NEW · REVISED · UPDATED

The Septic System Owner's Manual

by LLOYD KAHN · Art by PETER ASCHWANDEN

SHELTER
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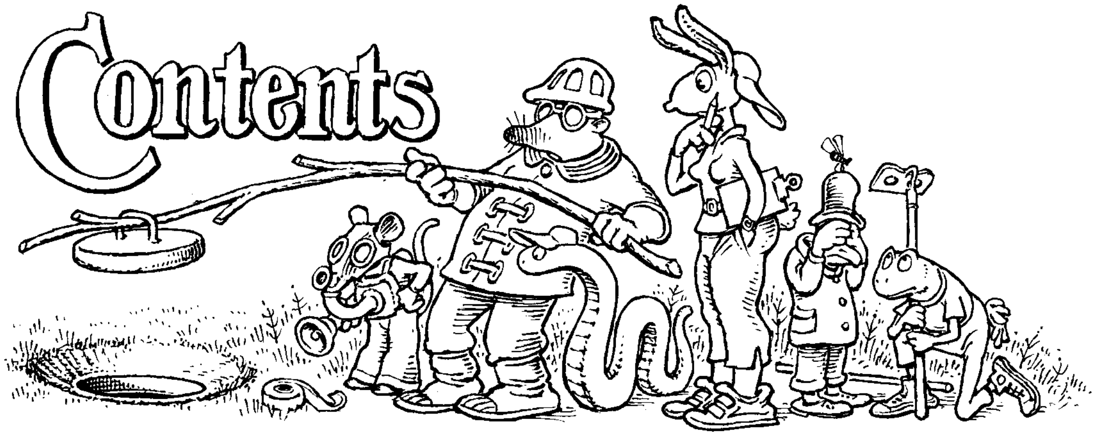
PUBLICATIONS

SUBTERRANEAN MYSTERIES REVEALED



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CHAPTER ONE

The Tank

Everything that goes down any of the drains in the house (toilets, showers, sinks, laundry machines) travels first to the septic tank. The septic tank is a large-volume, watertight tank which provides initial treatment of the household wastewater by intercepting solids and settleable organic matter before disposal of the wastewater (effluent) to the drainfield.

SEPTIC TANK CONSTRUCTION

Early tanks were often redwood (with limited life spans) and later, polyethylene (many with structural difficulties). Modern septic tanks are usually made of concrete or fiberglass or plastic and are available as prefabricated units. (Fiberglass and plastic tanks are lightweight and often used at sites where a truck cannot get in to deliver a concrete tank.) Many homemade tanks have been constructed of concrete block, but they are difficult to make watertight. (See below on the importance of a tank being watertight.) Most tanks are and will continue to be concrete. *(See p. 58 for more complete information on the different types of tanks.)*

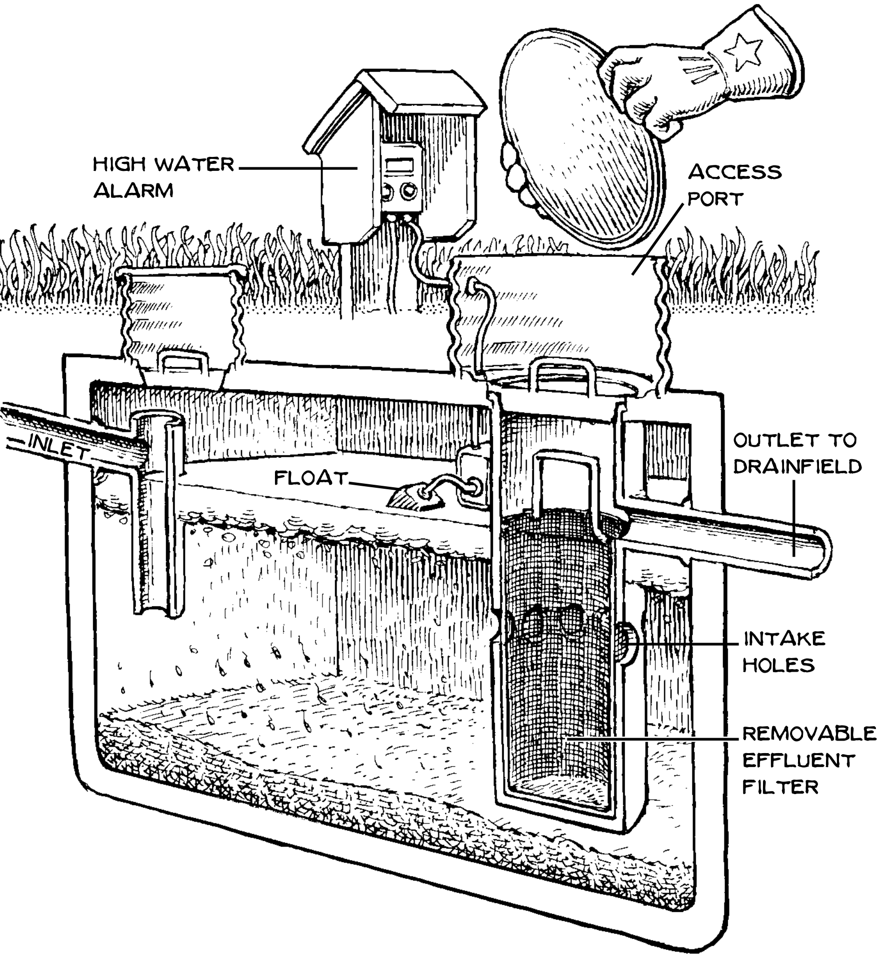
SEPTIC TANK SIZE

For single-family homes, tanks typically range in size from 500 to 1500 gallons of wastewater storage capacity. For a one- or two-bedroom home, a 1000- or 1200-gallon tank is common; for a three-bedroom home, a 1500-gallon tank. A typical 1000-gallon concrete tank measures about nine feet long by five feet wide and five feet deep.

