location of air vents, pressure regulators if applicable, Headworks (filter and valves) and pump tank.
21. Startup Controller readings:

    ETM____ Pump ct.____ Secondary timer ct.____ High alarm ct.____ Primary ct.____

22. Note how long it takes to drain return line in freezing climates, and set controller

SYSTEM MAINTENANCE

The best way to assure years of trouble free life from your system is to continuously monitor the system and to perform regular maintenance functions. For large systems or systems with a BOD > 30 mg/l automation of maintenance is essential. For smaller systems with a BOD < 30 mg/l inspection and maintenance should be performed every six months.

Routine and Preventative Maintenance

1) Clean the filter cartridge. This may be done with a pressure hose. The screen filter cartridge should be cleaned from the outside inwards, while the discs in the disc filter cartridge should be separated and then cleaned. If bacteria buildup is a problem, we advise first trying lye, and if the problem persists, soak the filter cartridge in a chlorine bath - a mixture of 50% bleach and 50% water.
2) Open the field flush valve and flush the field for 3-5 minutes by activating the pump in "manual" position. Close the flush valve. On automatic solenoid valves the manual bleed lever should always be in the closed position and the dial on top should be free spinning. This allows it to open when pulsed electrically. Clockwise rotation closes valve.
3) With the pump in the "manual" position, check the pressure in the drip field by using a pressure gauge on the schrader valve located on the air vents and by reading the pressure gauge located in the Wasteflow Headworks box. The pressure should be the same as shown on the initial installation records. On systems with manual flush valves, close the field flush valve completely and then open the valve slightly until there is a 1-2 psi drop or design pressure is reached. This will allow the field to drain after each dose to prevent the manifold lines from freezing.
4) Remove the lids on the vacuum breaker and check for proper operation. If water is seen leaking from the top of the vacuum breaker, remove the cap of the vacuum breaker and press down on the ball to allow any debris to be flushed out. Be careful not to come in contact with the effluent.
5) Turn off the pump and reset the controller for auto mode.
6) Periodically remove and clean the air vents, field flush and filter flush valves.
7) Visually check and report the condition of the drip field, including any noticeable wetness.
8) Treatment and distribution tanks are to be inspected routinely and maintained when necessary in accordance with their approvals.
9) Record the elapsed time meter, pump counter, override counter, high-level alarm and power failures. This information can be obtained from the controller.

Home Owners Guide For Care and Maintenance of Geoflow Drip Dispersal Field

A drip dispersal system has been installed on your property for the subsurface dispersal of the effluent from your home.

The drip dispersal system consists of a series of ½" diameter drip tubing installed at a shallow depth of 6-10" below the ground surface. It is designed to effectively disperse the treated effluent in the ground with a combination of soil absorption and plant uptake. Your drip dispersal system will function for many years with only minimal maintenance being required, provided the following recommendations are followed:

- Establish landscaping (preferably a grass cover) immediately. This will stabilize the soil and allow for the grass to take up the water.
- Do not discharge sump pumps, footing drains or other sources of clear water to the system, except for the effluent discharge from your treatment system.
- Maintain all plumbing fixtures to prevent excess water from entering the dispersal system.
- Do not drive cars, trucks or other heavy equipment over the drip dispersal field. This can damage the drip components or the soil and cause the system to malfunction. Lawn mowers, rubber wheeled garden tractors and light equipment can be driven over the drip field.
- Do not drive tent stakes, golf putting holes, croquet hoops etc., into the dispersal field.
- Contact your service company if your high water alarm should sound. The pump chamber is sized to allow additional storage after the high water alarm sounds but you should refrain from excessive water usage (i.e., laundry) until the system has been checked.
- After a temporary shut down due to a vacation or other reason, the treatment plant ahead of the drip field filter initially may not function effectively, resulting in the filter blocking.Refer to maintenance guidelines above to clean the filter.

  Contact your service company if you notice any areas of excessive wetness in the field. In most cases, this is usually caused by a loose fitting or a nicked dripline and can be easily repaired. Note: There may be some initial wetness over the dripline following the system's installation. This should cease once the ground has settled and a grass cover is established.

Site Inspection Sheet

Site Address _____ **Date**_____

Site observations

1 Is dripfield located at the lowest point in the site where all waters may pond?
2 Is there any water coming in from neighbors? Downspouts? Irrigation?
3 Construction debris anywhere near the site, or compaction from construction or other causes?
4 How wet is the field before digging?
5 Will effluent drain back to tank in freezing climates? If not, is equipment insulated from freezing?

Pump tank

1 Watertight?
2 At grade. Allow surface water to run off.
3 Inlet and outlet lines to be laid in gravel or compacted soils.
4 Float tree designed for easy removal for service and adjustment.
5 Float settings correct to design?
6 Pump set a few inches up from the bottom of the tank.
7 Waterproof wire nuts used to wire pump junction box.

Headworks - Filter and flush valves

1 Waterproof wire nuts used in wiring solenoid valves.
2 Is filter large enough to handle flow? Is it appropriate for the treatment unit?
3 Clean filter and valves after construction.
4 Check filter everytime system is serviced, and clean filter element.
5 Clean valves if they do not close properly. See if different valves have different toggles.
6 Insulate in freezing climates.
7 Have minimum of 1/2ft depth of 1" gravel under the Headworks for drainage and to keep gophers out.
8 Check pressure - across filter (if available).
9 Check pressure - on return line pressure should be as designed. Lower than 5 psi may be too low.

Zone valves

1 Index valves - Requires 10 gpm min. flow, needs to self drain in freezing climate.
2 Solenoids - Clean after installation if they do not close properly.

Supply and return lines

1 Make sure they are supported going into and out of the Headworks.
2 No dips.
3 Make sure water from dripline does not flow back into supply and return trenches.

Dripline

1 On contour.
2 Burial depth.
3 Check for kinking and local undulations (low areas) in installed driplines.
4 Flush lines during construction.
5 Is there ponding on surface?
6 Cover crop over field?

Airvents

1 Point of pressure measurement.
2 Insulate in freezing climates.
3 Make sure they are not in a position for surface or subsurface water to enter the system.
4 Check pressure at airvents. Should be as designed. Less than 7psi may be too low..

Return to?

1 Pump tank? Don't churn the tank on return.
2 Pretreatment? Can the equipment handle the additional flow.

Controller

1 Check field programmable settings against design.
2 Proper wiring of controller….wire floats and valves.
3 Keep moisture from running up wire into controller.

Notes

1 Use sheet for "As built" in Design Guidelines.
2 Keep a record of start-up pressures and system data screens.

Comments:

TROUBLE SHOOTING GUIDE:

Symptom: High water alarm activates periodically (1-2 times/week). During other times the water level in the pump chamber is at a normal level.

Possible cause: Peak water usage (frequently laundry day) is causing a temporary high water condition to occur.

Remedy: Set timer to activate the pump more frequently. Be sure to not exceed the total design flow. To avoid this, reduce the duration of each dose.

Remedy: Provide a larger pump tank to accommodate the peak flow periods.

Symptom: High water alarm activates during or shortly after periods of heavy rainfall.

Possible cause: Infiltration of ground/surface water into system.

Remedy: Identify sources of infiltration, such as tank seams, pipe connections, risers, etc. Repair as required.

Symptom: High water alarm activates intermittently, including times when it is not raining or when laundry is not being done.

Possible cause: A toilet or other plumbing fixture may be leaking sporadically but not continuously. Check water meter readings for 1-2 weeks to determine if water usage is unusually high for the number of occupants and their lifestyle. Also determine if water usage is within design range.

Remedy: Identify and repair fixture.

Symptom: High water alarm activates continuously on a new installation (less than 3 months of operation). Inspection of the filter indicates it is plugged with a gray colored growth. Water usage is normal. being done.

Possible cause: Slow start-up of treatment plant resulting in the presence of nutrient in the effluent sufficient to cause a biological growth on the filter. This is typical of lightly loaded treatment plants that receive a high percentage of gray water (i.e., from showers and laundry),

Remedy: Remove and clean filter cartridge in a bleach solution. Add a gallon of household bleach to pump tank to oxidize organics. Contact treatment plant manufacturer for advice on speeding up the treatment process possibly by "seeding" the plant with fresh activated sludge from another treatment plant.

Symptom: Water surfaces continuously at one or more isolated spots, each one foot or more in diameter.

Possible cause: Damaged drip line or a loose connection is allowing water be discharged under pressure and therefore at a much greater volume than intended.

Remedy: Dig up drip line. Activate pump and locate leak. Repair as required.

Possible cause: If water is at base of slope, can be caused by low-head drainage.

Remedy: Install check valves and airvents in the manifolds to redistribute water in the system after pump is turned off. This is not advised for freezing climates where manifold drainage is required.

Symptom: A portion of the drip field closest to the feed manifold is saturated while the rest of the field is dry.

Possible cause: Insufficient pump pressure. A pressure check at the return manifold indicates pressure of less than 10 psi.

Remedy: Check filter and pump intake to insure they are not plugged. If they are, clean as require.

Remedy: Leaks in the system may be resulting in loss of pressure. Check for water leaks in connections and fittings or wet spots in the field. Also check air vents to insure they are closing properly. Repair as necessary.

Remedy: Pump is worn or improperly sized. Pressure at feed manifold in less than 15 psi. Verify pressure requirements of system and provide a new or larger pump. As an alternate approach, the drip field may need to be divided into two or more zones.

Possible cause: The duration of each dose is of insufficient length to allow the drip field to become pressurized before the pump shuts off (or runs for only a brief time before turning off).

Remedy: Increase the pump run time and decrease the frequency of doses. Always calculate (or observe during field operation) how long the system takes to fully pressurize and add this time to the design dosing duration.

Symptom: High water alarm begins to activate continuously after a long period (1-2 years) of normal operation. Inspection of the filter indicates it is plugged with a heavy accumulation of sludge.

Possible cause: A buildup of solids in the pump tank due to carryover from the treatment plant.

Remedy: Replace the filter cartridge with a clean cartridge. Check the pump tank and if an accumulation of solids is noted, pump the solids out of the pump tank. Also, check the operation of the treatment plant to insure it is operating properly.

Symptom: Water surfaces at several spots in drip field during dosing periods. Installation is recent, less than 6 months of usage and the soil is a moderate to heavy clay. Possibly, the installation was completed using a non-vibratory plow.

Possible cause: Smearing of the soil may have occurred during installation of drip line. Also, the "cut" resulting from the installation allows an easy path for the water to surface during dosing.

Remedy: In most cases the sod will compact naturally around the drip line and the surfacing will diminish and ultimately cease. To help, reduce the duration of each dose and increase the number of doses/day. Also, it will help to seed the area to encourage the development of a good root zone.

Symptom: Entire area of drip field is wet, soft and spongy. It appears to be totally saturated with water. Situation occurs during dry season when there is little rainfall.

Possible cause: Water being discharged to drip field exceeds design. Excess water may be a result of infiltration, plumbing leaks or excessive water usage.

Remedy: Check water meter, elapsed time meter, pump counter, override counter or high level alarm counter to determine if water usage is in excess of design. Check for leaks or infiltration. Repair leaks as required. Reduce water usage by installing water saving fixture.

Remedy: If water usage cannot be reduced, enlarge drip field as required.

Possible cause: Area of drip field was inadequately sized and is too small.

Remedy: Provide additional soil analysis to verify sizing and enlarge as required.

Valve Troubleshooting

Symptom: Valve will not open manually

Check water supply and any possible master or gate valves to insure they are open.
Check that the valve is installed with the arrow pointing in the downstream direction
Check that the flow control is fully open, counterclockwise.
Turn off the water supply. Remove the solenoid and check for debris blocking the exhaust port.
Turn off the water supply. Remove the cover. Inspect the diaphragm for damage and replace if necessary.

Symptom: Valve will not open electrically

Check voltage at controller for 24 VAC station.
Check voltage across the solenoid lead wires for minimum 21 VAC.
Make sure handle on top of valve is free spinning. Not all the way open or all the way closed.
If the valve still does not operate, electrically replace the solenoid.

Symptom: Valve will not close

Insure the manual bleed lever is in the closed position.
Check for leaks around the flow control, solenoid or between valve cover and body.
Turn off the water supply. Remove the solenoid and check for debris or damage to the exhaust port.
Turn off the water supply. Remove valve cover and inspect for debris under diaphragm or debris in diaphragm ports.

