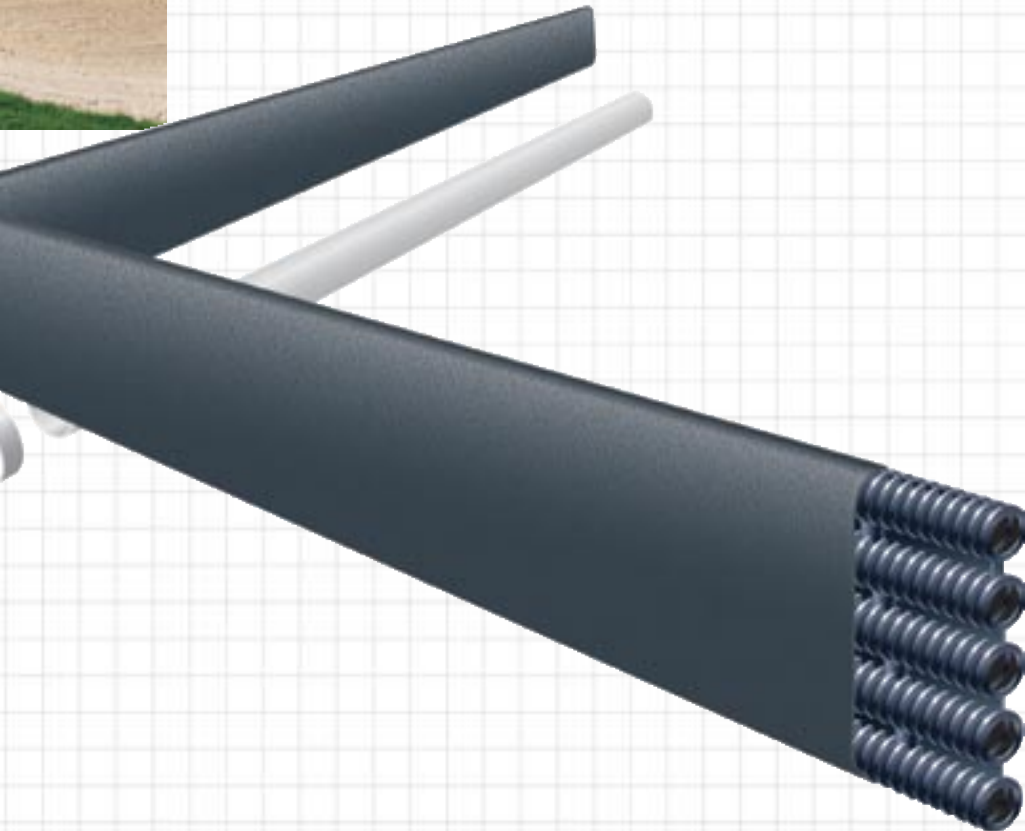




Multi-Flow Golf Course Drainage Guide

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1. Multi-Flow Technical Properties

Drainage Core

<u>Property</u>	<u>Test Method</u>	<u>Value</u>
Thickness, inches.	ASTM D-1777.....	1.0
Flow Rate, gpm/ft *	ASTM D-4716.....	29
Compressive Strength, psf.	ASTM D-1621 (sand method) ..	6000
Perforations / sq ft	-----	> 300

Geo-textile Filter

<u>Property</u>	<u>Test Method</u>	<u>Value</u>
Weight (oz/yd ²)	ASTM D-3776.....	4
Tensile Strength, lb...	ASTM D-4632.....	100
Elongation, %.....	ASTM D-4632.....	50
Puncture, lb....	ASTM D-4833.....	50
Mullen Burst, psi.	ASTM D-3786.....	200
Trapezoidal Tear, lb.....	ASTM D-4533.....	42
Coefficient of Perm, cm/sec.	ASTM D-4491.....	0.1
Flow Rate, gpm/ft ²	ASTM D-4491.....	100
Permittivity, 1/sec.....	ASTM D-4491.....	1.8
A.O.S., U.S. sieve.	ASTM D-4751.....	70
UV Stability, 500 hrs., %.....	ASTM D-4355.....	70
Seam Strength, lb/ft	ASTM D-4595.....	100
Fungus	ASTM G-21.....	no growth

Notes: Values given represent minimum average roll values.

*at gradient = 0.1, pressure = 10 psi for 100 hours in horizontal installation



Multi-Flow is available in three sizes: 6-inch, 12-inch, and 18-inch. Standard 150-foot length rolls are shipped in 55 inch diameter rolls.

For purposes of project design, assume the following flow rates:

6-inch -----	17 gpm
12-inch -----	29 gpm
18-inch -----	45 gpm

Rates will rise as slope and head pressure are increased and fall as they are decreased.

2. Basic Principles of Artificial Drainage

Artificial drainage

Artificial drainage is the collection and relocation of excess soil water. Once a fairway or green has reached the point where it is holding all the water that it is capable of holding, additional water from rain or irrigation will pond on the surface or flow to a lower point. A drainage system provides a passageway through which excess water can flow as it leaves a saturated area.

Consider the open trench

For the most basic model of a drainage system, picture for a moment a fairway that is crisscrossed by narrow trenches. Water from neighboring saturated soils or from puddles on the surface will seep into these trenches and flow from the area. Drainage products simply hold the walls of the trench open while allowing the surface to be covered and used.

Gravity's Role

Like natural drainage, artificial drainage systems rely on gravity. They cannot draw water uphill. Therefore, drainage systems are dependent on continuous natural or created slope. Water flows to a lower point whenever a lower point is available.

Collection and transport

Modern artificial drainage systems are comprised of:

- ✓ collector lines to gather the water
- ✓ a transport system to carry the water away

This *Design and Installation Guide* assumes that you will be using Multi-Flow for a collector system and a smooth, solid, rigid pipe for a transport system. (See FAQs for rationale)

When planning the layout of drainage collector lines consider these factors:

- ✓ Drainage lines that are spaced more closely together provide a more thorough and rapid response. In many situations 10 foot spacings are ideal.
- ✓ Drainage lines that are placed closer to the surface will generally respond more quickly. Drainage lines that are placed deeper will generally drain a wider area but will take a longer time to do so.
- ✓ Soil particle size will dramatically affect the speed at which water moves through the soil. Coarse, loosely-packed soil allows for fast water movement. Fine, compacted soils yield water at a slower rate. Placing collectors closer together and closer to the surface is helpful in porous soils because water in these soil types reaches the collectors more quickly, generating larger volumes, so extra carrying capacity is required. It is helpful in dense soils because closer spacings mean that water need not travel so far to get to the collectors. So close line spacings are advantageous regardless of soil type.
- ✓ Soil is often not uniform. Layers of clay or hard pan will affect the flow of water significantly.
- ✓ Collector line length is often limited by the carrying capacity of the product. For example, if you wish to be able to stay ahead of one inch of rainfall per hour, and you have installed 6-inch Multi-Flow (capable of carrying >1000 gallons per hour) on 10 foot centers, the line should not exceed 164 feet in length. (One square foot of water one inch deep is .623 gallons. $164 \times 10 \times .623 = 1022$ gal.)

Avoid blockage

Flowing water carries soil particles with it. Safeguards must be taken to halt the migration of silt and other fines or the collectors will become blocked. A geotextile filter will prevent blockage of the collectors. Coarse, clean sand will prevent blockage of the geotextile filter. Collector pipes should not be used without a filter covering and a fabric filter should not be used without a sand filter.



The open trench is the most basic model for an artificial drainage system.



This *Guide* assumes that you will be using Multi-Flow for a collector system.

length (feet) X
width (feet) X
.623 (gallons)

=

gallons of water
produced by a
1-inch rainfall

3. Vertical Installations

I. Design

A. Trenching

Effective drainage of fairways and along cart paths is usually best achieved with a vertical Multi-Flow installation. Bunkers are often drained this way as well. Vertical installations provide a sizable intercept area but leave only a narrow scar in the turf. A 4 inch wide trench is optimal. Depth will be determined by factors such as:

- anticipated depth of maintenance practices
- desired depth of desaturation
- width of area to be drained
- required response time
- speed at which full drainage is desired
- subsurface physical features
- the location of irrigation lines.