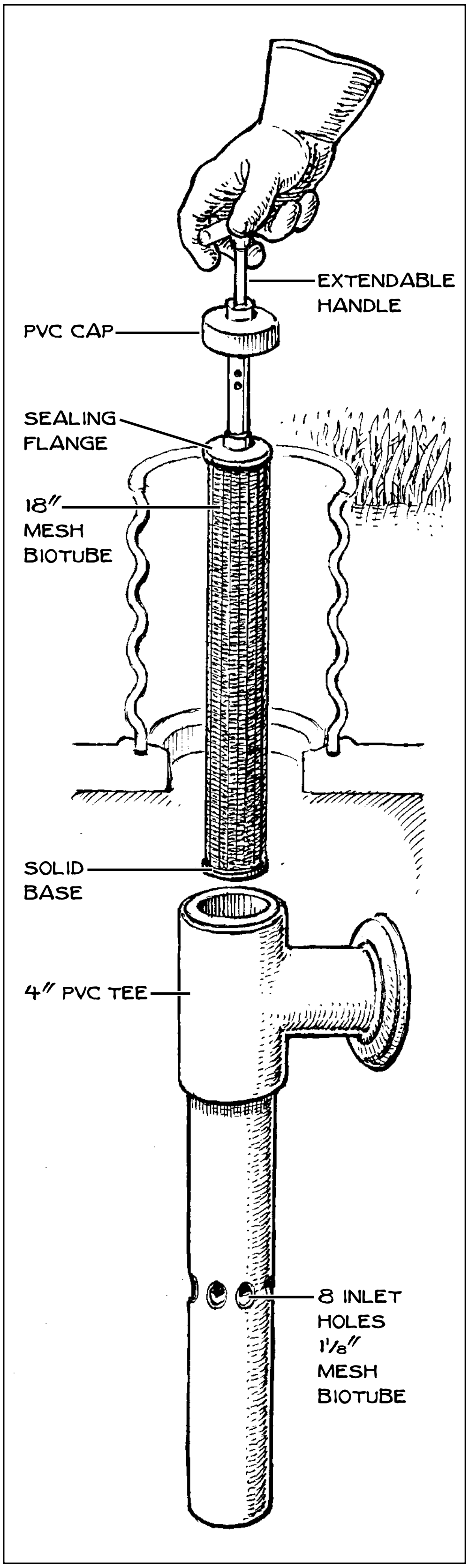
Although a 1500-gallon tank costs slightly more than a 1000-gallon one, it affords more complete digestion and can reduce pumping occurrences by a factor of four or more for a family of three.

THE MAIN JOB OF THE SEPTIC TANK IS TO INTERCEPT THE SOLIDS. THE TANK SEPARATES THE "FLOATERS" AND "SINKERS" FROM THE LIQUID, OR EFFLUENT, WHICH FLOWS OUT TO THE DRAINFIELD.

Moreover, the filter is relatively inexpensive (under $200) and can be quickly installed (retrofitted) in older tanks. The filter cartridge is removed and hosed off. The filters shown on this page are manufactured by in Oregon by Orenco Systems, Inc., 541-459-4449. Another manufacturer is Zabel Environmental Products, of Louisville, KY. *(See p. 174.)*



One-compartment septic tank with effluent filter
The filter is pulled out by hand periodically and hosed off. This relatively new accessory—when utilized regularly—can keep solids out of the drainfield.



Retrofit effluent filter by Orenco
This filter—narrower than the one in the tank above—was designed so it could be retrofitted to an existing tank. It is easy to pull out and hose off.

CHAPTER TWO

The Drainfield

WHERE DOES THE WASTEWATER GO AFTER IT LEAVES THE TANK?

Most commonly, wastewater goes to a drainfield, (also called *leachfield* or *disposal field)*. It can also go to a *mound (see p. 89)*, a *seepage bed (see p. 24)*, or a *seepage pit (see p. 25)*. The general and more technical term for all these methods of handling the wastewater from the tank is the *soil absorption system.* We will begin here with the most common type, the drainfield or leachfield.

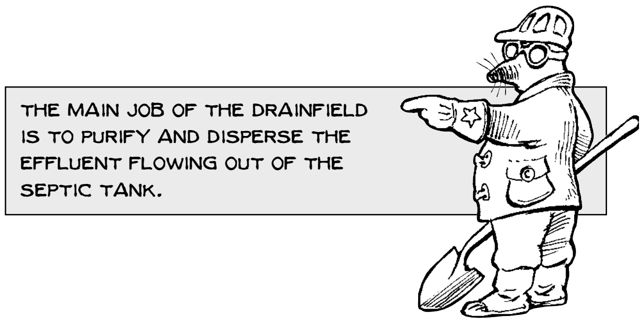
WHAT THE DRAINFIELD DOES

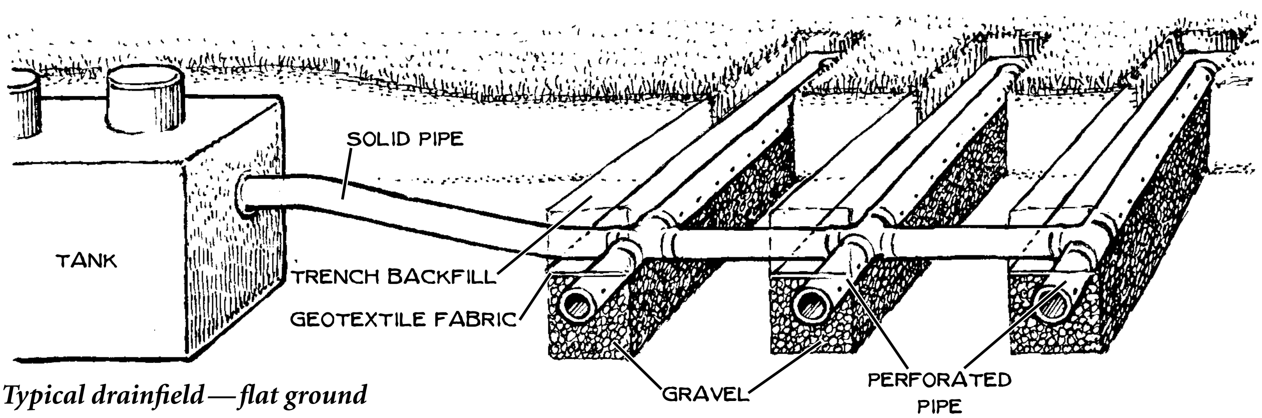
Once sewage undergoes primary treatment in the septic tank, the clarified effluent flows to the drainfield, where it is discharged into the soil for final treatment and disposal.