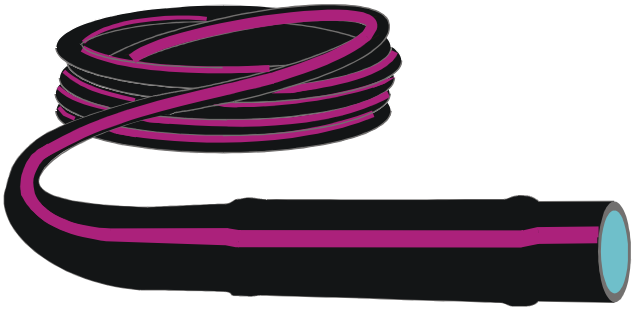
Symptom: Slow leak

Check for dirt or gravel embedded in the diaphragm seat.
Check actuator and exhaust fitting for proper seating.

WASTEFLOW™ Dripline

Description

The flexible 1/2" polyethylene dripline has large emitters regularly spaced in the line. With the dripline hidden about six inches below ground, effluent is distributed slowly and uniformly, reducing ponding, even in difficult soils and hilly terrain. WASTEFLOW is built to last. It is guaranteed to be trouble-free from root intrusion with built-in nano-ROOTGUARD® protection, and the dripline wall is protected from organic growth with the *Geoshield* lining. WASTEFLOW provides uniform distribution. The emitters have a Coefficient of variation of less than .05.



Different flow rates, dripline diameters and emitter spacings can be special ordered.

Use 600 series compression adapters or lockslip fittings to connect the dripline to PVC pipe.

nano-ROOTGUARD® Protection

NEW

WASTEFLOW dripline features patented nano-ROOTGUARD technology to prevent roots from clogging the emission points. The pre-emergent, Treflan®, is bound into WASTEFLOW emitters when they are molded to divert roots from growing into the emitter outlet. The system is guaranteed against root intrusion for 15 years.

BACTERICIDE Protection

Geoshield® is incorporated into the inner lining and emitters of WASTEFLOW dripline to prevent bacteria from forming and eliminates the need to scour the tubing. It is a tin based formula that defeats the energy system of microbial cells.

This means smaller pumps or larger zones can be used with WASTEFLOW dripline than unprotected dripline.

PC vs. CLASSIC

Geoflow, Inc. offers WASTEFLOW dripline in both pressure compensating (WASTEFLOW PC) and non-compensating (WASTEFLOW Classic) models.

We recommend that WASTEFLOW PC be used when the advantages are of substantial economic value.

a) Very long runs.

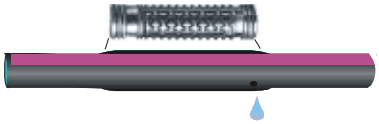
b) Steep slopes. Systems should be designed for the dripline lateral to follow the contour. If this is possible, the extra cost of pressure regulators required for WASTEFLOW Classic would likely be less than the incremental cost of WASTEFLOW PC.

c) Rolling terrain. If the difference in height from trough to peak exceeds six feet then WASTEFLOW PC should be used. Vacuum relief valves must be placed at the top of each rise.

WASTEFLOW PC and WASTEFLOW Classic can be interchanged to meet filter and zone flow requirements.

- WASTEFLOW is manufactured under US Patents 5332160,5116414 and Foreign equivalents.
- **Geoshield®** is a registered trademark of A.I.Innovations
- WASTEFLOW is a registered trademark of A.I.Innovation
- TREFLAN is a registered trademark of Dow Agro Chemicals.

WASTEFLOW Classic



Flow Rate vs. Pressure

Pressure psi	Head ft.	Flow Rate Classic Dripline
10 psi	23.10 ft.	.81 gph
15 psi	34.65 ft.	1.00 gph
20 psi	46.20 ft.	1.16 gph
25 psi	57.75 ft.	1.31 gph
30 psi	69.30 ft.	1.44 gph
35 psi	80.85 ft.	1.57 gph
40 psi	92.40 ft.	1.68 gph
45 psi	103.95	1.80 gph

Maximum Length of Run vs. Pressure

Flow variation +/- 5%

Pressure psi	Head ft.	Emitter Spacing 24”	18”	12”
10 psi	23.10 ft.	170’	165’	100’
15 psi	34.65 ft.	170’	165’	100’
20 psi	46.20 ft.	170’	165’	100’
25 psi	57.75 ft.	170’	165’	100’
30 psi	69.30 ft.	170’	165’	100’
35 psi	80.85 ft.	170’	165’	100’
40 psi	92.40 ft.	170’	165’	100’
45 psi	103.95 ft.	170’	165’	100’

Kd=0.9 Cv < .05

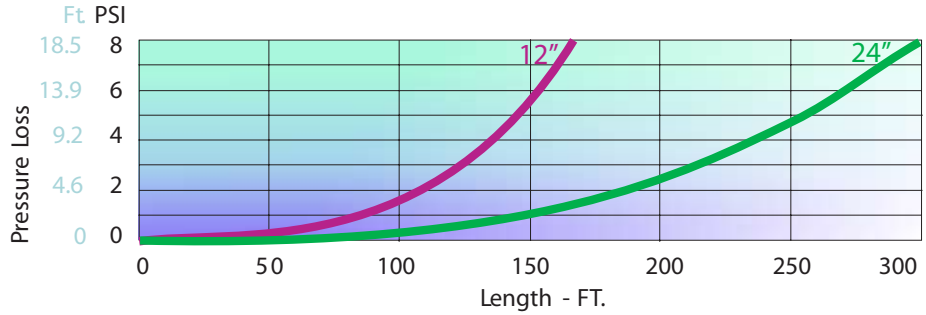
Standard Models:

WF16-4-24 WASTEFLOW Classic 24”/1.3gph
WF16-4-12 WASTEFLOW Classic 12”/1.3gph
Alternate flow rates, diameters and spacing available upon request.

WASTEFLOW Classic Specification

The dripline shall consist of nominal sized one-half inch linear low density polyethylene tubing, with turbulent flow drip emitters bonded to the inside wall. The drip emitter flow passage shall be 0.053” x 0.053” square. The tubing shall have an outside diameter (O.D.) of approximately .64-inches and an inside diameter (I.D.) of approximately .55-inches. The tubing shall consist of three layers; the inside layer shall be *Geoshield*® protection, the middle layer shall be black and the outside layer shall be purple striped for easy identification. The dripline shall have emitters regularly spaced 24” (or 12”) apart. The turbulent flow emitters shall be molded from virgin polyethylene resin. The turbulent flow emitters shall have nominal discharge rates of 1.3 gallons per hour at 20 psi. The emitters shall be impregnated with Treflan® to inhibit root intrusion for a minimum period of fifteen years and shall be guaranteed by the manufacturer to inhibit root intrusion for this period. WASTEFLOW Classic dripline shall be Geoflow model number WF16-4-24 (or WF16-4-12).

Wasteflow Classic 1 gph
Pressure Loss vs. Length of Run



WASTEFLOW PC 1/2 gph

Flow Rate vs. Pressure

Pressure	Head	Flow Rate 1/2 gph PC dripline
7-60 psi	16-139 ft.	0.53 gph

Maximum Length of Run vs. Pressure

Allows a minimum of 10 psi in the line.
Recommended operating pressure 10-45 psi.

Pressure psi	Pressure ft.	Emitter Spacing 6"	12"	18"	24"
10 psi	23.10 ft.				
15 psi	34.65 ft.		174'	260'	321'
20 psi	46.20 ft.	120'	229'	330'	424'
25 psi	57.75 ft.		260'	377'	478'
30 psi	69.30 ft.	150'	288'	415'	535'
35 psi	80.85 ft.		313'	448'	576'
40 psi	92.40 ft.	172'	330'	475'	612'
45 psi	103.95 ft.		354'	501'	651'
50 psi	115.5 ft.		363'	523'	675'
55 psi	127.05 ft.		377'	544'	700'
60 psi	138.6 ft.		403'	563'	727'

Kd = 2.070

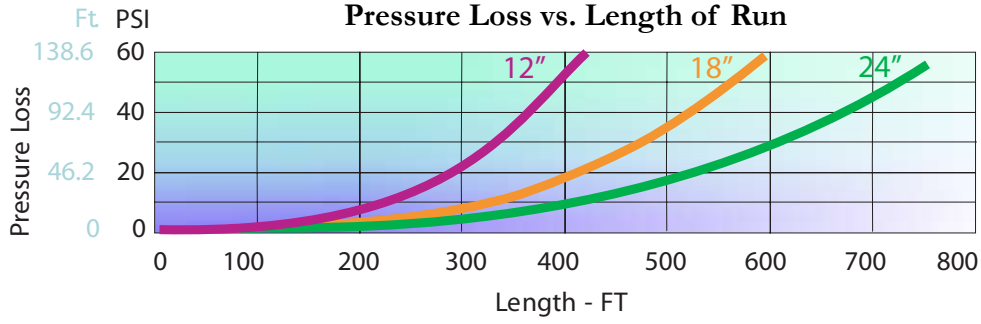
Standard Models:

WFPC16-2-24 WASTEFLOW PC 24"/.53gph or 2lph
WFPC16-2-18 WASTEFLOW PC 18"/.53gph or 2lph
WFPC16-2-12 WASTEFLOW PC 12"/.53gph or 2lph
Alternative spacing, flow rates and diameters available upon request.

WASTEFLOW PC ½ gph PC Specification

The dripline shall consist of nominal sized one-half inch linear low density polyethylene tubing, with turbulent flow drip emitters bonded to the inside wall. The drip emitter flow passage shall be 0.032" x 0.045" square. The tubing shall have an outside diameter (O.D.) of approximately .64-inches and an inside diameter (I.D.) of approximately .55-inches. The tubing shall consist of three layers; the inside layer shall be a *Geoshield*® protection, the middle layer shall be black and the outside layer shall be purple striped for easy identification. The dripline shall have emitters regularly spaced 24" (or 18" or 12") apart. The pressure compensating emitters shall be molded from virgin polyethylene resin with a silicone rubber diaphragm. The pressure compensating emitters shall have nominal discharge rates of 0.53 gallons per hour. The emitters shall be impregnated with Treflan® to inhibit root intrusion for a minimum period of fifteen years and shall be guaranteed by the manufacturer to inhibit root intrusion for this period. 0.53 gph WASTEFLOW PC pressure compensating dripline shall be Geoflow model number WFPC16-2-24 (or WFPC16-2-18 or WFPC16-2-12) .

Wasteflow PC 1/2 gph
Pressure Loss vs. Length of Run



WASTEFLOW PC 1 gph

Flow Rate vs. Pressure

Pressure	Head	Flow Rate 1 gph PC dripline
7-60 psi	16-139 ft.	1.02 gph

Maximum Length of Run vs. Pressure

Allows a minimum of 10 psi in the line.
Recommended operating pressure 10-45 psi.

Pressure		Emitter Spacing			
psi	ft.	6"	12"	18"	24"
10 psi	23.10 ft.	50'	95'	140'	175'
15 psi	34.65 ft.	63'	115'	172'	211'
20 psi	46.20 ft.	74'	146'	210'	265'
25 psi	57.75 ft.	88'	171'	242'	315'
30 psi	69.30 ft.	94'	180'	266'	335'
35 psi	80.85 ft.	103'	199'	287'	379'
40 psi	92.40 ft.	110'	211'	305'	385'
45 psi	103.95 ft.	116'	222'	321'	429'
50 psi	115.5 ft.		232'	334'	431'
55 psi	127.05 ft.		240'	347'	449'
60 psi	138.6 ft.		249'	360'	465'

Kd = 2.070

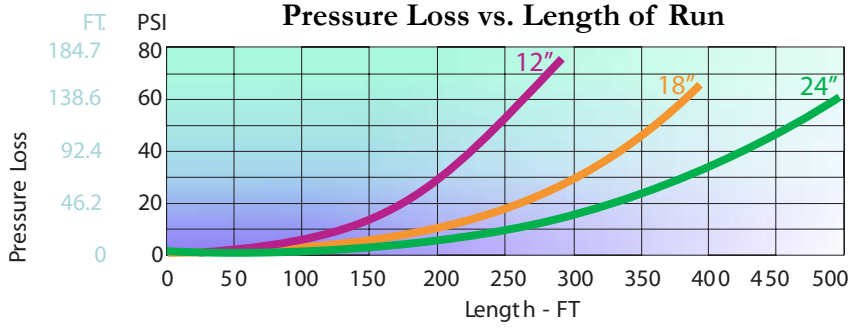
Standard models:

WFPC16-4-24 WASTEFLOW PC 24"/1.02 gph or 4lph
WFPC16-4-18 WASTEFLOW PC 18"/1.02 gph or 4lph
WFPC16-4-12 WASTEFLOW PC 12"/1.02 gph or 4lph
Alternative spacing, flow rates and diameters available upon request.