Vertically installed Multi-Flow provides a fast and effective solution for soggy fairways.



Cart paths frequently serve as a barrier and collector of water. Multi-Flow provides an escape route.

B. Line length and spacing.

On a level surface, subsurface drainage of turf is most effective within 5 to 8 feet of the drain line. Therefore, 10 to 16 foot spacings are ideal. On sloped surfaces a wider spacing is acceptable because gravity will aid in bringing water to the drain line. In fairways, a central collector line running up the center with arms reaching out into low lying areas on either side, is frequently the best course of action.

C. Product size selection

A line of 6-inch Multi-Flow could reach capacity in about 140 feet of water collection. 12-inch Multi-Flow could drain up to 235 feet of length before it reaches capacity. While 18-inch Multi-Flow could extend up to 360 feet. These lengths are based on the assumption that the line is collecting water from a 12 foot wide area during a one inch in one hour rainfall event.

D. Transport System

After water has been collected by the Multi-Flow system, it must be transferred to a transport system for its journey from the site. This maximizes the total output of the system in a given amount of time. Sometimes the water is discharged into a storm sewer, stream or pond. Increasingly, it is collected for reuse in irrigation.

The transport lines need to have a carrying capacity at least equal to the sum of all of the collector lines they are called on to service. For planning purposes it is useful to assume these numbers:

Multi-Flow Collectors

6-inch	17 gpm
12-inch.....	29 gpm
18-inch.....	45 gpm

PVC Transport Pipe

3-inch.....	52 gpm
4-inch.....	112 gpm
6-inch.....	327 gpm
8-inch.....	704 gpm

Suggested Multi-Flow Line Length Limits*	
6-inch	140 feet
12-inch	235 feet
18-inch	360 feet
* assuming 12 foot spacings 1 inch of rain per hour	



Standard PVC components can be slipped over any Multi-Flow multi-purpose connector to transition from collector lines.

If there is any danger that the water level at the discharge point will rise higher than the level of the collection system, a check valve should be installed on the discharge pipe. This will prevent contaminated water from backing up into the collector lines and causing siltation.

II. Installation

A. Equipment needed:

- 4-inch chain trencher and trenching spade
- turf utility vehicle
- utility knife
- laser level
- centering device(s) (optional)
- water and/or vibratory packer (optional)

B. Materials needed:

- appropriate size of Multi-Flow pipe for collector system
- appropriate Multi-Flow connectors
- clean, very coarse sand
- PVC or ABS pipe for transport system
- PVC or ABS adaptors if needed
- PVC tape

C. Trenching

Plot a path through the problem area to a desired discharge point marking the path with paint or flags. Begin trenching at the discharge point and proceed toward the highest point of the problem area. Measure regularly to ensure that you are maintaining a proper grade. A laser level or transit is a useful tool in this situation.

If the excavated material contains clay, remove it from the site before installing the drain.

D. Laying out the drain

Roll out the drain beside the trench. At the ends, pull back the geo-textile filter and snap the connectors in place. Connectors slip on more easily if they are manually pre-stretched. Push the fittings, such as end caps, couplers, side outlets or end outlets, firmly over the pipe to ensure a secure fit.

Then pull the fabric over the fitting and hold it in place with PVC pipe tape. This ensures that soil will not enter behind the fabric and block the drain core during placement.

Do not place Multi-Flow into a trench that contains standing water.



A walk behind trencher like this Toro is ideal. The 4-inch trench results in minimal disruption and minimal down time for the course.



Multi-Flow is easily cut to length using a common utility knife.



Roll out the pipe beside the trench and lower it into place. Use Multi-Flow connectors to ensure a secure transition between lines.

C. Connecting to transport system

- Usually connection to the transport system will be made with a multi-purpose connector. Most commonly this will be a 0600M, 1200M, or 1800M. These connectors empty from the bottom. Smooth, solid, rigid pipe makes for the most reliable transport system. Use of pipe cement will ensure a lasting connection. Multi-purpose connectors join to 3" PVC elbows and tees.

- In some situations it is preferable to discharge the water through an end outlet or a side outlet (e.g. 06003 or 06004). In these cases, cut the plastic membrane covering the opening of the outlet so that the exit pipe fits in snugly and is located at the bottom of the fitting. Insert the exit pipe and seal the joint from soil using PVC pipe tape. 6-inch Multi-Flow connectors attach to a 3-inch PVC while 12 and 18-inch Multi-Flow match 4-inch PVC.



When a multi-purpose connector is used, the transport pipe is located beneath the level of the collector pipes.



When an end or side outlet is used, the transport pipe is located at the same level as the bottom of the collectors.



Centering devices are helpful for holding Multi-Flow in the middle of the trench while backfilling.

D. Backfilling

Use clean very coarse sand to fill the trench. Hold Multi-Flow in the relative center of the trench while backfilling. Centering devices are helpful in this task. Bring the sand up to the surface or near to it. Jetting the sand-filled trench with water will help to settle the sand in place more quickly. A small vibratory packer also works well.

Topsoil can be blended with the sand at the surface of the trench to create a better turf growing medium. Never, however, cap the trench with clay or other dense impermeable material. See "Selecting Backfill Material: Extending the Life of Your Drainage System" on page 9 for more information on this topic.

4. Horizontal Installations

A. Think it through before you start.

A horizontal placement of Multi-Flow is usually the most effective way to design drainage in a new golf green. Before exploring this method, we will first discuss green drainage in a more general way.

Whether you are dealing with a USGA-style layered green, a California-style single material green, or even a push-up style green, an effective subsurface drainage system is a must. Assuming that the green has been constructed using porous materials, water will soon arrive at the relatively impermeable sub-base. If it does not have an easily accessible escape route from here, the green will become saturated. This invariably results in unacceptable growing and playing conditions.

Three primary considerations influence sub-surface golf course green drainage plans and practices:

- Does the system provide adequate drainage?
- Will the system be damaged by maintenance practices?
- Will the system avoid future failure and blockage?

Multi-Flow addresses these concerns by providing systems that are: 1.) low profile, 2.) intensively patterned, and 3.) adequately filtered.

1. Low profile

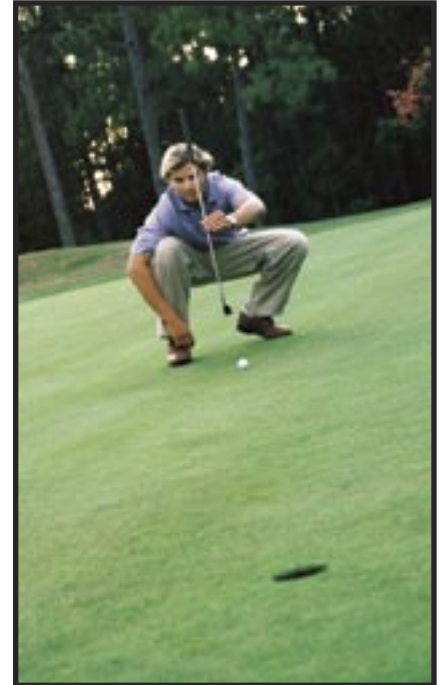
Multi-Flow's structure and shape provide unique drainage advantages. Its flat profile provides superior surface area allowing more opportunity for water to enter the system. Its superior strength significantly reduces the risk of being crushed. And its internal flow characteristics allow water to leave the green area quickly.

Furthermore, it need not be trenched in but is simply rolled out over the sub-grade where it lies out of reach of cup cutters and coring equipment.

2. Intensively patterned

Conventional wisdom has often placed drainage collector lines only in the low points of the green sub-base. The assumption was that since water will find these low-lying areas anyway and since greens allow water to move freely, this is all that is necessary.