Note: A typical drainfield consists of several relatively narrow and shallow gravel-filled trenches with a perforated pipe near the top of the gravel to distribute the wastewater throughout each trench. In most cases, drainfields will perform almost indefinitely if the system is designed, used, and maintained properly.

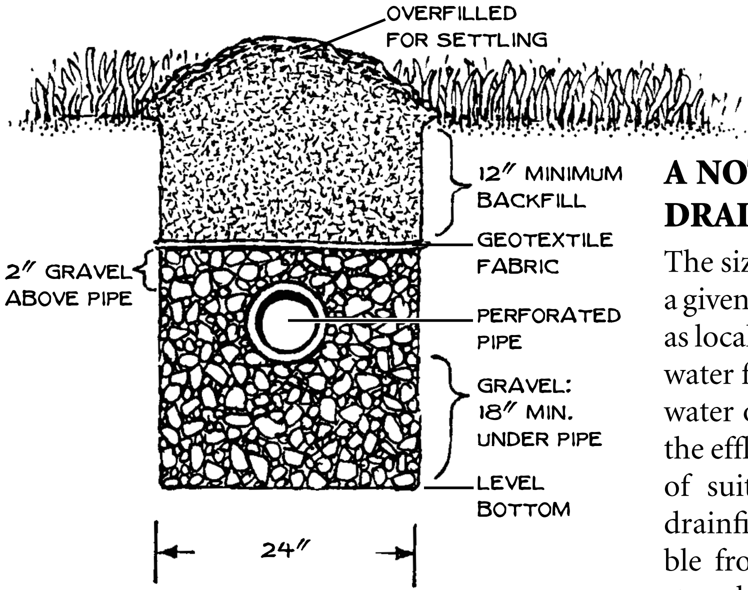
CONSTRUCTION OF DRAINFIELD

The typical drainfield trench is a level excavation, rectangular in cross section, with a level bottom. Trenches are typically 1 to 3 feet wide, 2 to 3 feet deep, and usually no more than 100 feet long. The trench is partially filled with a bed of clean gravel (¾- to 2½-inch diameter) to within 1 or 2 feet of ground surface. A single line of perforated pipe, 3 to 4 inches in diameter, is installed level (no slope) on top of the gravel and covered with an additional 2 or 3 inches of gravel.





Typical drainfield—flat ground



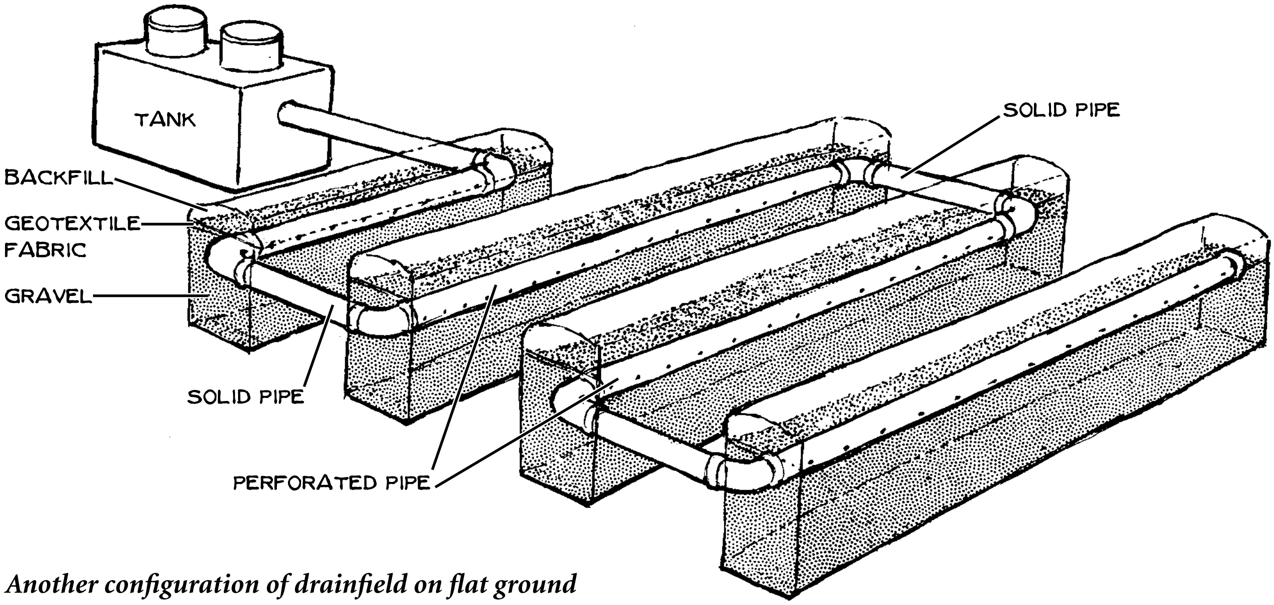
Cross section — typical drainfield. For an EPA diagram showing the pathway of air to the soil in a drainfield, see p. 159 in the Appendix.

The gravel is covered with a semipermeable geotextile fabric and the remaining 1 to 2 feet of the trench is backfilled with soil up to the ground surface. The fabric barrier keeps the backfill soil out of the gravel and prevents the fine soil particles from clogging the pores of the gravel. (Before the advent of geotextile fabric, a layer of straw or hay or untreated building paper was used for the soil-gravel barrier.)

A NOTE ABOUT DRAINFIELD DESIGNS

The size, design, and location of a drainfield for a given home depend on a variety of factors, such as local soil characteristics, the amount of wastewater flow, ground slope, and depth to groundwater or bedrock. The objective is to distribute the effluent into an area with an adequate depth of suitably permeable, unsaturated soil. The drainfield also should be located as far as possible from drinking-water wells, streams, lakes, steep hillsides, road-cuts, property lines, etc.