WASTEFLOW PC 1 gph PC Specification

The dripline shall consist of nominal sized one-half inch linear low density polyethylene tubing, with turbulent flow drip emitters bonded to the inside wall. The drip emitter flow passage shall be 0.032" x 0.045" square. The tubing shall have an outside diameter (O.D.) of approximately .64-inches and an inside diameter (I.D.) of approximately .55-inches. The tubing shall consist of three layers; the inside layer shall be *Geoshield*® protection, the middle layer shall be black and the outside layer shall be purple striped for easy identification. The dripline shall have emitters regularly spaced 24" (or 18" or 12") apart. The pressure compensating emitters shall be molded from virgin polyethylene resin with a silicone rubber diaphragm. The pressure compensating emitters shall have nominal discharge rates of 1.02 gallons per hour. The emitters shall be impregnated with Treflan® to inhibit root intrusion for a minimum period of fifteen years and shall be guaranteed by the manufacturer to inhibit root intrusion for this period. 1.02 gph WASTEFLOW PC pressure compensating dripline shall be Geoflow model number WFPC16-4-24 (or WFPC16-4-18 or WFPC16-4-12) .

Wasteflow PC 1 gph
Pressure Loss vs. Length of Run



Controllers

Geoflow's controllers are the brain in the system, utilizing a programmable logic controller (PLC) to activate the pump(s) cycles, zone valves and flush valves when needed. Telemetry and SCADA control systems available. Please contact Geoflow for custom panel information.

In 2007 Geoflow introduced a new touchscreen controller called the GeoTS.
Geared towards commercial sites with multiple zones or inputs, the key features of the
Geo TS are:

- 6" Touchscreen. Inputting parameters such as pump times and flush times is in plain English with help menus.
- Each zone can be set independently. Run times can vary from zone to zone, which is particularly beneficial when zones vary in size, soils, vegetation, topography etc.
- Measures flow data per zone. The amount of total water and average gallons per minute are logged by zone when using the flow meter option.

Comparison Chart between Geo standard Logo and Geo Touchscreen

Features	Geo Standard (Geo)	Geo Touchscreen (GeoTS)
Interface	1" Logo with arrows 	6" Touchscreen 
Programmable Logic Controller PLC	Yes	Yes
Programmed for 4-floats	Yes	Yes
Touch-safe panel	No	Yes
Each zone can have different run times	No	Yes
Measure flow rate for each zone	No	Yes
Manual or automatic flushing	Auto or manual	Auto only
Enclosure	Nema 4X fiberglass	Nema 4X fiberglass
HOA switch - pump	Toggle 3-way	Rotary 3-way
HOA switch - solenoids	Toggle	Touchscreen

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Features	Geo Standard (Geo)	Geo Touchscreen (GeoTS)
Lightning arrestor	Yes	Yes
Onscreen help menus	No	Yes
Log Functions - Elapsed time meter (ETM) - Pump events - Filter Flush Counter - Field Flush Counter - Peak timer events - High level alarm events - Power failure events - Push to silence - Add-on parts such as pressure sensor - Flow data (avg GPM & Total Flow by zone)	 Yes Yes Yes Yes Yes Yes Yes No No No	 Yes Yes- time & date stamped Yes- time & date stamped Yes- time & date stamped Yes- time & date stamped Yes- time & date stamped Yes Yes- time & date stamped Yes – if installed Yes- if Geoflow FM Pulse meter is installed
Programmable Parameters Independent zone run times Primary run and rest time Secondary run and rest time Filter Flush time & frequency Field Flush time & frequency Manifold Drain Back Time	 No Yes Yes Yes Yes Yes	 Yes – new feature Yes Yes Yes Yes Yes
Pre-built to accept the following optional parts: Flow meter Remote alarm Blower input Ultraviolet non audible alarm Rain Gauge	 No Yes No No No	 Geoflow FM-pulse meter Yes Yes Yes with N/O contact Yes with Geoflow gauge
Self diagnostics	No	Yes It has diagnosis capabilities for the floats, pumps, contactors and the PLC itself and any auxiliary components or standard features that have a sensor feedback wired to the panel.
Displays current status of equipment	No	Yes Gives the countdown on the screen to next event and what equip. is active.

Choose a GEO controller from the table below:

Step 1. Controller Type

- Choose between Geoflow's standard controller (Geo) and the Geo Touchscreen (Geo TS).

Step 2. No. of Zones

- If the zones are activated by the controller with solenoid valves, find the row that covers the number of zones in the project.
- If the zones are activated with index or Hydrotek valves, then choose a single zone controller. The single zone controllers do allow for index or Hydrotek valves.
- Zones activated with index & solenoid valve combinations can be special ordered.
- If the zones exceed the choices below, larger controllers can be special ordered.

Step 3: Number of pumps.

- Choose one pump (simplex) or two pumps (duplex).

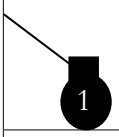
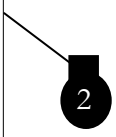
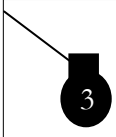
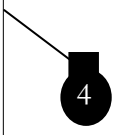
Step 4: Flushing operation.

- Choose manual or electronic field and filter flushing. Geoflow requires all direct septic systems use electronic flushing.
- Manual flushing only available on the Geo 1 controllers. Geoflow recommends using Auto flush panels where maintenance is not mandatory.

Step 5: Treatment option (GeoTS only)

- If the GeoTS panel is capable of monitoring your pretreatment system, and if greater than NSF requirements, can also control your treatment system. If this option is desired choose the row that says "yes".

Step 1 Type	Step 2 Zones	Step 3 Pumps	Step 4 Flushing	Step 5 Treatment	Part Number
Geo	1	Simplex	Manual	-	GEO1-SIM-MAN
			Automatic	-	GEO1-SIM-AUT
		Duplex	Manual	-	GEO1-DUP-MAN
			Automatic	-	GEO1-DUP-AUT
	2 - 4	Simplex	Automatic	-	GEO4-SIM-AUT
		Duplex	Automatic	-	GEO4-DUP-AUT
	5 - 8	Simplex	Automatic	-	GEO8-SIM-AUT
		Duplex	Automatic	-	GEO8-DUP-AUT
Geo TS	1	Simplex	Automatic	-	GEOTS-01-SIM
				Yes	GEOTS-01-SIM-T
		Duplex	Automatic	-	GEOTS-01-DUP
				Yes	GEOTS-01-DUP-T
	2 - 8	Simplex	Automatic	-	GEOTS-08-SIM
				Yes	GEOTS-08-SIM-T
		Duplex	Automatic	-	GEOTS-08-DUP
				Yes	GEOTS-08-DUP-T
	9 - 16	Simplex	Automatic	-	GEOTS-16-SIM
				Yes	GEOTS-16-SIM-T
		Duplex	Automatic	-	GEOTS-16-DUP
				Yes	GEOTS-16-DUP-T
	17 - 24	Simplex	Automatic	-	GEOTS-24-SIM
				Yes	GEOTS-24-SIM-T
		Duplex	Automatic	-	GEOTS-24-DUP
				Yes	GEOTS-24-DUP-T

Floats	Functions
	Float raised – Alarm enable. Activates the audible and visual alarm when raised. Audible alarm may be silenced by pressing the illuminated "PUSH TO SILENCE" button.
	Float raised – Peak Timer enable. The secondary timer will cycle the pump(s) more frequently. The secondary timer function will remain active until the Primary Timer enable float lowers. When the Peak Timer function has been completed and the Primary Timer enable float is reactivated, normal timer operation will resume.
	Float raised – Timer enable. The Primary Timer will control pump cycles, beginning with the off cycle. Note: On duplex panels the pumps will alternate with each timer cycle. The Primary float resets the secondary on/off float when in the down position.
	Float raised – Pump enable. Float lowered – Pump disable. Flashing visual & audible alarm enable. This is a secondary off float that will prevent the operation of the pump if the water level in the tank gets too low. Geo pump will be disabled in both the automatic and manual modes. GeoTS will allow you to run the pump for a short burst regardless of float position. This bottom float also activates the visual and audible alarms. Audible alarm may be silenced by pressing the illuminated "PUSH TO SILENCE" button.

Note: ETM and pump events are recorded whenever contactor is energized.

GEO-1 *MANUAL* **CONTROLLERS**

The Primary Timer (float 2-activated) controls the pump dose cycle during normal operating conditions. During high flow conditions the pump dosing cycles will be controlled by the Peak Timer (float 3 - activated). The Peak Timer off is typically set to trigger more frequent flow than the Primary Timer off setting.

If *duplex pump* option is chosen, the pumps are alternated every pump cycle and never operate simultaneously. There is a selection switch for pump 1, pump 2 or alternation. This allows one pump to be taken out of service for maintenance without affecting the operation of the system.

Pump dosing cycles are controlled by the timers when the H-O-A switch is in the auto position. Under normal conditions the Primary Timer (float 2) will control the pump(s). During high flow conditions, the Peak Timer (float 3) will control the pump(s). The Peak Timer will cycle the pump more frequently than the Primary Timer (field adjustable). The pump will dose for the same amount of time as it does when operated by the Primary Timer but the time in between doses, or the Peak timer "off time", will be 75 % of that of the Primary Timer "off time". Factory settings (operator adjustable) are 1 hr 55 minutes off and 5 minutes on for Primary Timer and Peak Timer is set to 1 hr 25 minutes off (1 hr 55 mins x 75%) and 5 minutes on. Consequently peak doses are more frequent than primary doses.

Hydraulically activated zone valve(s) will index each time the PLC calls for a dose. Each time the pump is turned on another zone is dosed. The controller does not dose all zones sequentially as "one" dose. For example if the Primary Timer is programmed to be off for 1hour on for 5minutes and there are four zones, each zone will get 6 doses - five minutes in length –in a 24-hour period. The controller will dose a single zone every hour and will not dose all zones every hour.

In the event of a *power outage* the Geo-TS controller continues the program where it left off, even if it was in the middle of an event. The Geo-1 resets itself and begins with a flush cycle in field 1.

Geo and GeoTS *AUTOMATIC* **Controllers**

The Primary Timer (float 2 activated) controls the pump dose cycle during normal operating conditions. During high flow conditions the pump dosing cycles will be controlled by the Peak Timer (float 3 activated).

If *duplex pump* option is chosen, the pumps are alternated every pump cycle and never operate simultaneously. There is a selection switch for pump 1, pump 2 or alternation. This allows one pump to be taken out of service for maintenance without affecting the operation of the system. *The Vortex Filter flush valve* will open for 15 seconds (operator adjustable) at the end of the pump cycle to allow the filter to self-flush.

Pump dosing cycles are controlled by the timers when the H-O-A switch is in the auto position. Under normal conditions the Primary Timer (float 2) will control the pump. During high flow conditions, the Peak Timer (float 3) will control the pump. The Peak Timer will cycle the pump more frequently than the Primary Timer. The pump will dose for the same amount of time as it does when operated by the Primary Timer but the time in between doses, or the Peak Timer "off time", will be 75% that of the Primary Timer "off time". Factory settings (field adjustable) are 1 hr 55 minutes off and 5 minutes on for Primary Timer and Peak Timer is set to 1 hr 25 minutes off (1 hr 55 mins x 75%) and 5 minutes on.
Zone valve(s) will open when the PLC calls for a dose or flush. These can be electrically operated solenoid valves (requires any controller other than the Geo-1 or GeoTS-1) or hydraulically activated index valves (used with Geo-1 or GeoTS-1). If hydraulically activated index valves are used in combination with a solenoid field flush valve, a field setting for number of zones and number of zone valves is available. With Geo controllers the total doses of all zones in a 24-hour period must be considered when setting the "off" timer(s). After the pump is deactivated the solenoid valve will remain open to allow for drainage of the supply line. If hydraulically activated index valve is used, be sure to drain the supply line in freezing climates.