This practice overlooks the effect that moving water has on the structure of the green. Moving water carries fine particles with it. The more water that moves and the higher velocity at which it moves, the more soil it will carry with it. Installing drain lines further apart requires that water move in greater volume to fewer collection points. This results in greater soil migration which causes a break down of the soil structure and a potential

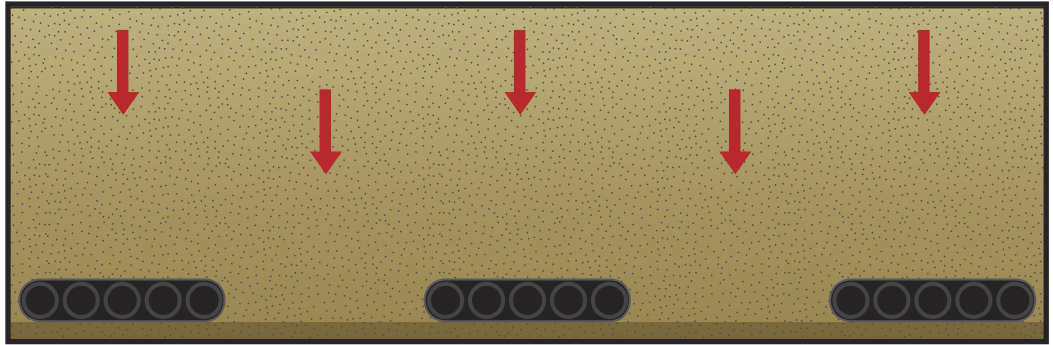


Due to their construction and heavy traffic, it is imperative that greens be well drained. Newly constructed greens are best drained with horizontally installed Multi-Flow.

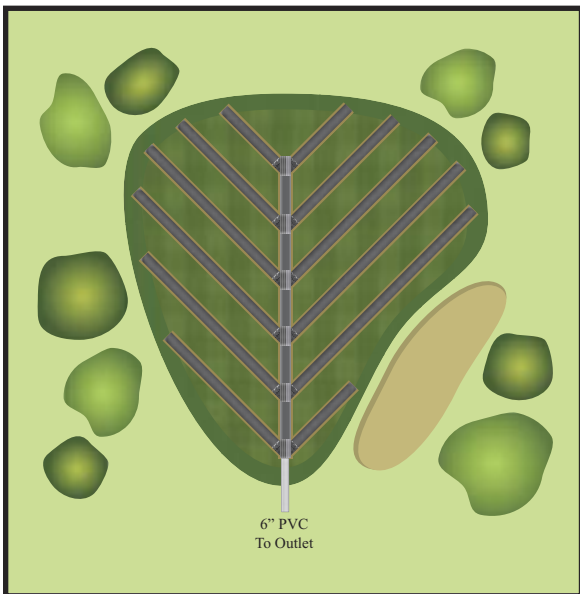


Multi-Flow is simply rolled out over the sub-grade where it lies out of reach of cup cutters and coring equipment.

With closely spaced Multi-Flow lines, particle movement is significantly reduced. This increases drainage efficiency and dramatically extends the life span of the green.



The veins on a leaf are a model of effective fluid transfer in nature. It is also true on a golf green: the less distance water needs to travel to an escape route, the better the drainage is.



An intensive pattern in a herringbone configuration provides uniform drainage to every part of the green.

blocking of drainage lines.

Drainage on a golf green should be gentle and thorough. Intensive patterning decreases the velocity of the water movement and consequently protects the fragile integrity of the green structure. Spreading drainage lines out over the entire sub-grade of the green means that water has less distance to travel and results in less soil migration.

But locating lines closer together also ensures a prompt and thorough drainage. Look at the veins on the back side of a leaf for a model of effective drainage. The less distance water needs to travel to reach an escape route, the better the drainage is. Intensively patterned drainage allows for the removal of significant amounts of water in a short time without disrupting the structure of the soil.

3. Filtered

Two separate filters assure that the drainage system will not fail. Multi-Flow's 4 ounce, needle-punched geotextile wrap prevents sand from entering the flow channels. Two inches of clean, very coarse sand effectively protects the geotextile from blockage due to silt and other soil fines.

B. System Design and Layout

When designing drainage for a green, the main Multi-Flow collectors should lie horizontally on the sub-grade and be placed along the line of maximum fall. A 4" diameter PVC pipe should be placed directly below the main line, exiting the green at the low end. PVC tees must be installed in the PVC lines, pointing upward, at each location where a Multi-Flow double wye will connect to the laterals. The PVC pipe should be backfilled with native soil, leaving only the opening to the PVC tee exposed and lying flush with the soil surface.

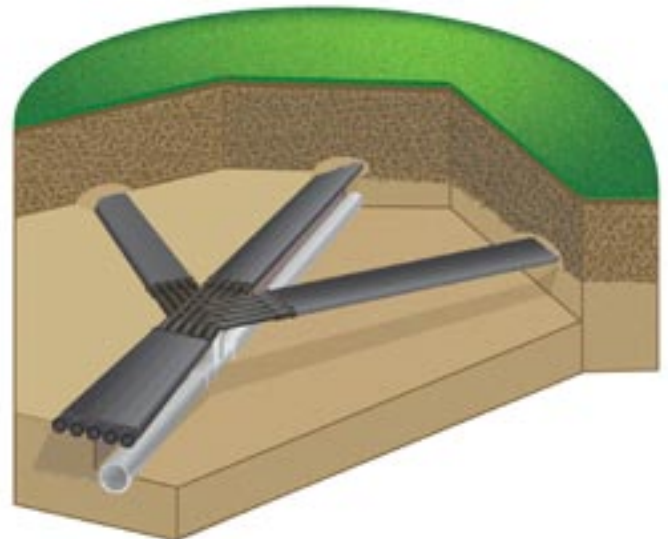
If a geotextile fabric is to be used as a barrier between unstable subsoil and the gravel drainage blanket as in a USGA green or between the subsoil and the green mix as in a California style green, it should be installed at this time, and openings should be cut into the barrier fabric for the PVC tees to emerge through. Typically, the barrier fabric

should not cover the Multi-Flow drainage product. Locate lateral Multi-Flow collectors across the slope of the sub grade, allowing a natural fall to the main line, where they will connect into the double wye.

Lateral lines should be spaced not more than 12 feet apart and extended to the perimeter of the green. Lines should be placed in water-collecting depressions, if they exist.

If the green exceeds 100 feet in width, an additional herringbone, or half herringbone, must be installed along one side of the original pattern in order to maintain maximum flows.

At the low end of the gradient, adjacent to the main line's exit from the green, vertical drainage product should be placed along the perimeter of the green, extending to the ends of the first set of laterals. This smile drain will facilitate drainage of the water that may accumulate at the low end of that drainage area. The vertical drainage product can be discharged into the 4-inch PVC pipe by way of a Multi-Flow connector, such as a 06009, and a PVC tee as it exits the green.



Locating the transport pipe beneath the trunk collector line is both effective and convenient.

C. System Installation.

1. Wherever the grade exceeds 3%, stakes should be placed to prevent movement of the Multi-Flow during later stages of construction.
2. Avoid applying more than 6,000 psf to the Multi-Flow during construction. Once the 2 inch band of sand is in place, additional pressure on the Multi-Flow is permissible.
3. The geotextile filter fabric should be securely taped to all fittings to prevent the infiltration of sand or soil during placement.
4. Maintain a grade of at least .5%; 1% is preferable.
5. If the PVC transport system terminates in a stream or pond that is likely to reach the height of the exit pipe, a check valve must be installed to prevent back flow through the drainage system.