Specific design criteria are provided by local building or sewer codes and often vary from one locality to the next. Local health departments often require a permit before allowing any work on a drainfield and frequently can offer helpful advice. A comprehensive presentation of the many and various local design rules is beyond the scope of this book. Rather, our intent is to provide a basic understanding of what the drainfield is and how it works.



Another configuration of drainfield on flat ground

CHAPTER THREE

The Soil

> "SOIL IS THE KEY TO CLEAN WATER. IT IS A LIVING FILTER BETTER THAN ANY FILTER MAN HAS INVENTED. NO MATERIAL CLEANS NUTRIENTS OR DISEASE-CAUSING MICROBES FROM WASTEWATER AS WELL AS EARTH DOES. SOIL WORKS AS A PHYSICAL STRAINER, A CHEMICAL RENOVATOR, AND A BIOLOGICAL RECYCLER OF ALL WASTEWATER PASSING THROUGH IT."
>
> –*SEPTIC TANK PRACTICES*, PETER WARSHALL, ANCHOR PRESS, NY, 1979

THE SECOND NATURAL WONDER OF SEPTIC SYSTEMS

The first wonder of the conventional septic system is the mechanism of gravity power. *(See p. 18.)* No hardware, no motors. The second wonder is the amazing function of naturally occurring soil microorganisms in purifying septic effluent. Underground, a host of microscopic life forms are busy filtering, feeding on, and thereby purifying septic tank effluent.

SOIL BASICS

We will define some basic terms and attempt to give you a sense of these unseen, largely unknown, natural subterranean life forms that are working night and day on your behalf. Although this information may not seem as practical as other material in the book, it may have its useful aspects: if you understand the soil's life forms and their functions, it may help you to make better-informed decisions about what goes down the drain and what you can do to maintain a healthy system. *(See Chapter 4, "Down the Drain.")* Further, understanding a bit about the cleansing action of the soil is fascinating even to non-engineers—an example of a powerful force existing in nature that humans have been able to utilize so well.

Suitable soil is an effective treatment medium for septic tank effluent. The soil community consists of billions of microorganisms—including bacteria, protozoa, fungi, molds, and other organisms—living and interacting with the minerals, organic matter, water, and air which comprise the soil. This complex biological community, as well as the physical structure of the soil itself, provides the mechanisms by which the wastewater is purified as it percolates through the soil and returns to the underlying groundwater, or is taken up by plants, or is evaporated.

CHAPTER FOUR

Down the Drain

No man, woman launderer, or laundresse shall dare to throw out the water or suds of fowle cloathes in open streets, nor within lesse than a quarter of one mile, dare to do the necessities of nature, since by these immodesties, the whole fort may bee choked and poisoned. . . .

–from the first sanitation law in Virginia

DAILY HOUSEHOLD MAINTENANCE

Everyone knows that to keep a household functioning, floors have to be swept, the garbage taken out, and clothes washed. We all know that our cars have to be lubricated and the oil changed periodically. Yet very few people know anything about routine care and maintenance of their septic systems. Many of us grew up in cities, where everything went down the drain, never to be seen or heard from again.

Most septic system problems are due to lack of reasonable care and maintenance. Septic systems do require a few simple steps in daily household management, as well as a timely schedule of inspections and periodic pumping.

In this chapter we'll discuss what you can do on a daily basis to promote a healthy septic system. The previous chapters provided enough of the basics so you'll understand the following recommendations.

WHAT GOES DOWN THE DRAIN

There are three simple, basic things that you can do on a day-to-day basis to help your septic system.

1. Minimize the liquid load.
2. Minimize the solids load.
3. Be careful about what goes down the drain.

A DAILY WATER BUDGET

Water conservation practices ☐ compared with normal water use ☐

ACTIVITY (PER PERSON)	CIRCUMSTANCES	WATER USED	TOTAL
TOILET 4 flushes per day	ultra-low flush toilet	1.6 gallons per flush	6.4 gallons*
	conventional toilet	3.5–7 gallons per flush	14–28 gallons
SHOWER Once a day, 5 minutes	low-flow showerhead	2.5 gallons per minute	12.5 gallons*
	conventional head	3–8 gallons per minute	15–40 gallons
BATH Once a day	tub ¼ to ⅓ full	9–12 gallons	9–12 gallons
	full tub	36 gallons	36 gallons
SHAVING Once a day	one full basin	1 gallon	1 gallon*
	open tap	5–10 gallons	5–10 gallons
BRUSHING TEETH Twice a day	wet brush and rinse	¼ to ½ gallon	less than 1 gallon*
	open tap	2–5 gallons	4–10 gallons
WASHING HANDS Twice a day	one full basin	1 gallon	2 gallons*
	open tap	2 gallons	4 gallons
COOKING** Washing produce	1 full kitchen basin	1–2 gallons	1–2 gallons*
	open tap	5–10 gallons	5–10 gallons
AUTOMATIC DISHWASHER Once a day, full load	short cycle	8–12 gallons	8–12 gallons
	standard cycle	10–15 gallons	10–15 gallons
MANUAL DISHWASHING Once a day	full basins, wash/rinse	5 gallons	5 gallons*
	open tap	30 gallons	30 gallons
LAUNDRY Two full loads per week	portion of full load	10–15 gallons	10–15 gallons*
	full load	35–50 gallons	35–50 gallons
CAR WASHING Twice a month	5 full 2-gallon buckets	20 gallons per month	⅔ gallon/day
	hose, shut-off nozzle	100 gallons per month	3.5 gallons/day
LAWN TREES, SHRUBS, GARDEN	Watering requirements vary with plant species, type of turf, season, region, and soil type.		