Field flush valve will open at the end of the dosing cycle. The pump will continue to run for 5 seconds (field adjustable) to accommodate the opening of this valve. After the pump is deactivated the field flush valve will remain open for five minutes (field adjustable) to allow for drainage of the return line in freezing conditions. It is best to clock the length of time it takes the return flush line to drain and use this to set your drain time.
The activated zone valve remains open at the end of the dose for same "#" minutes as return flush and filter flush valves to accommodate drainage of supply line.

To periodically *flush the dripfield,* after 10 dosing cycles (operator adjustable) the pump will operate for # minutes (field adjustable) with the field flush valve open. The field flush cycle will repeat until all zones have been flushed.

In the event of a *power outage* the Geo-TS controller continues the program where it left off, even if it was in the middle of an event. The Geo-1 resets itself and begins with a flush cycle in field 1.

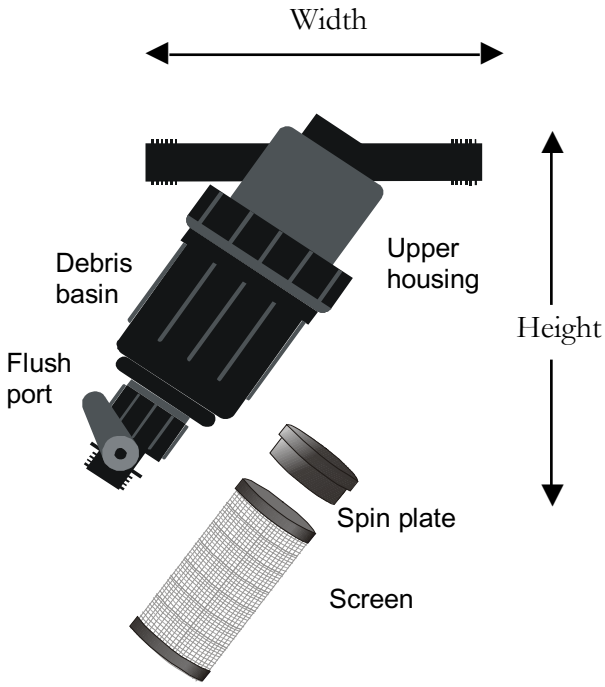
Vortex Filters

Description

The Vortex filters are placed between the pump and dripfield to screen out any debris. Spin plates at the top of each screen direct the flow of debris to the base of the screen for easy self cleaning.

Features

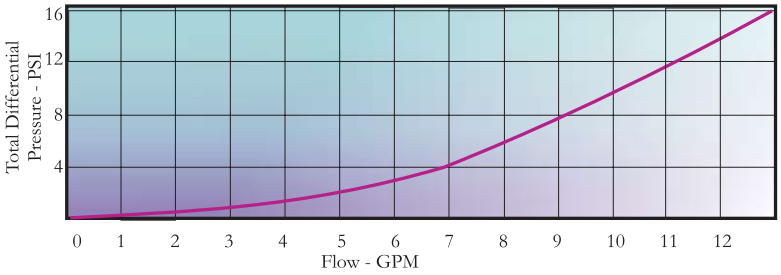
- Simple self cleaning filter. Geoflow's Vortex filter depends on a simple forward flush to self clean. Incoming water is forced through a directional nozzle plate onto the inside of the stainless steel screen. A centrifugal motion starts inside the screen chamber, throwing particles outward against the screen. Gravity moves the debris down the screen wall to the ¾" flush outlet at the base of the Vortex Filter.
- It is simple to install and operate, requiring very few moving parts.
- Can be plumbed to self clean periodically with electronically activated solenoid valves, or continuously with slightly opened ball valves.
- Sturdy stainless steel screen proven effective in onsite wastewater applications. A sintering process in which three pieces of stainless steel mesh are transformed into one; a perforated plate, 30m then 150 mesh.
- Body is a two-piece threaded housing with O-ring seal. Molded from high heat ABS and chemical resistant glass reinforced plastic.



Item Number	Size (MPT)	Max. Flow rate (GPM)	Max. Pressure (psi)	(ft.)	Width	Height	Flush Port (MPT)	Area of Filtration (inches^2)
AP4E-.75F	3/4"	10	80	185	6.0"	6.0"	3/4"	23.4
AP4E-1F	1"	20	80	185	6.0"	7.0"	3/4"	28.4
AP4E-1.5F	1.5"	45	100	231	12"	15.5"	3/4"	60.8
AP4E-2F	2.0"	70	80	185	12"	16.0"	3/4"	60.8

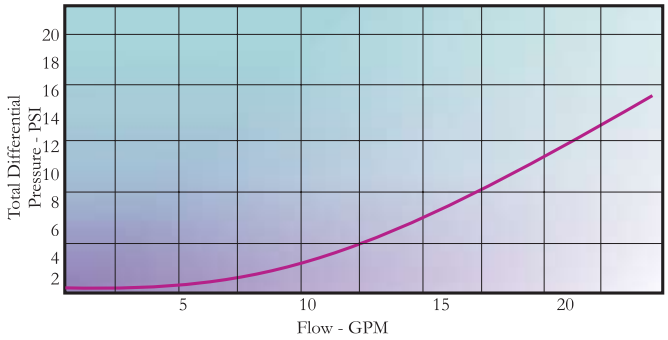
When in doubt, it is best to choose the filter with the larger screen area.

3/4” Vortex Filter AP4E-.75F



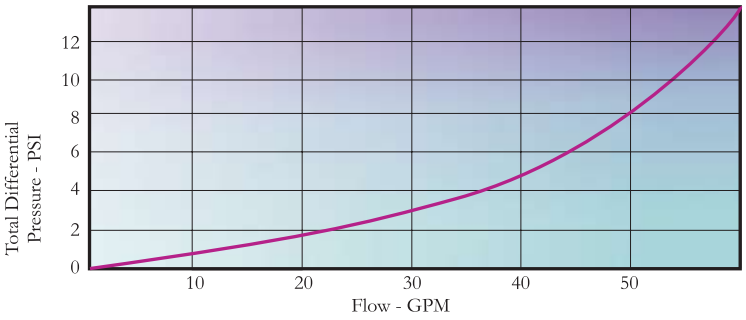
Specification:
The Y filter body shall be molded from glass reinforced engineering grade black plastic with a 3/4 inch male pipe thread (MIPT) inlet and outlet. The two piece body shall be capable of being serviced by untwisting and shall include an O-ring seal. An additional 3/4 inch MIPT outlet shall be capable of periodic flushing. The 150-mesh filter screen is all stainless steel, providing a 23.4 square inch filtration area. The screen collar shall be molded from vinyl. The ¾” filter shall be Geoflow Vortex Filter model number AP4E-75F.

1” Vortex Filter AP4E-1F



Specification:
The Y filter body shall be molded from glass reinforced engineering grade black plastic with a 1 inch male pipe thread (MIPT) inlet and outlet. The two piece body shall be capable of being serviced by untwisting and shall include an O-ring seal. An additional ¾ inch MIPT outlet shall be capable of periodic flushing. The 150 mesh filter screen is all stainless steel, providing a 28.4 square inch filtration area. The screen collar shall be molded from vinyl. The 1” filter shall be Geoflow Vortex Filter model number AP4E-1F.

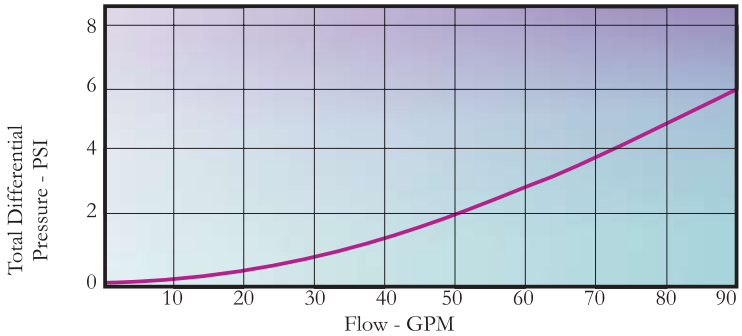
1.5” Vortex Filter AP4E-1.5F



Specification

The Y filter body shall be molded from glass reinforced engineering grade black plastic with a 1.5 inch male pipe thread (MIPT) inlet and outlet. The two piece body shall be capable of being serviced by unscrewing and shall include an O-ring seal. An additional 3/4” MIPT outlet shall be capable of periodic flushing. The 150 mesh filter screen is all stainless, providing a 60.8 square inch filtration area. The outer support shell shall be woven stainless steel wire, and the inner screen shall be made of stainless steel cloth. The inner and outer screens shall be soldered together. The screen collar shall be molded from vinyl. The 1 ½” filter shall be Geoflow model number AP4E-1.5F.

2” Vortex Filter AP4E-2F



Specification

The Y filter body shall be molded from glass reinforced engineering grade black plastic with a 2 inch male pipe thread (MIPT) inlet and outlet. The two piece body shall be capable of being serviced by unscrewing and shall include an O-ring seal. An additional 3/4” MIPT outlet shall be capable of periodic flushing. The 150 mesh filter screen is all stainless, providing a 60.8 square inch filtration area. The outer support shell shall be woven stainless steel wire, and the inner screen shall be made of stainless steel cloth. The inner and outer screens shall be soldered together. The screen collar shall be molded from vinyl. The 2” filter shall be Geoflow model number AP4E-2F.

BioDisc Filter

Description

The BioDisc(TM) filters are placed between the pump and dripfield to trap debris from entering the drip system.

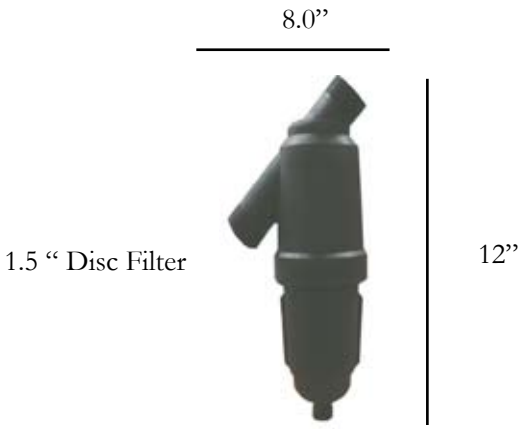
Features

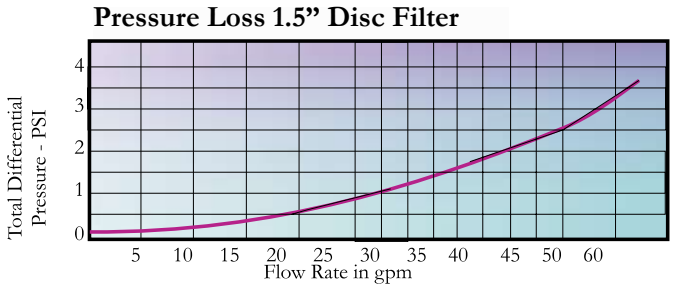
Geoflow's disc filters are protected with anti bacteria. Designed for applications with high organics, the *Geoshield*® is molded into each disc to discourage unwanted growth on the filter element. A single filter can be placed in line, and requires manual cleaning.

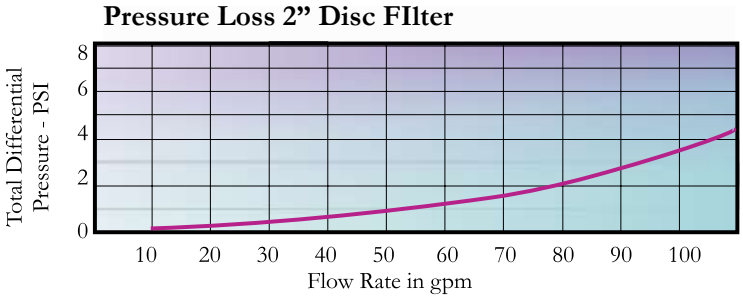
Specification

The BioDisc filter body and discs shall be molded of polyethylene resins. The disc shall include *Geoshield*® anti-bacterial compound to protect the filter element against slime build-up. Filtration shall be 120 mesh/130 micron. The two piece body shall be capable of being serviced by untwisting and shall include an O-ring seal. The seals shall be manufactured from Nitrilo rubber. The inlet and outlet shall be ____ inch MPT. The UF disc filter shall be part number BioDisc___ as supplied by Geoflow, Inc.