D. Backfilling

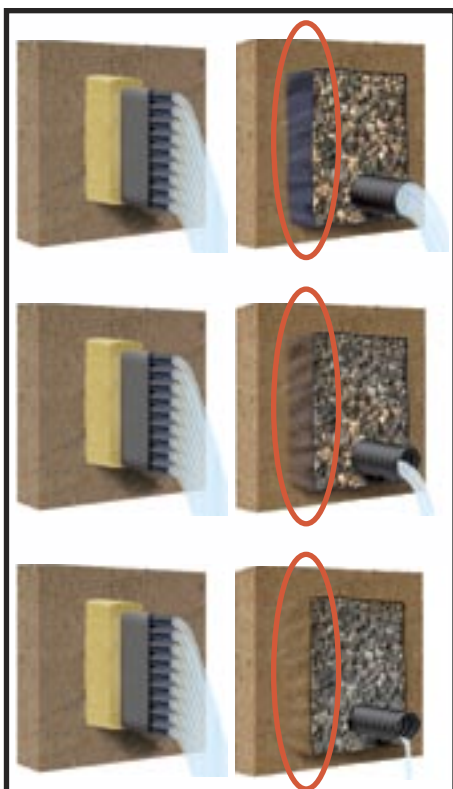
Backfill material may be the single most important factor affecting the longevity of a drainage system. Sand functions as a filtration tool, removing silt and clay particles, while allowing water to pass through. A 2 inch band of very coarse sand should be installed covering the top and sides of each collector line.

This sand backfill could be eliminated if the select aggregate is free from silt and clay but this is seldom the case. See "Selecting Backfill Material: Extending the Life of Your Drainage System" on page 9 for more information on this topic.



Clean, very coarse sand acts as an excellent filter, dramatically extending the life expectancy of the system. A 2 inch band should be installed covering the top and sides of each collector line.

5. Selecting Backfill Material: Extending the Life of Your Drainage System



A properly placed sand filter will dramatically extend the life of a drainage system.



Very coarse sand makes for the best backfill.

Backfill estimation guideline:
trench depth (inches) X
trench width (inches) X
trench length (feet) ÷
3888 =
yards³ of backfill
(total volume of trench)

Quality backfill means a longer lasting system

At Varicore, we regularly receive questions about backfill. We sometimes even encounter the misconception that select backfill is a concept linked exclusively to Multi-Flow drainage. Choice of backfill will have no greater, and no less, effect on the life of a Multi-Flow system than it will on any other drainage system. Multi-Flow systems, and all other golf course drainage systems enjoy longer life when quality backfill is used.

French drains block

It is a well known fact that French drains frequently block up, sometimes in a remarkably short amount of time. This blockage typically occurs on the trench liner. Small particles of clay or silt are carried by moving water until they are arrested by the fabric filter. The actual life span of a French drain depends on the soil type and the rainfall amounts. This same blockage can occur with round pipe or panel drain wrapped in geo-textile. Golf course superintendents and greens committees have wrestled with this issue for many years.

Very coarse sand

The best solution to this problem is to employ a high quality geo-textile filter and then protect it with very coarse sand. Sand is an excellent filter of clay and silt. As the water containing these contaminants moves through the sand, it slows down and the particulate matter drops out. An inch or more of sand is a very effective filter.

A sand filter is far more feasible with a Multi-Flow system than with a traditional French drain. It would be very difficult, if not impossible, to insert a layer of sand between the trench wall and the geo-textile liner in a French drain. However, it is relatively easy and affordable to use sand as a backfill medium surrounding Multi-Flow in a 4 inch wide trench. With sand as a primary filter and a 4-ounce needle-punched geo-textile as a secondary filter, a Multi-Flow system will provide long-lasting, effective drainage.

Perfect sand

According to the USDA system of classification, very coarse sand has an approximate particle size of between 1.0 and 2.0 mm. Some designers have used this for a sand spec:

When passed over a sieve, very coarse sand will have:

- less than 5% retained on a #10 U S standard sieve,
- less than 5% passing a #30 U S standard sieve
- no more than 1 % passing through a #50 U S standard sieve.

Unfortunately, good quality sand is not uniformly available. But, the closer installers come to this recommendation, the longer their system will last. Absolute conformity is frequently not practical. On one hand, sand contaminated with clay or silt will impede the movement of water as well as accelerate the blinding of the drainage system. On the other hand, large diameter pea rock and mixed particle size gravel will allow for rapid movement of water at first, but are susceptible to infiltration by fines over a period of time. Buck shot, washed medium sand, or small-particle gravel without fines are better choices, but will not perform quite as well as clean, very coarse sand. When the perfect sand cannot be found, look for an alternate following these two criteria and in this order:

1. Look for sand that is clean
2. Look for sand that is coarse

6. Frequently Asked Questions

Why is drainage so important for healthy grass?

Walking on, maintaining, or driving over a course that is saturated will compact the soil by forcing suspended soil particles into voids. This will inhibit the growth of healthy grass as well as making the surface hard and uneven.

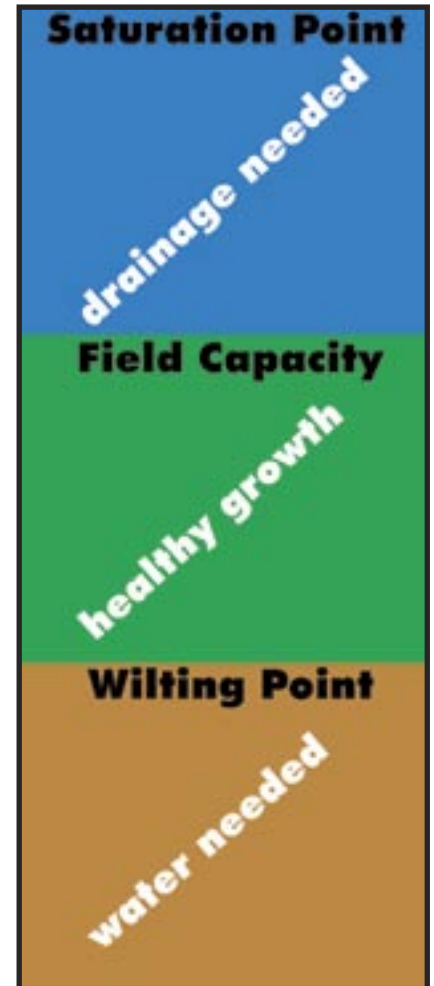
Is it possible to over drain my course?

Drainage cannot and will not remove all water from the soil. It only reduces it from the unacceptable "saturation point" to the desired level of "field capacity." At this point, water clings to surrounding soil particles which refuse to yield any more moisture to gravity. Fortunately, plants can still access this remaining soil water. Due to plant usage, combined with evaporation, soil moisture levels will eventually fall to a "wilting point" at which time additional water becomes mandatory.

Why use Multi-Flow for a collector system?

Following best management practices, the Multi-Flow drainage system excels in a number of ways. Shape, function, strength and design combine to make Multi-Flow an unparalleled product:

- Multi-Flow provides a large surface area that interfaces with saturated soils. This allows water to enter the system rapidly.
- Multi-Flow's narrow shape allows for insertion into a narrow trench resulting in minimal excavation.
- Multi-Flow's enclosed, circular, flow channels allow for extraordinary flow rates.
- Multi-Flow's strength allows it to be installed in shallow applications where it might be subjected to the weight of surface traffic as well as in extra deep installations where it may bear the weight of many tons of soil.
- Multi-Flow comes wrapped in a premium, needle-punched, geo-textile filter preventing sand and soil from entering and blocking the system.
- A large array of connectors allows the Multi-Flow system to be configured in limitless designs. Horizontally or vertically, Multi-Flow can be laid out in almost any pattern using 45° or 90° alignments. It can combine 6, 12, and 18-inch products and can empty from the end, side, or bottom.
- Multi-Flow is pliable, making it suitable for tight corners and assisting in connecting fittings conveniently.



What are the requirements of a transport system?

Transport systems need to be able to carry water away from the site as fast as the collector system can accumulate it. Furthermore, the transport system must be at least as strong as the collector system. PVC, ABS, and dual wall corrugated HDPE pipe are good options.