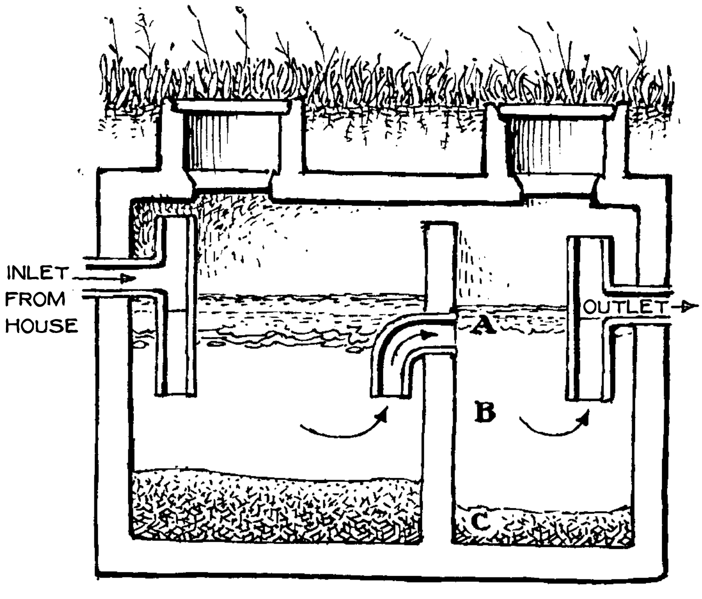
*Total with water conservation practices = about 50 gallons per day per person.
**Real cooking figures will be higher to include boiling water, rinsing utensils, etc.

CHAPTER FIVE

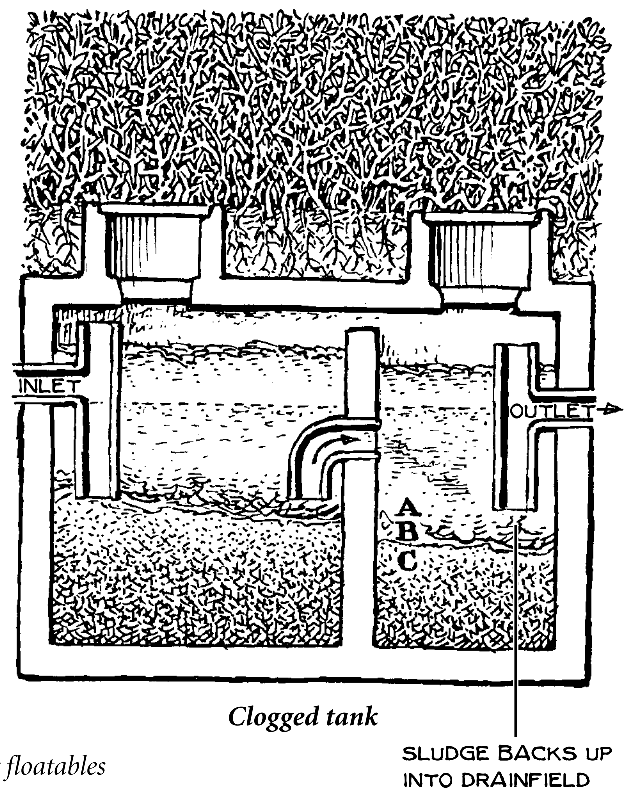
Septic System Maintenance

In the last chapter we talked about what goes down the drain. Here we're going to cover long-term periodic maintenance, which consists mainly of septic tank inspection and pumping when necessary. We'll also discuss drainfield inspection.

People often say, "Oh, I've never had to pump my tank," as if that were proof that their septic system works fine. But be aware, failure to pump tanks is (next to improper siting and design) perhaps the greatest single cause of septic system failure. Here's what can happen:



Healthy tank



Clogged tank

*A. **Scum** at top: cooking fats, oils, grease, soap scum, other floatables*

*B. **Liquids** in middle*

*C. **Sludge** at bottom: solids heavier than water and what is left over after solids have been partially eaten by bacteria. Once sludge gets up to outlet pipe, it enters and clogs drainfield.*

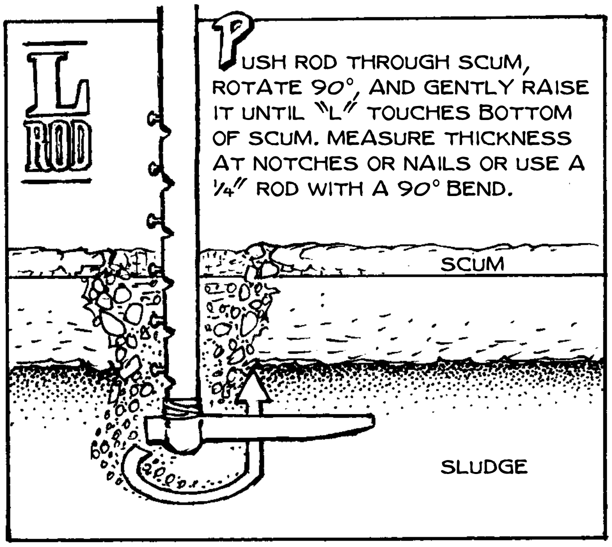
What to Look For

Once the tank is open, here's what to look for (assuming the tank has two compartments):

Inlet Chamber

1. *Odor:* Odors should not be *too* obnoxious when you open the inlet side. (Odors will be a lot stronger when you stir the contents.)
2. *Insects:* There should not be too many flies or flying insects present.
3. *Scum:* Should be firm, with a crust, but not solid. It should be like pudding, a medium brown color, and 3 to 4 inches deep. By poking a stick through the scum, you can estimate the average thickness. Or, you can fashion an "L-rod," as shown at the top right. You can figure on there being equal amounts of scum above and below the water line.)