Part No.	Inlet/ Outlet diameter	Max Flow Rate per Filter	Max Pressure PSI	Max Temp (°F)	Length	Filtration Surface Area	Filtration Size	Weight lbs.
BioDisc-1.5F	1.5"	30 gpm	145psi 335ft.	140	12"	72.7 sq. in.	120 mesh 130 micron	3.3.
BioDisc- 2F	2"	60 gpm	145 psi 335 ft.	140	20"	156.9 sq. in.	120 mesh 130 micron	13.2







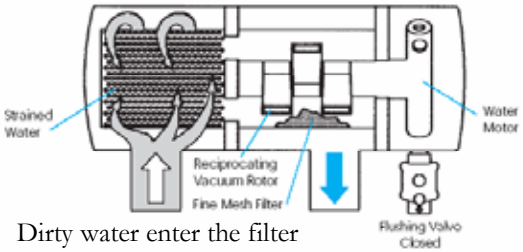
- **BioDisc** is a trademark of A.I.Innovations.
- **Geoshield®** is a registered trademark of A.I.Innovations.

GeoVac Filter

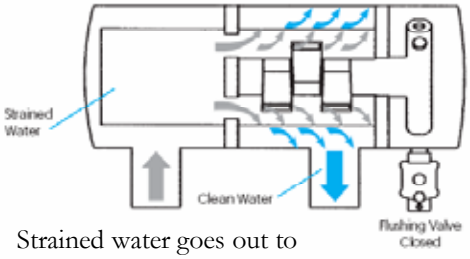
NEW

Description

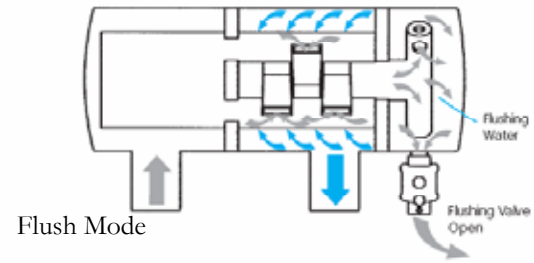
The GeoVac is a stainless steel filter with an automatic, self-cleaning, screen-type water filter for heavy loads of onsite wastewater.



Dirty water enter the filter



Strained water goes out to the drip field



Flush Mode

Filtering Mode

Pressurized water enters the filter inlet and travels through a fine stainless steel screen where contaminants are filtered out. The clean water passes through to the inside of the screen, then out to the drip field.

Flush Mode

A solenoid flush valve is time activated. When the flushing valve opens, the pressure differential is reduced on the area being swept by the reciprocating cleaning nozzles. This causes the clean water to reverse flow through the filter element as the cleaning nozzles rotate across the entire surface of the screen, pushing contaminants off the screen, through the nozzles, through the water motor and out through the flush valve.

The water passing through the angular holes in the motor creates a torsion rotation of the nozzles, thus vacuuming the entire inside diameter of the filter element.

At the end of the flushing cycle, the unit automatically returns to full filtering mode.

During the filter flush cycle the filtration process continues uninterrupted.

Features

The GeoVac avoids the danger of forcing contaminated water back into the system. The GeoVac filter will deliver clean water or no water. The entire filter flushing mechanism and fine screen assembly is modular and can be removed from the filter body without having to detach the filter from supply and delivery manifolds.

6” or 8” Filter with flanged connections

Specifications

Materials for 2” GeoVac	
Tank:	Stainless steel. Type 304, 18-gauge
Vacuum Motor and nozzle assembly	Glass-filled Noryl
Filter Screen	3-layer sintered stainless steel. Type 316
Materials for 3”, 4”, 6”, 8” GeoVac	
Tank:	Stainless steel. Type 304, 18-gauge
Vacuum Motor and nozzle assembly	Engineered grade polymer
Filter Screen	3-layer sintered stainless steel. Type 316

	Model/Part No.				
	GeoVac 75-02	GeoVac 150-03	GeoVac 250-04	GeoVac 500-06	GeoVac 700-08
Max. flow rate (gpm)	75	150	250	500	700
Inlet/Outlet diameter (inches)	2”	3”	4”	6”	8”
Inlet/Outlet connection (included in box)	Grooved	Grooved	Grooved	Flange	Flange
Filter flush min. flow (gpm)	30	40	40	40	50
Filter flush min. time (seconds)	6	10	10	20	20
Min. downstream working pressure (psi)	35	35	35	35	35
Max. working pressure (psi)	125	125	125	150	150
Pressure loss at max. recommended flow rate	1psi/2.31 ft.	1psi/2.31 ft.	1psi/2.31 ft.	1psi/2.31 ft.	1psi/2.31 ft.
Screen area (inches^2)	118	224	448	867	1300
Screen sizes Micron Mesh	100 150	100 150	100 150	100 150	100 150
Max. Temperature (F^o)	180	180	180	180	180
Filter housing diameter (inches)	10”	10”	10”	15”	15”
Flushing outlet diameter (inches) NPT	1”	1”	1”	2”	2”
Supplied with flush valve	1.5”	1.5”	1.5”	2”	2”
Weight (lbs.)	30	55	80	395	435
Length (inches)	16.7”	39.2”	49.4”	60.6”	72.6”
Min. clearance req. on lid end	36”	36”	36”	56”	70”
Min. clearance req. on sensor end	12”	12”	12”	12”	12”

Installation

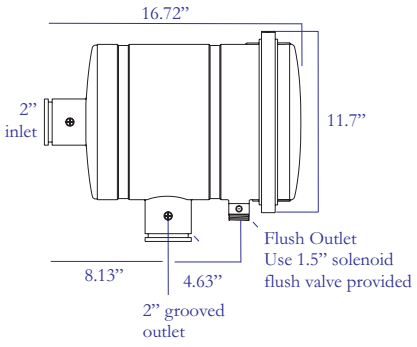
- Flush valve should be placed on the discharge nipple with the arrow pointing downwards.
- The tank can rest on the inlet/outlet nipples or can be mounted on a stand.
- Check the connections on the manifold or stand to make sure they are on the same plane. If improperly aligned the tank could be distorted when the filter connections are tightened.
- The back flush line should not run uphill. This will reduce the required backpressure differential and reduce the cleaning effectiveness.
- The GeoVac filter needs to be insulated against freezing.

Maintenance

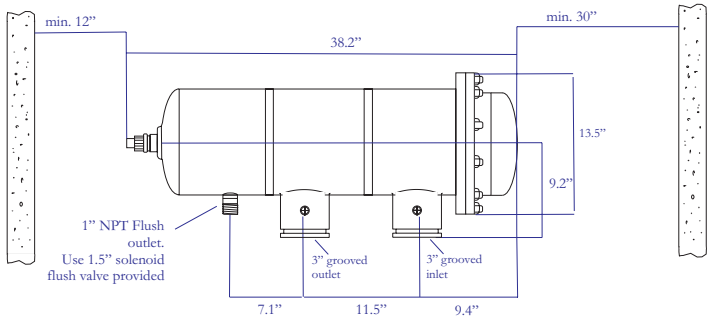
- Manually clean filter element periodically.
- Clean and grease all o-rings with waterproof lubricant.
- Check welds and hydraulic connections.
- Before servicing filter internals, slowly open the filter flush valve and allow the filter to empty out.
- Make sure pump is on manual off so it does not pressurize while servicing.
- Ensure bolts and nuts of covers and all connections are uniformly tightened.

GeoVac Dimensions

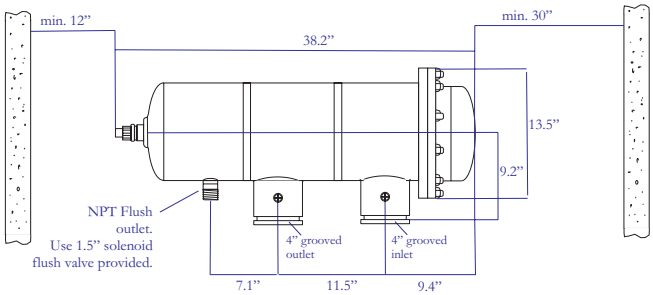
GeoVac 75-02



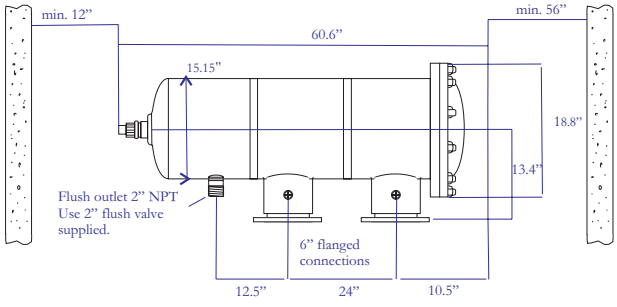
GeoVac 150-03



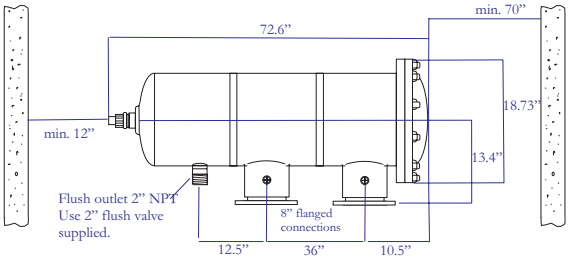
GeoVac 250-04



GeoVac 500-06



GeoVac 700-08



Description

Geoflow's digital flow meters are a turbine style meter with rate/totalizer – designed to measure and display both the rate of flow and total flow. The local display model includes a digital screen, while the Pulse Output Model is outfitted with a pulse access that can be read on your Geo Touchscreen controller.

FLOW METER – Digital Display

This is a stand alone meter with a local display that includes: Rate of Flow, Batch and Cumulative Totals. It is powered by lithium batteries for approximately 9000 hours.

Model No.	FM-DDS-050	FM-DDS-100	FM-DDS-150	FM-DDS-200
Meter size	3/4 " FPT	1" FPT	1.5" FPT	2" FPT
Flow Rate	2-20 gpm	5-50 gpm	10-100 gpm	20-200 gpm
Material - Housing - Bearings - Shaft - Rotor - Rings	 PVC Ceramic Tungsten carbide PVDF Stainless steel	 PVC Ceramic Tungsten carbide PVDF Stainless steel	 PVC Ceramic Tungsten carbide PVDF Stainless steel	 PVC Ceramic Tungsten carbide PVDF Stainless steel
Accuracy	3%	3%	3%	3%
Temp range	32°F-140°F	32°F-140°F	32°F-140°F	32°F-140°F
Max Pressure	150 psi	150 psi	150 psi	150 psi
Typical K factor	2400	540	215	100
Frequency range	48-480 Hz	45-450 Hz	36-460 Hz	33-330 Hz
Weight	0.88 lbs	1.0 lbs.	1.4 lbs.	1.68 lbs.

FLOW METER – Pulse Output Model

The pulse output flow meter is wired directly to the Geo Touchscreen controller, sending data that is logged by the controller and read on the controller screen. It uses no batteries.

Model No.	FM-PLS-100	FM-PLS-150	FM-PLS-200
Meter Size	1" FPT	1.5" FPT	2" FPT
Flow Rate	5-50 gpm	10-100 gpm	20-200 gpm
Material			
Housing	PVC	316 Stainless steel	316 Stainless steel
Bearings	Ceramic	Ceramic	Ceramic
Shaft	Ceramic	Tungsten carbide	Tungsten carbide
Rotor	PVDF	PVDF	PVDF
Rings	Fluorocarbon	316 Stainless steel	316 Stainless steel
Accuracy of reading	+/- 1.5%	+/- 1%	+/- 1%
Typical K factor	540	215	100
Pressure Rating	150 psi	1500 psi	1500 psi
Frequency Range	45-450 Hz	36-360 Hz	33-330 Hz
Shipping Weight	1.9 lbs.	4.6 lbs.	6.8 lbs.
Typical K factor	540	215	100
Wrench flat size	1-5/8"	2- 3/8"	3"

Installation

Although the Geoflow flow meter is designed to withstand outdoor conditions, a cool dry location where the unit can be easily serviced is recommended.