Flow rate requirements will vary depending on the number of collector lines that are being fed into a transport pipe. 6, 12, and 18-inch Multi-Flow collectors are capable of delivering 17, 29, or 45 gallons per minute, respectively. Multiply the number of collector lines times the appropriate gpm to determine the maximum expected rate.

Does Varicore provide design assistance?

Varicore willingly provides drainage pattern drawings made specifically for your fairways, cart paths, bunkers, and greens. We also assist customers with material take-offs and performance estimates from those drawings. These are not official construction drawings. Because we cannot typically be on site to measure elevations etc., drawings will not contain such information. These drawings are provided to customers without charge for use in planning and budgeting.

Why does Multi-Flow incorporate a geo-textile filter?

Without a geo-textile filter, drainage products themselves can fill with soils. When rainfall is heavy, drainage systems tend to wash clean inside, but during drier periods, blockage is common.

Systems that do not employ a geo-textile tend to use crushed rock or similar backfill. The voids in these materials are prone to wash full of soil as well. Geo-textiles are a very effective way of keeping these particles out of the pipe.

Not all geo-textiles are equally effective at this task. First of all, geo-textiles with larger openings do not blind as quickly as those with smaller openings. Of course those with larger openings are also less effective as filters.

Secondly, those with a needle-punched surface last longer than those with a smooth surface because they have more surface area for collecting fines. Multi-Flow employs a heavy needle-punched polypropylene filter with openings as large as a # 70 U.S. standard sieve. Its openings are of optimum size and its "fuzzy" surface provides more filter area.

If I cannot find the recommended backfill medium should I select another drainage system?

Obviously we would not want to see installers backfill Multi-Flow, or any other drainage product for that matter, with native soil. The system would quite likely suffer premature failure. The customer might then blame the drainage product instead of the real culprit, the fines, for that failure. We know that sometimes courses must settle for less than the very best. Any kind of select backfill is to be preferred over the native excavated soil. Multi-Flow's size and shape makes premium backfill a more realistic possibility than in a French drain system. However, that is only one of many attractive Multi-Flow features. Superior strength, increased surface area, faster flow rates, better quality filter, professional and speedy service, and an unparalleled connector system all combine to put Multi-Flow head and shoulders above the competition with or without the very best backfill. It would be unfortunate if someone chose to install an inferior drainage product because of the illusion that it could be safely backfilled with inferior backfill.

Will my choice of backfill void Multi-Flow's warranty?

Multi-Flow's warranty is not affected by backfill choices. Varicore Technologies guarantees that each roll of pipe leaving our factory meets the high standard laid out on our product spec sheet. Choice of backfill and installation techniques will in no way affect this warranty. Varicore manufactures the highest quality drainage products. So, it

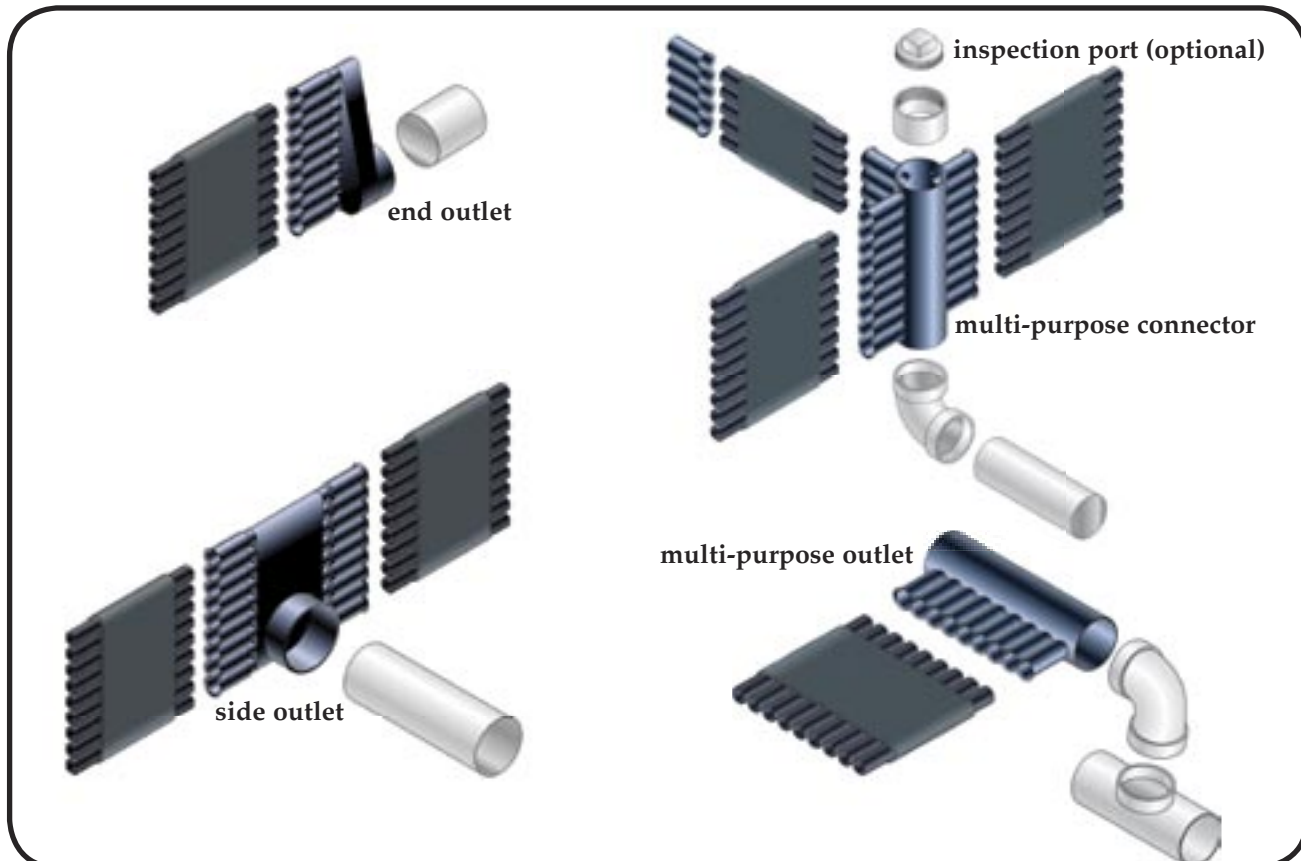
encourages courses to insist on installation practices that insure the longest possible life and the highest level of performance from the drainage system.

How do I decide whether to install Multi-Flow horizontally or vertically?

The unique features of your drainage site will determine the drainage profile. Vertical installations are most common. They allow for installation in a narrow trench with less excavation, less spoil, and less backfilling. Horizontal installations are used when the situation calls for a low profile or to avoid trenching altogether. Typically vertical installations are used in fairways, along cart paths, and in most bunkers. A horizontal profile is employed in greens and some bunkers. When remediating existing greens, it sometimes makes sense to install Multi-Flow vertically here as well.