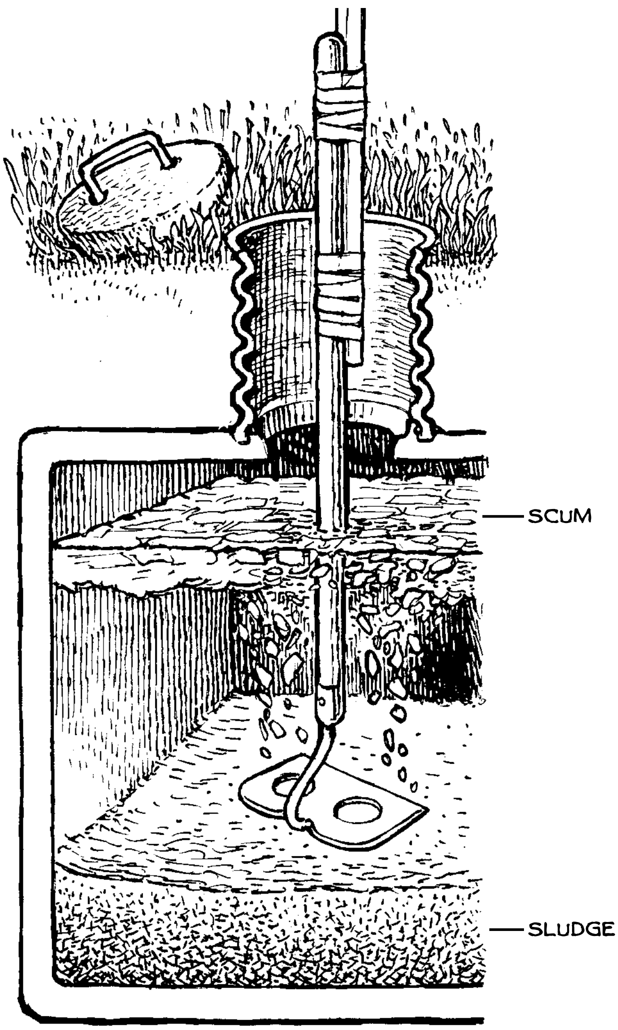
   Tip: Sometimes you can use a hose with high pressure to squirt a hole in the scum big enough to estimate its thickness.
4. *Sludge:* You can use a long stick, but best is a concrete hoe (the type with two holes is best) and an extension handle wired or taped on. As you lower the hoe, it's a little tricky is to tell when you first hit the sludge. Thus, proceed slowly. If you feel resistance halfway to the bottom, it needs pumping.
5. *Inlet tee:* Concrete tees deteriorate. Be sure to check this.



Homemade scum-measuring device

A COOL SLUDGE/SCUM TOOL

GET A 1-INCH CLEAR PLASTIC TUBE, 5 TO 6 FEET LONG. SLOWLY PUSH THE TUBE TO THE BOTTOM OF THE TANK, THEN COVER THE TOP WITH YOUR THUMB AND REMOVE CAREFULLY. WIPE THE TUBE OFF, AND YOU SHOULD BE ABLE TO SEE A PROFILE OF YOUR TANK, INCLUDING SLUDGE, CLEAR EFFLUENT, AND SCUM.



Homemade sludge-measuring device
You can use hoe to measure depth to *sludge, then a rod to measure depth* of *sludge.*

CHAPTER SIX

Red Alert! . . . System Failure

Your system has failed—that's presumably why you're reading this chapter. Water has backed up into the shower, the toilets won't flush, and/or drains won't drain. This means wastewater has backed up from the tank through the main drain into the house. *It's going the wrong way!* Or—untreated effluent is surfacing on the ground. In this chapter we'll talk about different types of failures, their causes, and what to do when your system fails.

PROBABLE CAUSES OF FAILURE

One or more of the following may have happened:

1. The sewage pipe between the house and the tank is blocked or broken.
2. Either the inlet or outlet tee is blocked or broken.
3. The line between the tank and drainfield is blocked or broken.
4. If the system has a pump, there may have been an electrical or mechanical failure.
5. The tank itself is blocked with solids or has collapsed (an old redwood tank perhaps).
6. The drainfield is flooded due to heavy rains or flooding.
7. The drainfield is (partially or completely) clogged with solids or roots.

LOCATING THE PROBLEM

When the septic system is failing, there is a procedure for locating the cause, called the *discovery process,* in which you search for the problem in the following order:

System Blockage

You start by searching for a blockage somewhere in the system because this is the easiest cause to locate, and the easiest (and cheapest) problem to solve.

1. If only one fixture does not drain, check for blockage between the fixture and the main drain pipe. Use clean-outs for checking.
2. If all fixtures on one branch of the drain pipe do not drain, check for blockage in that branch. Also, check the tank inlet for blockage.
3. Open the tank.

   If it is flooded, the problem may be at the outlet or beyond. Check the outlet for blockage.

   If it is not flooded, you can check the various household fixtures by running a hose down them to see if the water makes it to the tank.
4. If sewage is not arriving at the tank, then check for a pipe line blockage between the house and the tank.

CHAPTER SEVEN

Graywater Systems

FIRST, SOME DEFINITIONS

Blackwater is wastewater from the toilet or kitchen sink.*

Graywater is simply everything else.

Graywater system is a system which separates graywater from blackwater to divert it away from the septic tank.

WHY DIVERT GRAYWATER?

Separate treatment of graywater can greatly reduce the load on a septic tank. It can also provide water (and nutrients in some cases) to plants; this is especially useful in times of drought or where water is in short supply (or expensive).

Washing Machine and Bath/Shower

The two largest producers of wastewater are the washing machine and the bath/shower. Laundry water is relatively easy to recycle since no changes are needed in the house plumbing. It is also relatively easy to install a diverter valve for sinks and bath/shower, so that you can toggle between a graywater system and the septic tank, as conditions warrant.

Wastewater from the toilet *and* the kitchen sink are blackwater and should go into the septic tank. Many people have tried diverting kitchen sink water into graywater systems, usually with unfortunate results (smell, clogging, frequent maintenance).

*Kitchen sink water is generally not considered blackwater, but because of the many raw food particles it contains and the problems they can cause, we put it in the blackwater category.

WHAT CAN GO WRONG: HEALTH CONSIDERATIONS

Graywater may contain infectious organisms, so keep this in mind when designing and using a system. Even though graywater is the water you just bathed in, or residue from clothes you wore not long ago, it may contain harmful microorganisms. (Bath/shower water, even laundry water, for example, may contain traces of feces.)

Safety Guidelines

All graywater safety guidelines stem from these two principles:

1. Graywater must pass slowly through healthy topsoil for natural purification to occur.
2. Graywater systems should be designed so that no contact takes place before purification.