The Geoflow meter can be mounted on horizontal or vertical runs of pipe. Mounting at the twelve o'clock position on horizontal pipe is recommended. Backpressure is essential on downward flows.

The GD Flow Meter accuracy is affected by disturbances such as pumps, elbows, tees, valves in the flow stream. Install the meter in a straight run of pipe as far as possible from any other disturbances. The distance required for accuracy will depend on the type of disturbance.

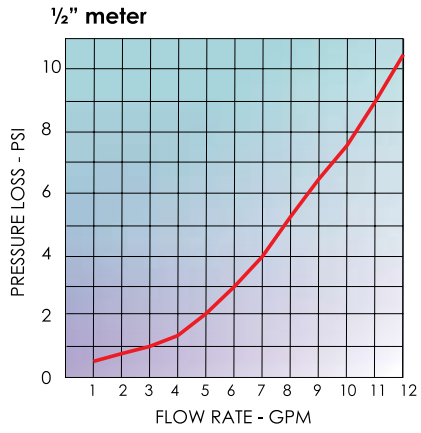
Type of Disturbance	Min. Inlet Pipe Length	Min. Outlet Pipe Length
Flange	10 x Pipe I.D.	5 x Pipe I.D.
Reducer	15 x Pipe I.D.	5 x Pipe I.D.
Elbow	20 x Pipe I.D.	5 x Pipe I.D.
Two Elbows 1 direction	25 x Pipe I.D.	5 x Pipe I.D.
Two Elbows – 2 directions	40 x Pipe I.D.	5 x Pipe I.D.
Pump or gate valves	50 x Pipe I.D.	5 x Pipe I.D.

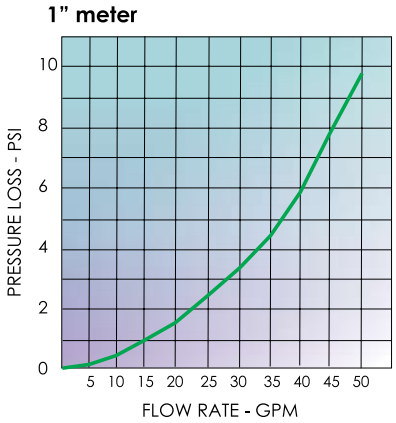
The flow meter is factory calibrated. When measuring total flow, accumulated error over time must be considered. Accuracy is based on laboratory testing of nominal pipe dimensions. Your actual accuracy will vary based on your actual pipe I.D. and other installation factors.

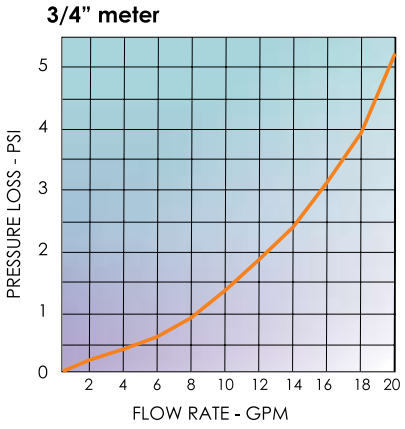
Maintenance

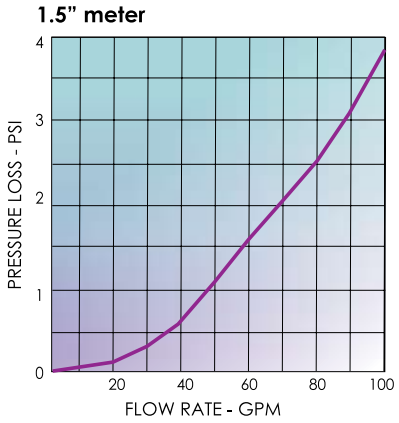
1. Periodically remove the sensor assembly from the pipe fitting and inspect the meter for signs of wear and obstructions. Clean the paddle of any foreign objects. Paddle and axle wear can be caused by chemicals and/or abrasive fluids. Replace the paddle and axle if worn.
2. Inspect O rings. Immediately replace the o-rings at any sign of wear, swelling, cracking or discoloration.
3. Replace the batteries every 12 months.

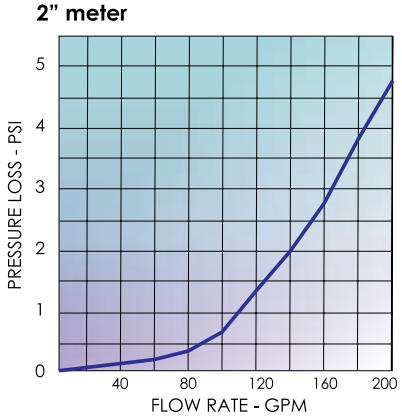
Flow Rate vs. Pressure



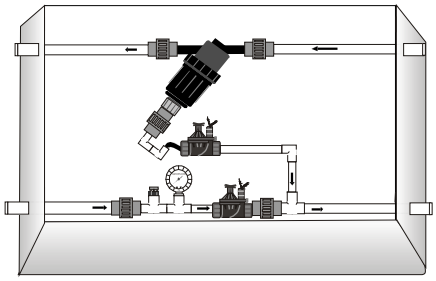








The headwork refers to the components that are placed between the pump tank and the dripfield itself. There are multiple options available, depending on the application, personal preferences or regulatory requirements. The following list is a guide to help choose the best headworks for your needs.



WHW Sporty

The following choices will need to be made:

1) Filter type and size

Geoflow offers 3 filter types;

a) Vortex **(V)** screen filter .75" 1" 1.5" 2"

b) BioDisc **(D)** filter 1.5" 2"

c) GeoVac™ filter. 2" 3" 4" 6" 8"

The Geovac filter is ordered from the filter specification page and always includes connections and filter flush valve. Field flush valves and flow meters can be added separately. See GeoVac filter product sheet for details.

2) Sporty vs. Ultra Headworks

Geoflow offers sporty headworks **(WHWS)** that is simple and ultra headworks **(WHWU)** that can be used for commercial, industrial or residential projects. While all headworks include drip filters, flush valves and pressure readings, the Ultra headworks also includes a digital flow meter. The electrical wiring on the Ultra Headworks is bundled in a junction box for a water resistant connection.

3) Flushing

Will the system be flushed manually **(M)** with a ball valve or automatically with solenoid valves **(A)**. The Ultra headworks are only available with automatic field and filter flushing.

4) Flow Meter

Sporty Headworks: Order a flow meter separately and install it downstream of the headworks.

Ultra Headworks comes with 2 choices; one with a local digital display **(DDS)**, and one with a pulse output **(PLS)** that is displayed on the touchscreen of the Geo-TS controllers.

Sporty Headworks

Ultra Headworks Box

Ultra Headworks

a) Vortex Headworks

Sporty Headworks

Item No.	Filter	Flushing	Dimensions (in.)
WHWS-V-75F-M	3/4" Vortex Filter	Manual Field & Filter	13 x 24 x 15
WHWS-V-75F-A	3/4" Vortex Filter	Automatic Field & Filter	13 x 24 x 15
WHWS-V-1F-M	1" Vortex Filter	Manual Field & Filter	13 x 24 x 15
WHWS-V-1F-A	1" Vortex Filter	Automatic Field & Filter	13 x 24 x 15
WHWS-V-1.5F-M	1.5" Vortex Filter	Manual Field & Filter	17 x 30 x 15
WHWS-V-1.5F-A	1.5" Vortex Filter	Automatic Field & Filter	17 x 30 x 15
WHWS-V-2F-M	2" Vortex Filter	Manual Field & Filter	17 x 30 x 15
WHWS-V-2F-A	2" Vortex Filter	Automatic Field & Filter	17 x 30 x 15

Ultra Headworks

Item No.	Filter	Flushing	Dimensions (in.)	Flow Meter
WHWU-V-75F-A	3/4" Vortex filter	Automatic Flush	25.5 x 25.5 x 22	Specify DDS or
WHWU-V-1F-A	1" Vortex filter	Automatic Flush	25.5 x 25.5 x 22	PLS at the end
WHWU-V-1.5F-A	1.5" Vortex filter	Automatic Flush	25.5 x 25.5 x 22	of the item no.
WHWU-V-2F-A	2" Vortex filter	Automatic Flush	25.5 x 25.5 x 22	

b) BioDisc Headworks

Sporty Headworks (Manual Filter Flush only)

Item No.	Filter	Flushing	Dimensions (in.)
WHWS-D-1.5F-M	1.5" Disc Filter	Manual Field Flush	17 x 30 x 15
WHWS-D-1.5F-A	1.5" Disc Filter	Automatic Field Flush	17 x 30 x 15
WHWS-D-2F-M	2" Disc Filter	Manual Field Flush	17 x 30 x 15
WHWS-D-2F-A	2" Disc Filter	Automatic Field Flush	17 x 30 x 15

Ultra Headworks

Item No.	Filter	Flushing	Dimensions (in.)	Flow Meter
WHWU-D-1.5F-A	1.5" DISC filter	Automatic Flush	25.5 x 25.5 x 22	Specify DDS or
WHWU-D-2F-A	2" DISC filter	Automatic Flush	25.5 x 25.5 x 22	PLS at the end
				of the item no.

c) GeoVac

See GeoVac filter product sheet for details.

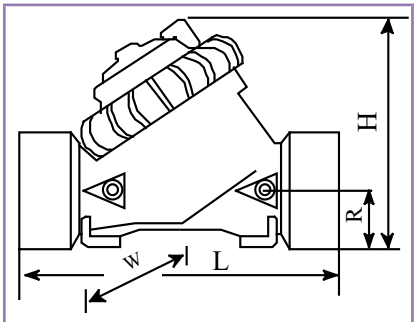
Solenoid Valve +

In 2007 Geoflow introduced a new solenoid valve, the SVLV-B. Recognized for its efficiency and productivity, the new SVLV-B valves have been tried and tested in onsite wastewater applications.

Description

The Solenoid Valve is used to flush field and filters and as zone valves. It is electrically operated. It is normally closed, and in the event of a power failure the valve will close. Geoflow does use normally open solenoid valves in the dual filter headworks. These may be special ordered.

New 2007 Model
Globe Valve
1" and 1.5"

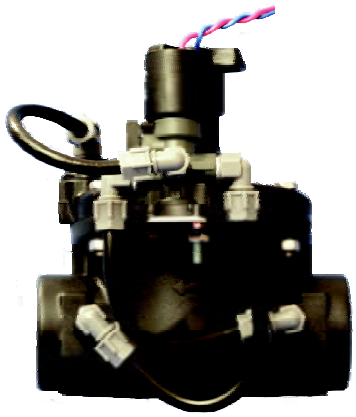
	SVLV-B-100	SVLV-B-150	SVLV-B-200	SVLV-B-300
Inlet/Outlet Size (FNPT)	1"	1.5"	2"	3"
Body Pattern	Globe	Globe	Y	Y
Length (L)	4.3"	6.3"	9.0"	12.2"
Height (H)	4.5"	7.2"	7.4"	11.0"
Width (W)	3.0"	5.0"	5.4"	
R	7/8"	1-3/8"	1-5/8"	4.0"
Weight	12.5 oz	2.2 lbs.	2.97 lbs.	8.8 lbs.
Valve Pattern	Globe	Globe	Wye	Wye
Operating Range	10-150 psi	10-150 psi	7-140 psi	7-140 psi
Max pressure	180° F	180° F	180° F	180° F
Materials				
Body & cover	Nylon reinforced	Nylon reinforced	Glass filled nylon	Glass filled nylon
Metal Parts	Stainless Steel	Stainless Steel	Stainless Steel	Stainless Steel
Diaphragm	Natural Rubber	Natural Rubber	NBR (Buna-N), nylon reinforced fabric	NBR (Buna-N), nylon reinforced fabric
Seals	NBR & NR	NBR & NR	NBR (Buna-N)	NBR (Buna-N)

Installation

The manual bleed lever should always be in the VERTICAL position and the dial on top should be free spinning. Clockwise rotation closes valve.
Pressure Loss through valves (in psi)
Recommended minimum pressure differential: 7 psi

Maximum Length of wire run- Controller to Valve

# Wire	Resistance Ohm/ 1000'	Maximum Run
#18	6.39	800 ft.
#16	4.02	1,275 ft.
#14	2.58	2,000 ft.
#12	1.62	3,200 ft.
#10	1.02	5,100 ft.
#8	0.641	8,000 ft.
#6	0.403	12,750 ft.
#4	0.253	20,500 ft.
#2	0.158	32,500 ft.