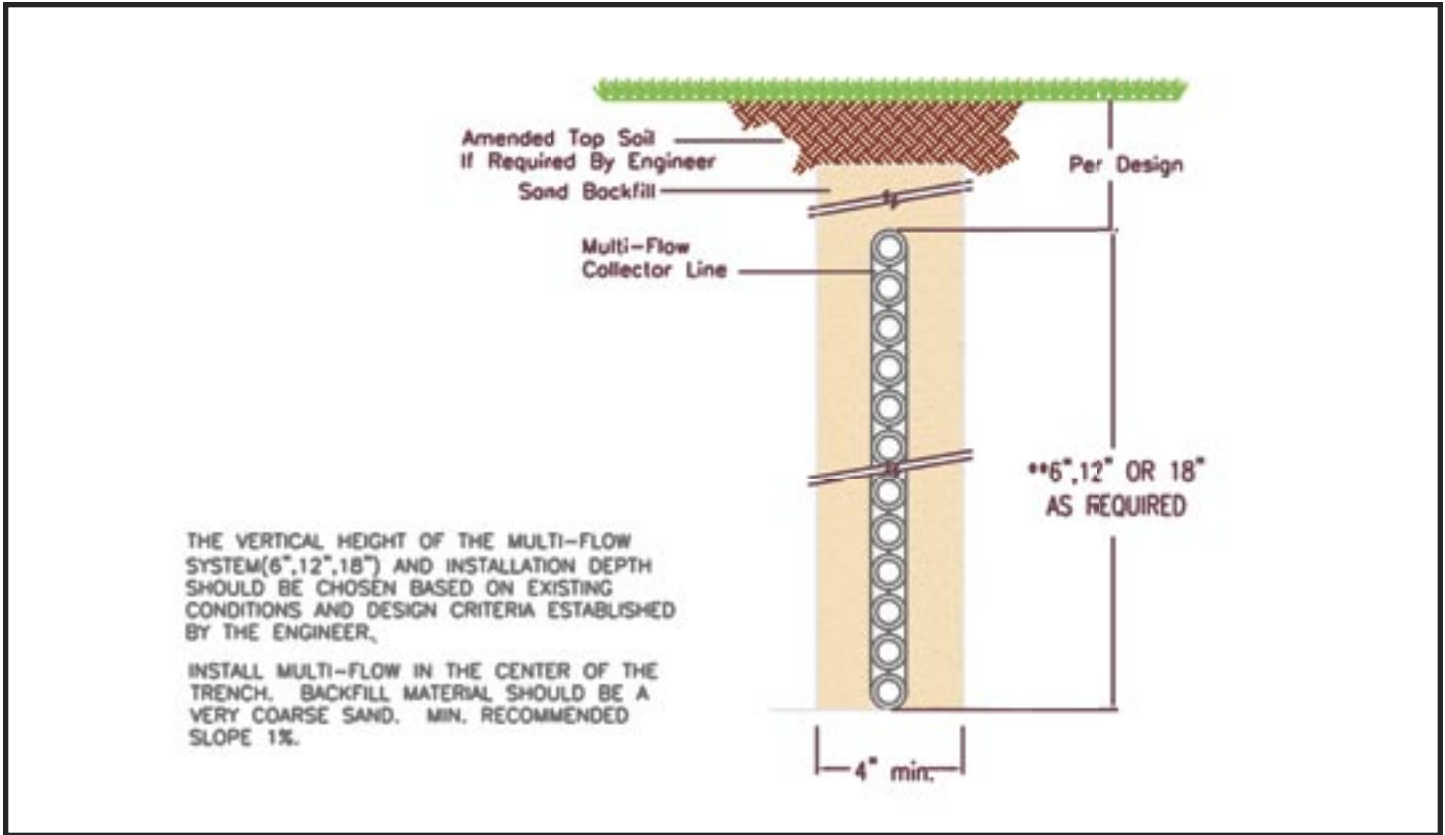
How do I connect my Multi-Flow collector system to my transport system?

You can exit the Multi-Flow system from any multi-purpose connector, from an end outlet, or from a side outlet. In most situations, exiting from a multi-purpose connector is advised. A standard PVC or ABS elbow or tee easily and securely makes these transitions. You can also exit from a 6-inch horizontal cross or double wye.

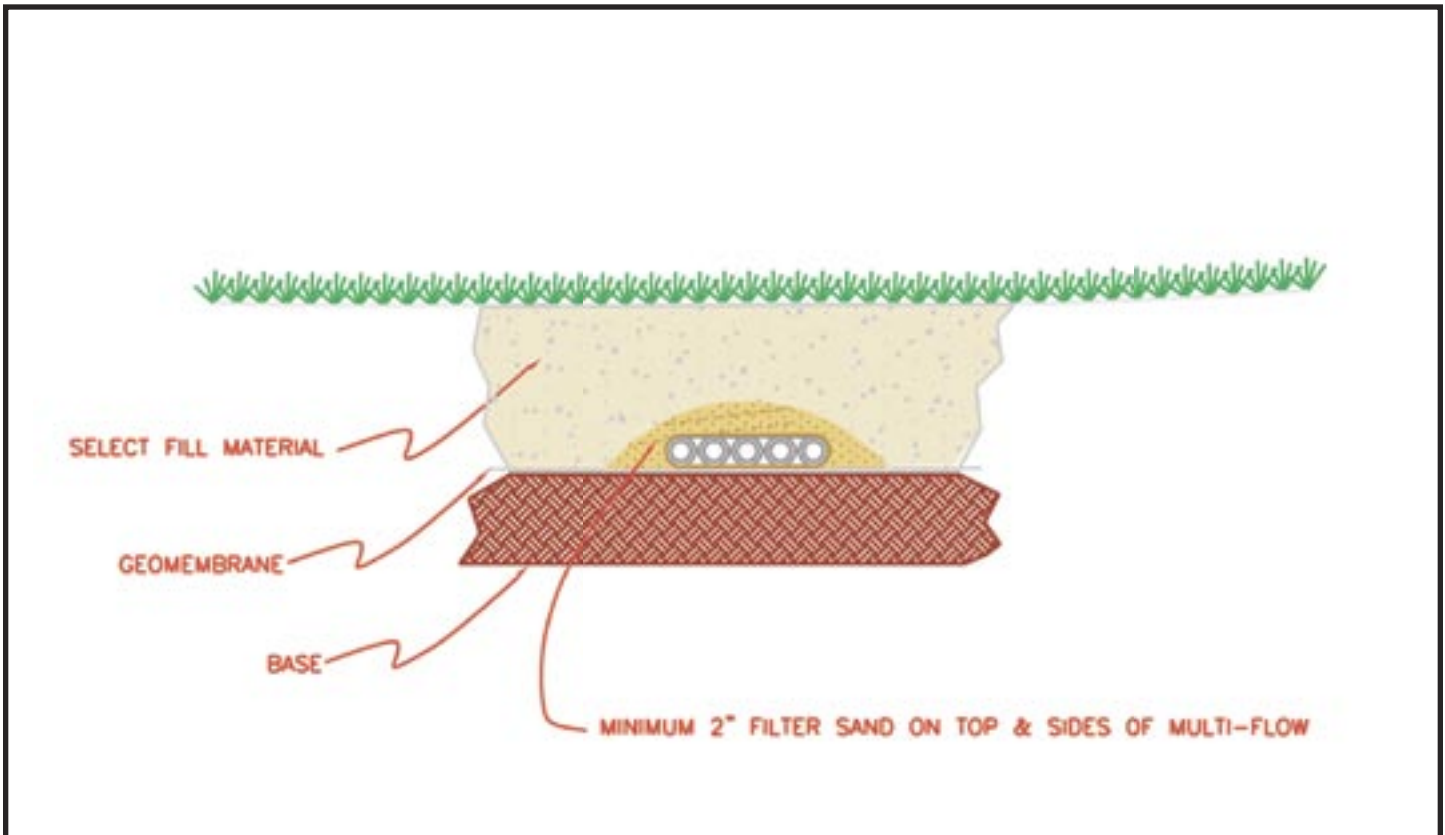


Outletting the Multi-Flow System

Vertical Installation



Horizontal Installation



8. Example Drawing: Fairway

Notes

830' - 6" Multi-Flow
Part# 06000

8 6" End Caps
Part# 06001

6 6" Couplers
Part# 06002

4 6" to 6" Connectors
Part# 06009

Total System Capacity
>8,320 Gallons Per Hour
.75% Minimum slope for
Multi-Flow and PVC in
direction of water flow.