When graywater is used for irrigating plants, it is purified naturally by biological activity in topsoil, as in a septic tank drainfield. The treatment level is probably higher, however, since biological activity is highest in the top few inches of soil. The water and nutrients are certainly more available to plants. Soil microorganisms break down organic contaminants (including bacteria, viruses, and biocompatible cleaners) into water-soluble plant nutrients. Plant roots take up these nutrients and much of the water. The pure water left over percolates down and recharges the aquifer.

EBBE'S SMALL DRAINFIELD

This system was designed by Ebbe Borregaard for washing machine discharge. It consists of a shallow underground system, 7 feet × 22 feet × 15 inches deep, with no holding tank or filtering.

Construction Details

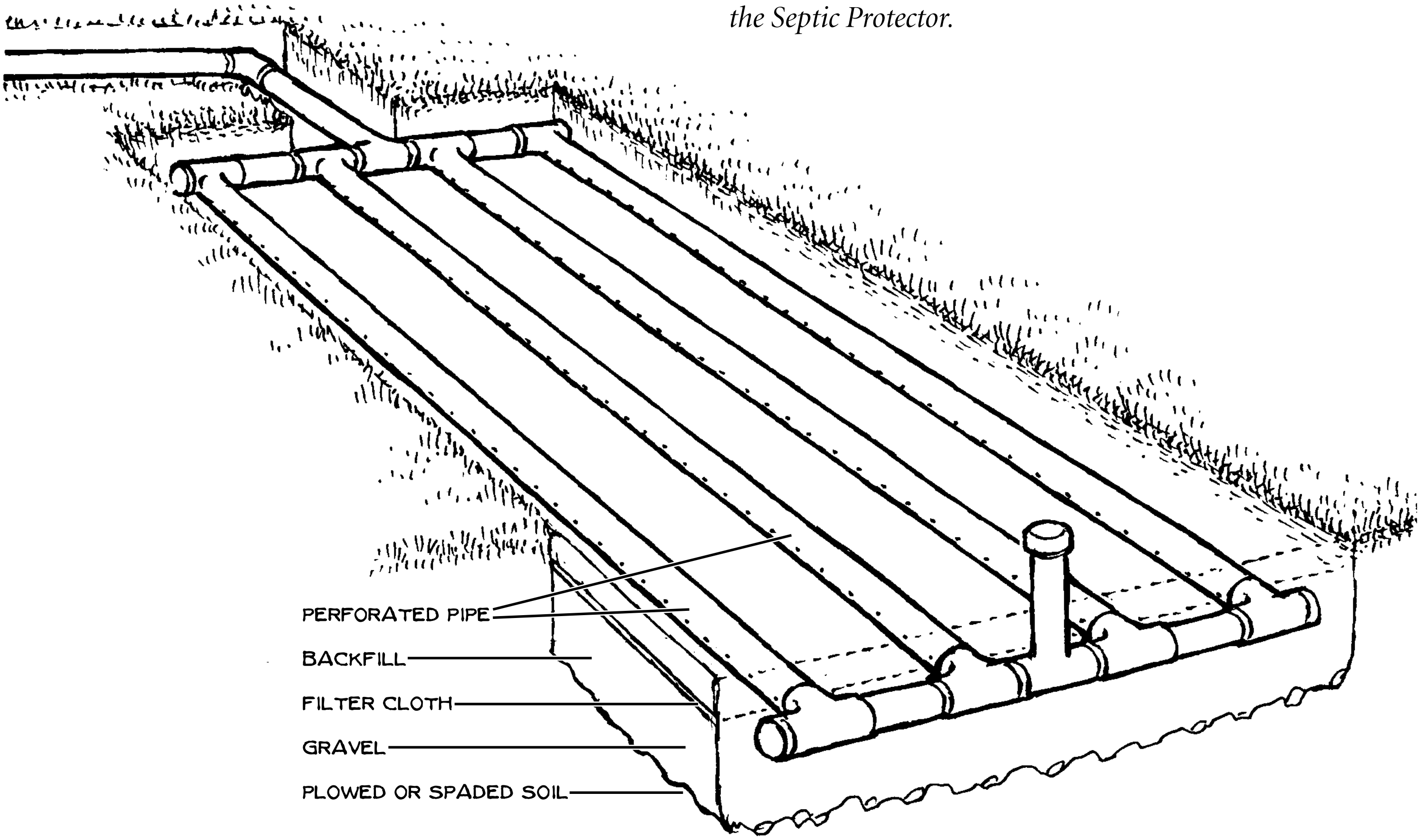
The bottom is loosened with a digging fork (or rototiller), then layered with about 4 inches of gravel. Next a system of manifolds (feeder pipes) and drain lines of 4-inch flexible plastic perforated pipe is assembled. Pipe and gravel must be level.

The gravel is covered with landscape filter cloth to reduce silt infiltration, and the topsoil is replaced. The pipes in this system hold about 65 gallons, enough to accept almost two laundry loads of water—even if percolation is slow.

In areas of high water tables and winter saturation, this drainfield could conceivably be a mini-mound (partially above grade).

The same type of drainfield has been used by some homeowners for outdoor showers.

Note: It is important to keep lint out of this system, to avoid clogging. *See p. 175 for info on the Septic Protector.*



Small drainfield
This simple drainfield is set up to receive wastewater directly from shower, bathtub, bathroom sink, or from surge tank connected to washing machine.

CHAPTER EIGHT

Composting Toilet Systems

by Carol Steinfeld

This garbage heaped up beside the stone blocks, the tumbrels of mire jolting through the streets at night, the awful scavengers' carts, the fetid stream of subterranean slime that the pavement hides from you, do you know what all this is? It is the flowering meadow, it is the green grass, it is marjoram and thyme and sage . . . it is perfumed hay, it is golden wheat, it is bread on your table, it is joy, it is life.