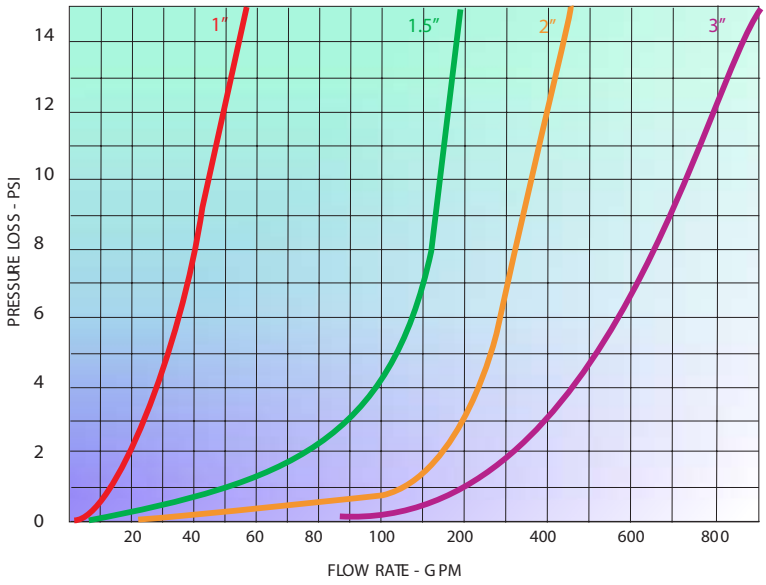
Y Valve
2" and 3"

Electrical data:
Wiring requires a single lead from the controller to each solenoid valve, plus a common neutral to all solenoids. Type UF wire, UL listed, is recommended for all hookups.

Standard 24V ACV (50-60Hz)
Current Holding 0.24A 5.76 VA
Current Inrush 0.46A 11.04VA
Maximum allowable loss 4.8 Volts for the 24V AC system
Contact Geoflow for optional voltages or larger valves

Maximum Voltage loss with a valve with a three way Solenoid is 4.8 volts

Solenoid Valve Flow vs. Pressure Chart

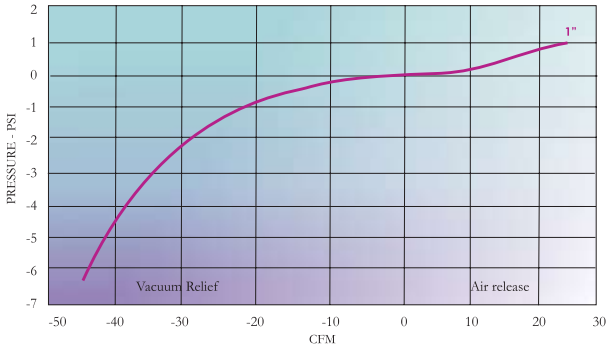


Description

Air release allows air to escape the system at startup and vacuum relief allows air to enter the system during shutdown. Air vents are installed at the high point of the drip field to keep soil from being sucked into the drip emitter due to back siphoning or back pressure. This is an absolute necessity with underground drip systems. They are also used for proper drainage of the supply and return manifolds. Use one on the high point of the supply manifold and one on the high end of the return manifold and any high points in the system. A pre-installed schrader valve allows pressure testing off the air/vacuum breaker.

Item No.	Inlet	Pressure to seal	Max pressure	Height inches	Width inches	Weight Lbs.
APVBK-1	1" MPT	5 psi	80 psi	5.5	3.43	.67
APVBK-2	2" MPT	1 psi	200 psi	10.75	3.98	6.62

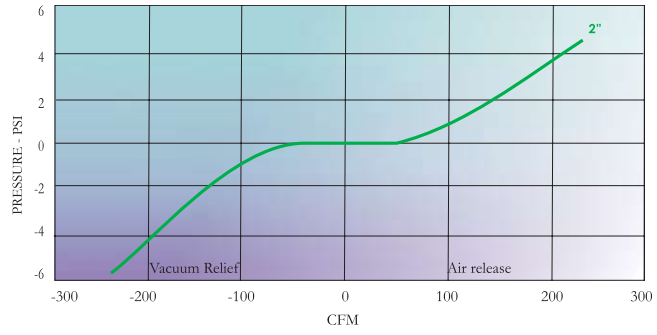
1" Vacuum Relief/Air Release



Specification 1"

The air vacuum breakers provide instant and continuous vacuum relief and non-continuous air release It shall be rated to 80 psi. Both the body and the removable dirt cover shall be constructed of molded plastic. The body and the dirt cover shall be connected with a ¾ inch hose thread. The ball shall be constructed of low density plastic and the internal seat shall be constructed of vinyl. Inlet size shall be 1 inch male pipe thread. The air/vacuum relief valve shall Geoflow Item no. APVBK-1.

2" Vacuum Relief/Continuous Air Release



Specification 2"

The air vent shall provide instant and continuous vacuum relief and air release and continuouis air release. Both the body and the removable dirt cover shall be constructed of molded plastic. It shall be rated to 200 psi. The ball shall be constructed of low density plastic and the internal sear shall be constructed of vinyl. Inlet size shall be 2 inch male pipe thread. Outlet shall be 1.25" socket ell. The air/vacuum relief valve shall Geoflow Item no. APVBK-2.

Pressure Regulators

Description

The regulators are preset to regulate pressure in the field. These are required with Wasteflow Classic and optional with Wasteflow PC. Under normal operating conditions the pressure in the dripline should be: 10 - 45 psi for Wasteflow Classic and Wasteflow PC.

Low, Medium and High Flow Regulator

NEW

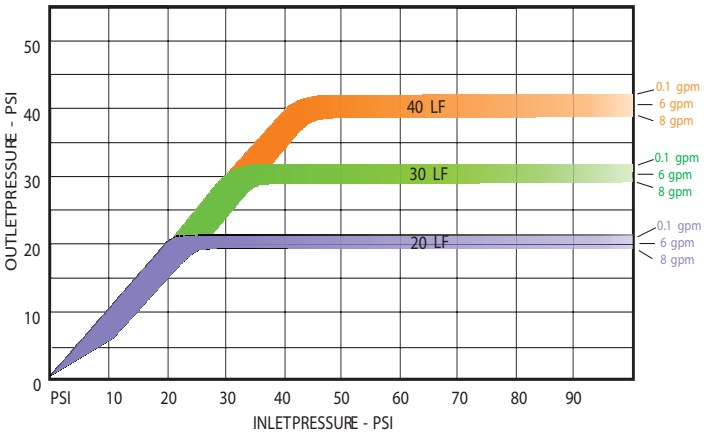
Extra Flow Regulator- flows up to 90 gpm

Pressure Regulator Specification

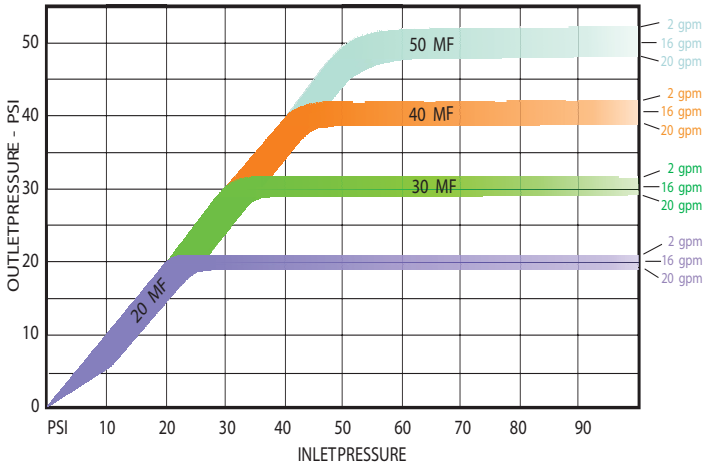
Geoflow's pressure regulator shall be designed to handle steady inlet pressures of ___ psi and withstand severe water hammer extremes. It shall handle flow rates between ___ gpm and ___ gpm. Flow restriction shall be negligible until the factory preset pressure is reached. Regulatory accuracy shall be within +/- 6%. Inlet and outlet size shall be ____" FIPT. The body shall be constructed of high impact engineering grade thermoplastics. Regulation shall be accomplished by a fixed stainless steel compression spring enclosed in a chamber separate from the normal water passage. Each regulator shall be water tested for accuracy. Pressure regulator shall be Geoflow model number PMR-____ - _ F. Refer to table to fill in the blanks.

Item No.	Outlet Pressure	Flow Range	Max. Inlet Pressure Psi	Max. Inlet Pressure ft.	Inlet Size	Outlet Size
PMR-20-LF	20 psi	1/10 - 8 gpm	150	347	¾" fipt	¾" fipt
PMR-20-MF	20 psi	2 - 20 gpm	150	347	1"fipt	1"fipt
PMR-20-HF	20 psi	10 - 32 gpm	100	23	1.25" x 1" fipt	1.25"fipt
PMR-20-XF	20 psi	20 - 90 gpm	90	208	3"ID socket	3"ID socket
PMR-30-LF	30 psi	1/10 - 8 gpm	150	347	¾" fipt	¾" fipt
PMR-30-MF	30 psi	2 - 20 gpm	150	347	1" fipt	1"
PMR-30-HF	30 psi	10 - 32 gpm	100	23	1.25" x 1"fipt	1.25"
PMR-30-XF	30 psi	20 - 90 gpm	100	23	3"ID socket	3"ID socket
PMR-40-LF	40 psi	1/10 - 8 gpm	150	347	¾" fipt	¾" fipt
PMR-40-MF	40 psi	2 - 20 gpm	150	347	1" fipt	1"
PMR-40-HF	40 psi	10 - 32 gpm	100	23	1.25" x 1" fipt	1.25"
PMR-40-XF	40 psi	20 - 90 gpm	125	289	3"ID socket	3"ID socket
PMR-50-LF	50 psi	1/10 - 8 gpm	150	347	¾" fipt	¾" fipt
PMR-50-MF	50 psi	2 - 20 gpm	150	347	1" fipt	1"
PMR-50-HF	50 psi	10 - 32 gpm	100	23	1.25" x 1" fipt	1.25"
PMR-50-XF	50 psi	20 - 90 gpm	125	289	3"ID socket	3"ID socket

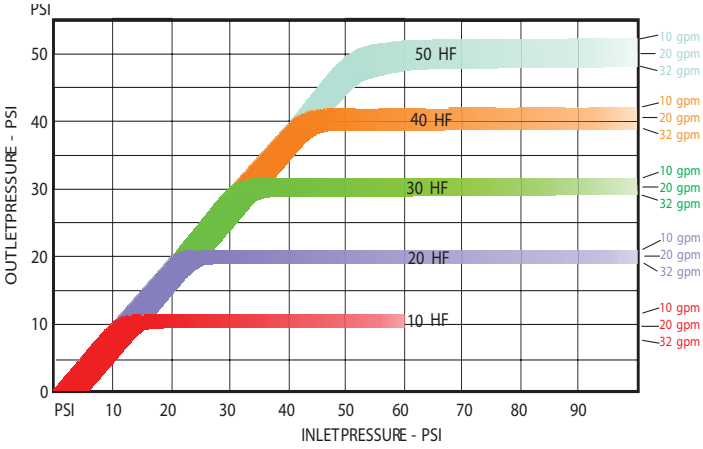
Low Flow



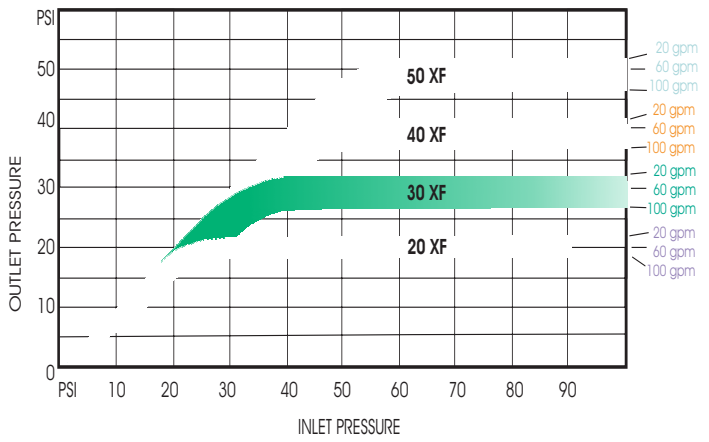
Medium Flow



High Flow



Extra Flow



True Union Ball Check Valve

Ball Check Description

The Ball Check valves prevent backflow or drain down in the system. The true union provides easy access for in-line installation and servicing. The true union ball check is designed for quick positive sealing with minimum turbulence, low restriction, and efficient fluid transfer. It can be installed vertically or horizontally. System pressure will unseat the ball, allowing flow. Backflow or head pressure of 30" or 1 to 2 psi will seat the ball and stop back flow. Each check valve ships with female thread and socket adapters. This valve is manufactured 100% from thermolastic materials, making is less suseptable to corrosion.