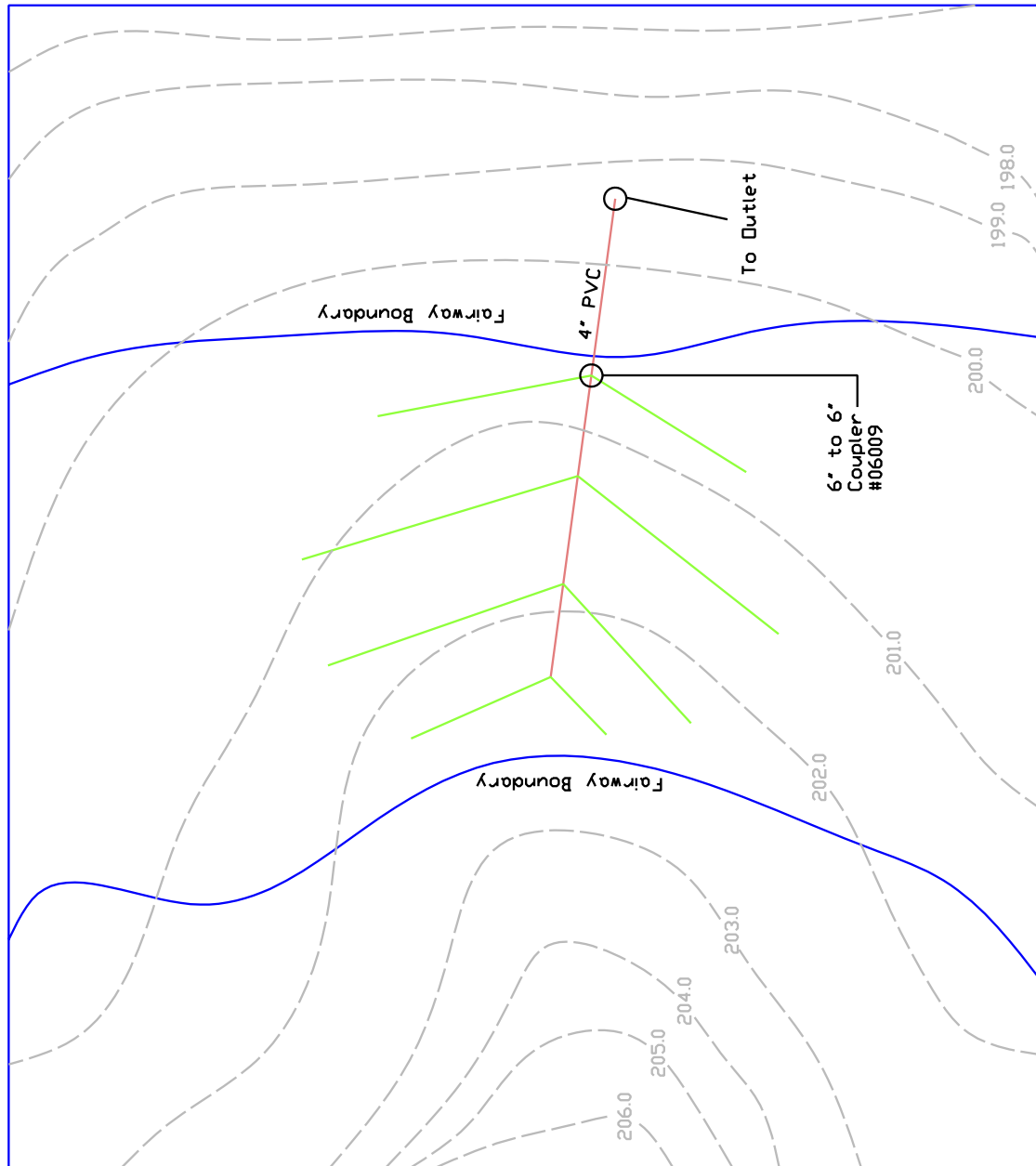
Install Multi-Flow in
center of trench.
Backfill material should
be a coarse clean sand.



ATP 2/7/05

Golf Course Fairway

Typical Multi-Flow
Installation
Patent 4995759



Varicore Technologies, Inc.

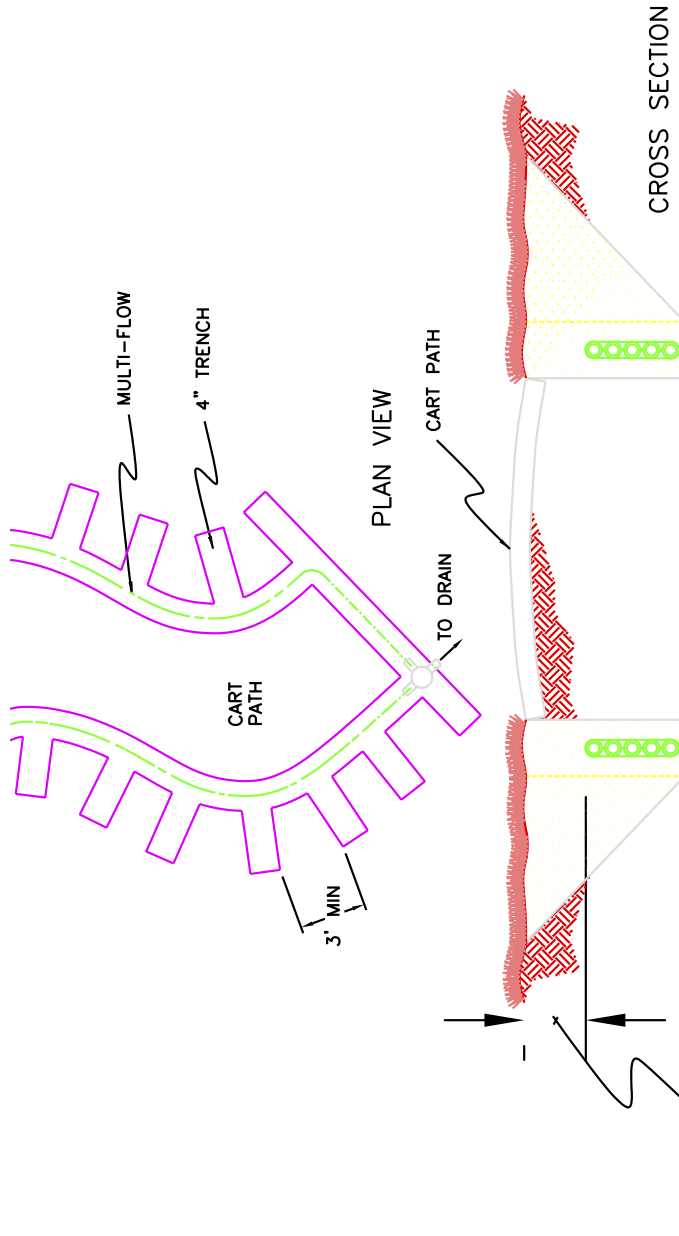
Notes

.75% Minimum slope for Multi-Flow and PVC in direction of water flow.
 Install Multi-Flow in center of trench.
 Backfill material should be a coarse clean sand.



ATP 3/02/05

Cart Path
 Typical Multi-Flow Installation
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TYPICAL MULTI-FLOW INSTALLATION
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Example Drawing: Green

Notes

587' - 6" Multi-Flow
Part# 06000

25 6" End Caps
Part# 06001

5 6" Couplers
Part# 06002

1 6" Side Outlet
Part# 06003

10 6" Horizontal
Double Y
Part# 06016

Total System Capacity
>21,000 Gallons Per Hour
.75% Minimum slope for
Multi-Flow and PVC in
direction of water flow.