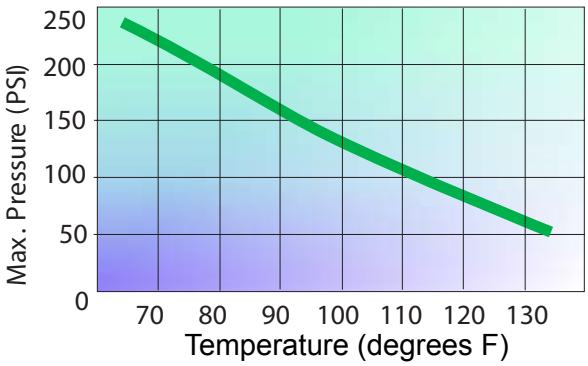
Ball Check Valve

Ball Check Model No.	Inlet/Outlet Size (FPT or socket)	Length (inches)	Height (inches)	Max Temp	Weight (lbs.)
CV-B-05	0.5"	3.50"	2.0"	140 °	0.75
CV-B-10	1.0"	5.09"	2.31"	140 °	1.1
CV-B-15	1.5"	6.59"	3.81"	140 °	2.2
CV-B-20	2.0"	7.53"	4.22"	140 °	3.0

Ball Check Specifications

All thermoplastic check valves shall be True Union Ball type constructed from PVC Type I Cell Classification 12454. Socket end connections are manufactured to ASTM D2467-94. Threaded connections are manufactured to ASTM D2464-88. The O-Ring seat shall be Viton®. All valve components shall be replaceable. The check valve shall be pressure rated at 235 psi, non-shock water at 73° F.

True Union Ball Check Maximum Pressure Rating
at Given Temperature



Ball Check Installation

Connection - Each Geoflow ball check valve ships with female thread and socket adapters. Install in a box for easy access. It is recommended that these check valves be installed no closer than 10 pipe diameters from a pump and no closer than 5 pipe diameters from an elbow.

Spring Check Valve

Spring Check Valve Description:
The spring check valve is used to prevent backflow and siphoning. The ½ pound stainless steel spring maintains a positive seal, even when no back pressure is present. Minimum of 2 psi required to open the valve.

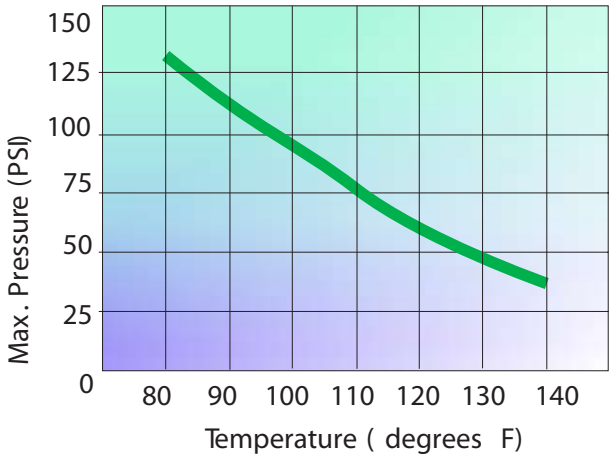
Spring Check Valve

Spring Check Model No.	Inlet/Outlet Size (FPT or socket)	Length (inches)	Height (inches)	Max Temp
CV-S-05	0.5"	4.13"	2.22"	140 °
CV-S-10	1.0"	5.25"	2.88"	140 °
CV-S-15	1.5"	5.9"	3.89"	140 °
CV-S-20	2.0"	7.0"	4.29"	140 °

Spring Check Specifications
Thermoplastic Spring check valves shall be constructed from PVC Type 1, cell class 12454 material conforming to ASTM D-1784. Seals shall be EPDM. Valves shall have socket end connections for solvent weld. All Spring check valves shall be pressure rated at 150 psi at 73 degrees F. All spring check valves shall require 2 psi to open.

Spring Check Installation
Connection - FIPT slip connections. Install in a box for easy access. It is recommended that these check valves be installed no closer than 10 pipe diameters from a pump and no closer than 5 pipe diameters from an elbow.

Spring Check
Maximum Pressure Rating at Given Temperature



Drip Plow

Description

The drip plow is a state of the art direct burial plow that pulls dripline below ground with minimum disturbance to the soils. Developed by an industry professional who formerly installed industrial cable and drip irrigation lines, this plow is built with meticulous care to details for ease of use.

Features

- Heavy duty. Solid parts are carefully welded and worked for a clean, professional plow that is built to last for many years.
- Large chute that easily allows fittings to slide through.
- Two levelers mounted on the assembly to easily make alignments as needed. Shank drafts down and lifts soil up so there is little damage to the structure. The angle of the shaft does not wedge sideways and compress or smear the soil.
- Sod cutter included.
- Unique tubing hold to keep coils from slipping off the reel.
- Mounts to toolbar. Gang one, two three or four in a row for multi-row installations.
- Tubing reel has tension setting.
- Depth control.
- Articulates. Hinges to make tight curves.

PVC 40 FRICTION LOSS CHART

	½" pipe		¾" pipe		1" pipe		1 ¼" pipe		1 ½"pipe	
	Velocity FPS	Pressure Drop PSI	Velocity FPS	Pressure Drop PSI	Velocity FPS	Pressure Drop PSI	Velocity FPS	Pressure Drop PSI	Velocity FPS	Pressure Drop PSI
1	1.05	0.43	0.60	0.11	0.37	0.03				
2	2.11	1.55	1.2	0.39	0.74	0.12	0.43	0.03		
3	3.17	3.27	1.8	0.83	1.11	0.26	0.64	0.07	0.47	0.03
4	4.22	5.57	2.41	1.42	1.48	0.44	0.86	0.11	0.63	0.05
5	5.28	8.42	3.01	2.15	1.86	0.66	1.07	0.17	0.79	0.08
6	6.33	11.81	3.61	3.01	2.23	0.93	1.29	0.24	0.95	0.11
8	8.44	20.10	4.81	5.12	2.97	1.58	1.72	0.42	1.26	0.20
10	10.55	30.37	6.02	7.73	3.71	2.39	2.15	0.63	1.58	0.30
15			9.02	16.37	5.57	5.06	3.22	1.33	2.36	0.63
20					7.42	8.61	4.29	2.27	3.15	1.07
25					9.28	13.01	5.36	3.42	3.94	1.63
30					11.14	18.22	6.43	4.80	4.73	2.27
35							7.51	6.38	5.52	3.01
40							8.58	8.17	6.30	3.88
45							9.65	10.16	7.09	4.80
50							10.72	12.35	7.88	5.83
60									9.46	8.17
70									11.03	10.87

	2" pipe		2 ½" pipe		3" pipe		4" pipe		6" pipe	
	Velocity FPS	Pressure Drop PSI	Velocity FPS	Pressure Drop PSI	Velocity FPS	Pressure Drop PSI	Velocity FPS	Pressure Drop PSI	Velocity FPS	Pressure Drop PSI
6	0.57	0.03								
8	0.76	0.06	0.54	0.02						
10	0.96	0.09	0.67	0.04						
15	1.43	0.19	1.01	0.08	0.65	0.03				
20	1.91	0.32	1.34	0.13	0.87	0.05				
25	2.39	0.48	1.67	0.20	1.08	0.07				
30	2.87	0.67	2.01	0.28	1.30	0.10				
35	3.35	0.89	2.35	0.38	1.52	0.13	0.88	0.03		
40	3.82	1.14	2.64	0.48	1.73	0.17	1.01	0.04		
45	4.30	1.42	3.01	0.60	1.95	0.21	1.13	0.05		
50	4.78	1.73	3.35	0.73	2.17	0.25	1.26	0.07		
60	5.74	2.42	4.02	1.02	2.60	0.35	1.51	0.09		
70	6.69	3.22	4.69	1.36	3.04	0.47	1.76	0.12		
80	7.65	4.13	5.36	1.74	3.47	0.60	2.02	0.16		
90	8.60	5.13	6.03	2.16	3.91	0.75	2.27	0.20		
100	9.56	6.23	6.70	2.63	4.34	0.91	2.52	0.24	1.11	0.03
125	11.95	9.42	8.38	3.97	5.42	1.38	3.15	0.37	1.39	0.05
150			10.05	5.56	6.51	1.93	3.78	0.51	1.67	0.07
175					7.59	2.57	4.41	0.68	1.94	0.09
200					8.68	3.40	5.04	0.90	2.22	0.12

GEOFLOW LIMITED WARRANTY

A. WASTEFLOW® PERFORMANCE WARRANTY

GEOFLOW products which contain nano-ROOTGUARD® are warranted to remain free of root intrusion for a period of fifteen (15) years from the date of delivery to the buyer, provided such product is stored and installed according to the manufacturer's instructions. Any such products that may be clogged by intrusion of roots shall in the first ten years be replaced 100% by Geoflow. And thereafter, for the eleventh (11th) to fifteenth (15th) years, at the price of such replacement less 20% per year. This warranty is expressly limited to providing the buyer with a replacement for any defective product or part and does not include the cost of installation of the replacement and in no case shall GEOFLOW be liable for any special incidental or consequential damages. In addition, the terms of our Basic Warranty set out below, apply to all WASTEFLOW products.

B. BASIC WARRANTY

All GEOFLOW products are warranted to be free from defects in material and workmanship for a period of two (2) years from the date of delivery to the buyer, provided that the product is correctly installed and maintained by qualified persons according to the manufacturer's recommendations. Geoflow shall have the option to repair or replace all, or part of the defective product, or refund all or part of the purchase price within the warranty period. Technical support is provided when the drip package includes exclusively genuine Geoflow controllers, headworks, valves and filters installed in conjunction with Geoflow dripline. If Geoflow provides technical support for products at no charge to the buyer, it shall be given at buyer's sole risk without any express or implied warranty, and Geoflow shall not be responsible or liable for the results thereof.

WARRANTY TERMS & CONDITIONS

CLAIMS: All claims must be made in writing to GEOFLOW, Inc. within fifteen (15) days after the defect was discovered.

THESE WARRANTIES DO NOT COVER: Conditions caused by others including but not limited to: abuse, misuse, neglect, carelessness, damage by animals or chemicals, accident or disaster: unauthorized alterations, modifications or repairs; transportation or installation; water pressure in excess of or short of recommended amounts; improper or inadequate water treatment or filtration; or failure to follow storage, installation, operation and maintenance instructions.

LIMITATIONS: These warranties constitute the exclusive warranties made by GEOFLOW for its products and is expressly in lieu of all other warranties, express or implied, including any warranty of merchantability or fitness for a particular purpose. These are the only warranties made by GEOFLOW and GEOFLOW does not authorize any employee, dealer, agent, representative or other person to create for it any other obligation or liability.

LIMITATION OF REMEDIES: As indicated above, in no case shall GEOFLOW be liable for any special incidental or consequential damages based upon breach of warranty, breach of contract, negligence, strict tort, or any other legal theories. Some states do not allow limits on warranties or remedies for breach in certain transactions. In such states the limits of this paragraph and the preceding paragraph may not apply. This warranty gives you specific legal rights, and you may have other rights, which vary from state to state.

GEOFLOW reserves the right to make changes and improvements in their products without incurring any obligation to similarly alter products previously purchased.

CHOICE OF LAW: These warranties and any liability of GEOFLOW hereunder shall be governed by, construed and enforced according to the laws of the State of California. Any disputes arising out of or relating to these warranties, not resolved by mutual agreement, shall be submitted to final and binding arbitration before JAMS, or its successor.

10/19/2007

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