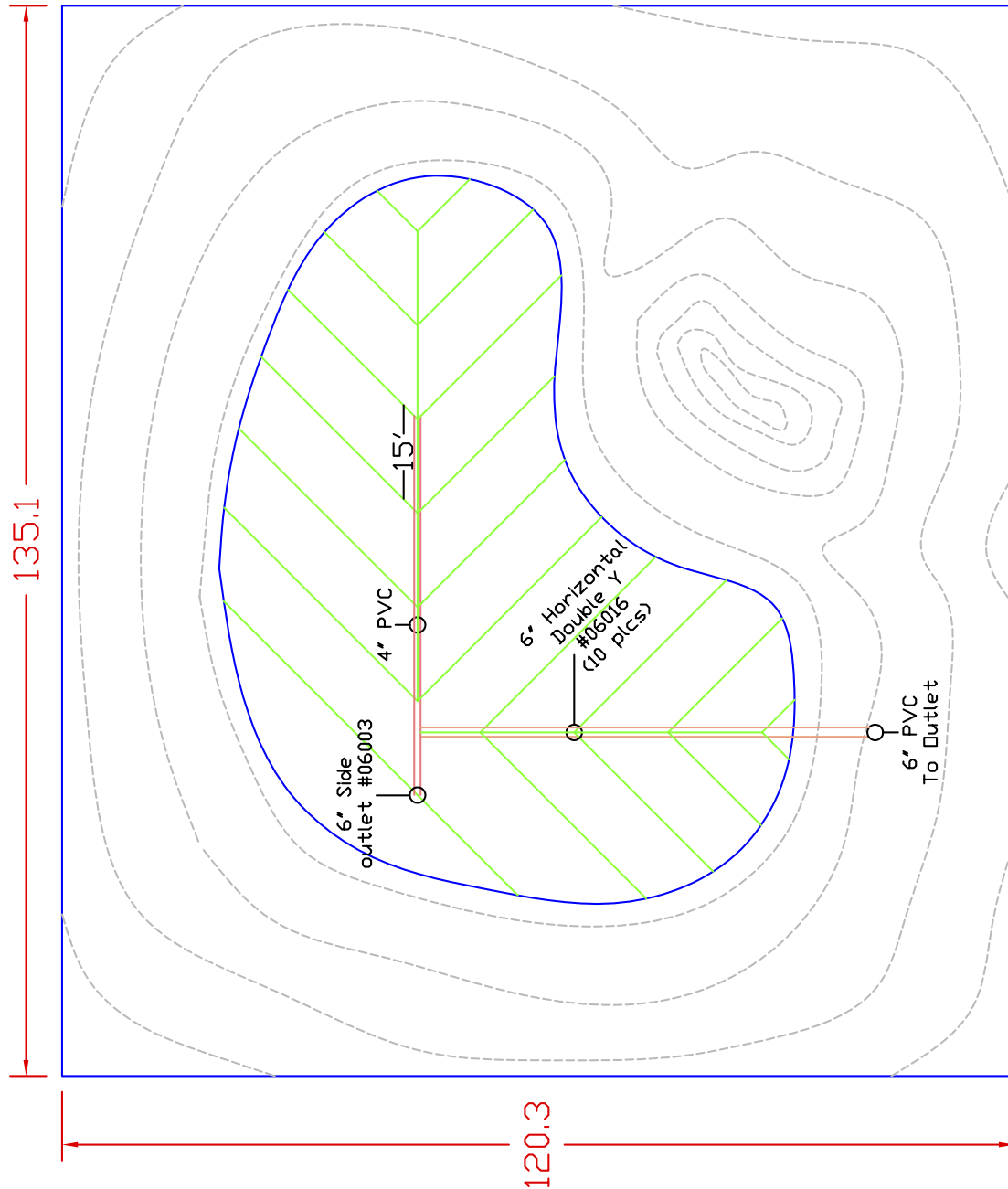
Install Multi-Flow
horizontally on compact
base. Cover with a
coarse clean sand.



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Golf Course Green

Typical Multi-Flow
Installation
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Notes

163' - 6" Multi-Flow
Part# 06000

8 6" End Caps
Part# 06001

1 6" Couplers
Part# 06002

2 6" Double-Y
Part# 06006

1 6" cross
Part# 06008

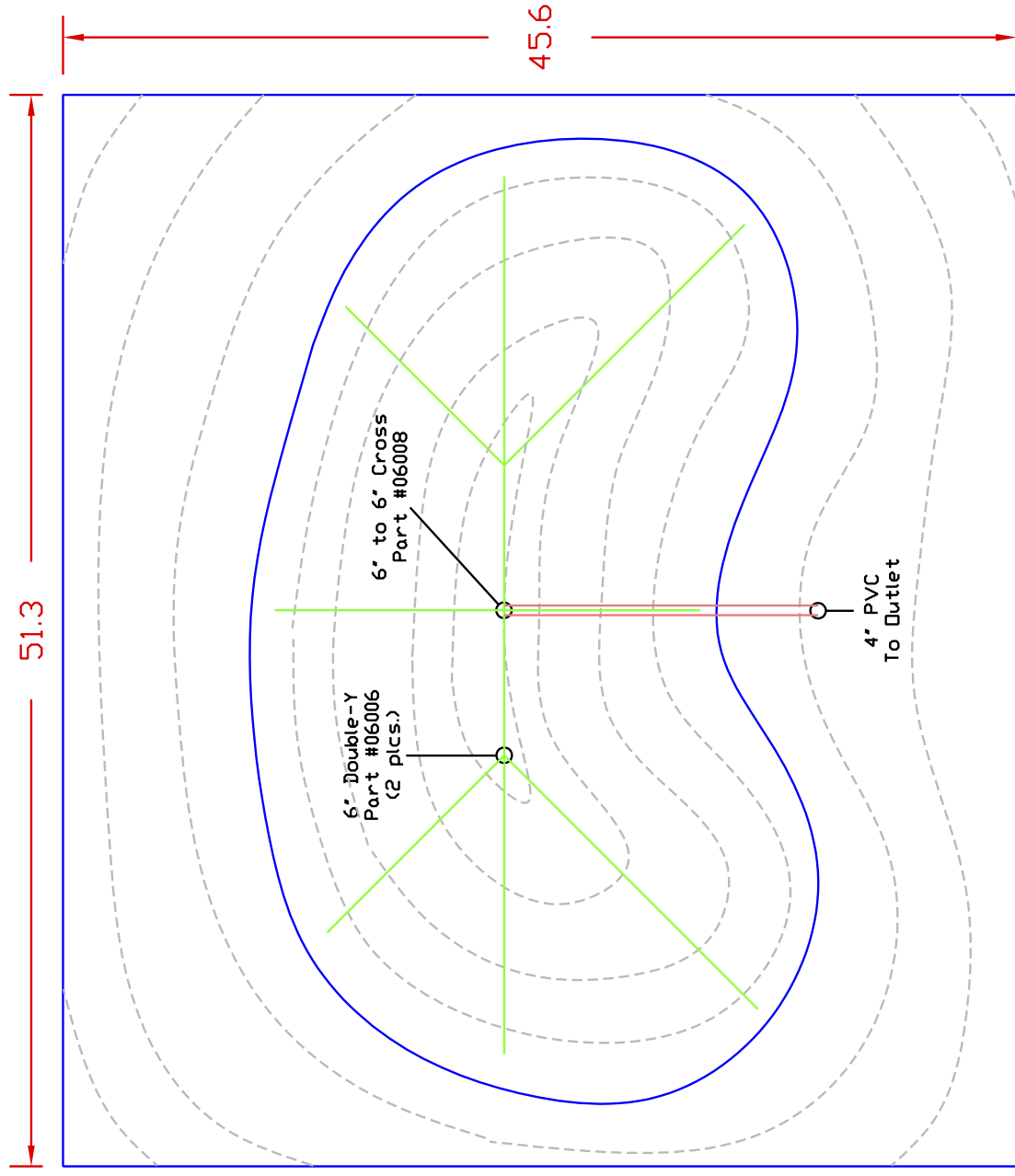
Total System Capacity
>8,100 Gallons Per Hour
.75% Minimum slope for
Multi-Flow and PVC in
direction of water flow.

Install Multi-Flow in center
of trench.
Backfill material should be
a coarse clean sand.



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Golf Course Bunker
Typical Multi-Flow
Installation
Patent 4995759



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