–*Victor Hugo,* Les Miserables, *1862*

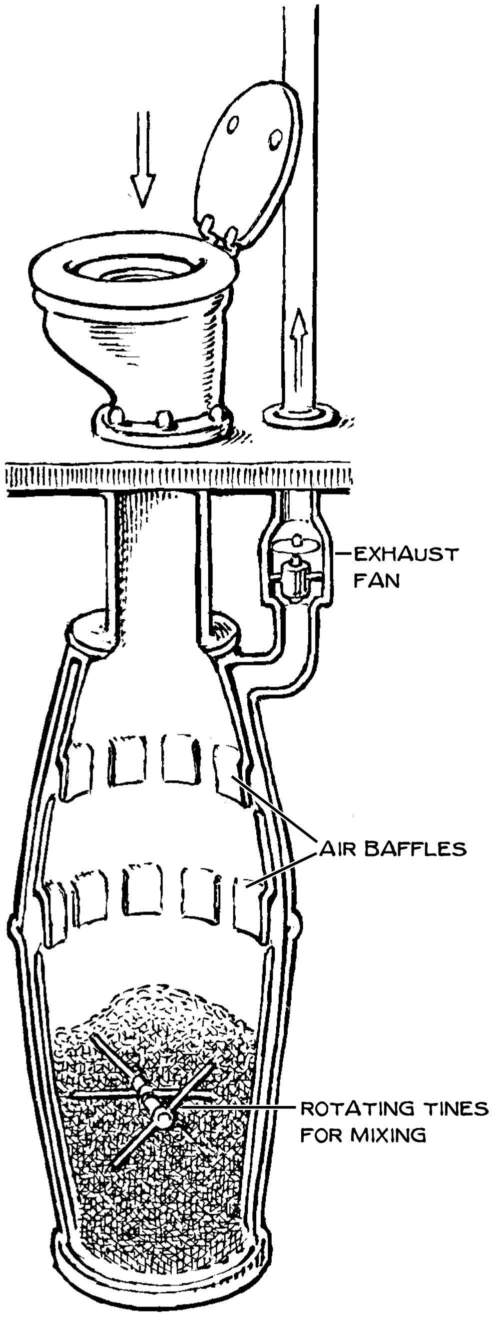
When a full septic system is not feasible, such as in remote areas or where there is poor soil drainage, an alternative system can include a composting toilet system.

Composting toilets (also known as dry, biological, or waterless toilets) use the same biological process as that at work in a yard waste composter to oxidize and break down blackwater (excrement and toilet water) into a stable form that looks like soil, not sewage.

Once considered an option only for parks, back-to-the-landers, and seasonal cottages, composting toilet systems are now turning up in mainstream homes and buildings. Increasing their acceptance is the adoption of microflush toilets and graywater-only systems for the rest of the wastewater equation. Also, many owners now opt for service contracts to maintain the systems.

Composting relies on air-using, or *aerobic,* bacteria, which work 10 to 20 times faster than the anaerobic bacteria at work in septic tanks. So, the challenge of composting toilets is getting air to the composting process while minimizing human exposure to it. That requires careful engineering of air flow so that air is taken in and then exhausted through the exhaust chimney, not the toilet room. It also requires some management of the composting material: either turning or batching the material and adding chunky carbon material to keep it porous, so the aerobic bacteria are healthy and functional. Keeping the material aerated also means that it can't be saturated, so only waterless or microflush toilets are used with composting toilets.

Composting toilets first enjoyed relatively wide play in the United States in the 1970s in response to new awareness of water pollution caused by wastewater. A few companies and nonprofit organizations introduced manufactured models and build-it-yourself designs. However, the need for testing became evident when several systems proved faulty, due to shoddy construction or poor designs that revealed a misunderstanding of the requirements of composting. There were reports of odors, flies, incomplete processing, hard-to-empty systems, and compacted organic material. Formal damnation came in the early 1980s from the U.S. Environmental Protection Agency and the California Department of Health in the form of a report that identified flaws resulting from poor design,



Phoenix Composting Toilet System
Bulking agent, such as wood shavings, is added for aeration and additional carbon. Tines are rotated manually to mix material. Note air baffles inside tank for adequate oxygen intake, and fan in vent for exhausting odors.

A COMPOSTING FUTURE?

Composting toilets are fast losing their reputation as rustic toilets, and due to growing awareness of water pollution sources, are getting more serious attention from regulators, public health officials, and property owners.

They're becoming more high-tech, with sensors and monitors that automatically adjust for heat, air, and moisture.

In the future, composting toilet systems may be serviced by central management districts, and the end-product taken to a central composting facility.

THE KEYS, THEN, TO SUCCESSFUL COMPOSTING TOILET SYSTEMS ARE:

1. A WELL-DESIGNED UNIT
2. PROPER INSTALLATION
3. CONSCIENTIOUS MAINTENANCE

NORTH AMERICAN COMPOSTING TOILET MANUFACTURERS AND DISTRIBUTORS

BioLet
150 East State Street
Newcomerstown, OH 43832
800-524-6538
www.biolet.com

Clivus Multrum
15 Union Street
Lawrence, MA 01840
800-425-4887
www.clivus.com

CHAPTER NINE

Advanced Systems

The beauty of a typical standard system—comprised of a septic tank and a drainfield—is that it uses no electricity or mechanical devices. Aside from periodic pumping of accumulated septic tank solids, the system operates by natural processes. Gravity—that deceptively elegant and often overlooked principle—provides all the power needed for water and wastes to flow through the system. Treatment and disposal of the wastewater is accomplished by natural physical, chemical, and biological processes in the soil of the absorption system.

Given adequate site and soil conditions, septic systems with gravity-flow drainfields can provide successful sewage treatment and disposal for decades—some say practically indefinitely—when properly constructed and maintained.

Just what is an "advanced system"? What we call here "advanced systems" are those used where the conventional gravity-fed system will not provide adequate treatment, typically due to insufficient land, high groundwater, proximity to rivers, bays, lakes, etc., poor soil, or shallow soil over bedrock. An advanced system is, in the broadest sense, one which incorporates some modification of, or addition to, the standard gravity-powered tank and drainfield setup. A wide variety of advanced systems have been developed in response to the needs of different site conditions. Since these systems are used for sites with limited soil or other problems, the margin of safety (otherwise afforded by optimal soil and site conditions) is limited, and any failure is likely to be difficult (and expensive) to correct.

TYPES OF ADVANCED SYSTEMS

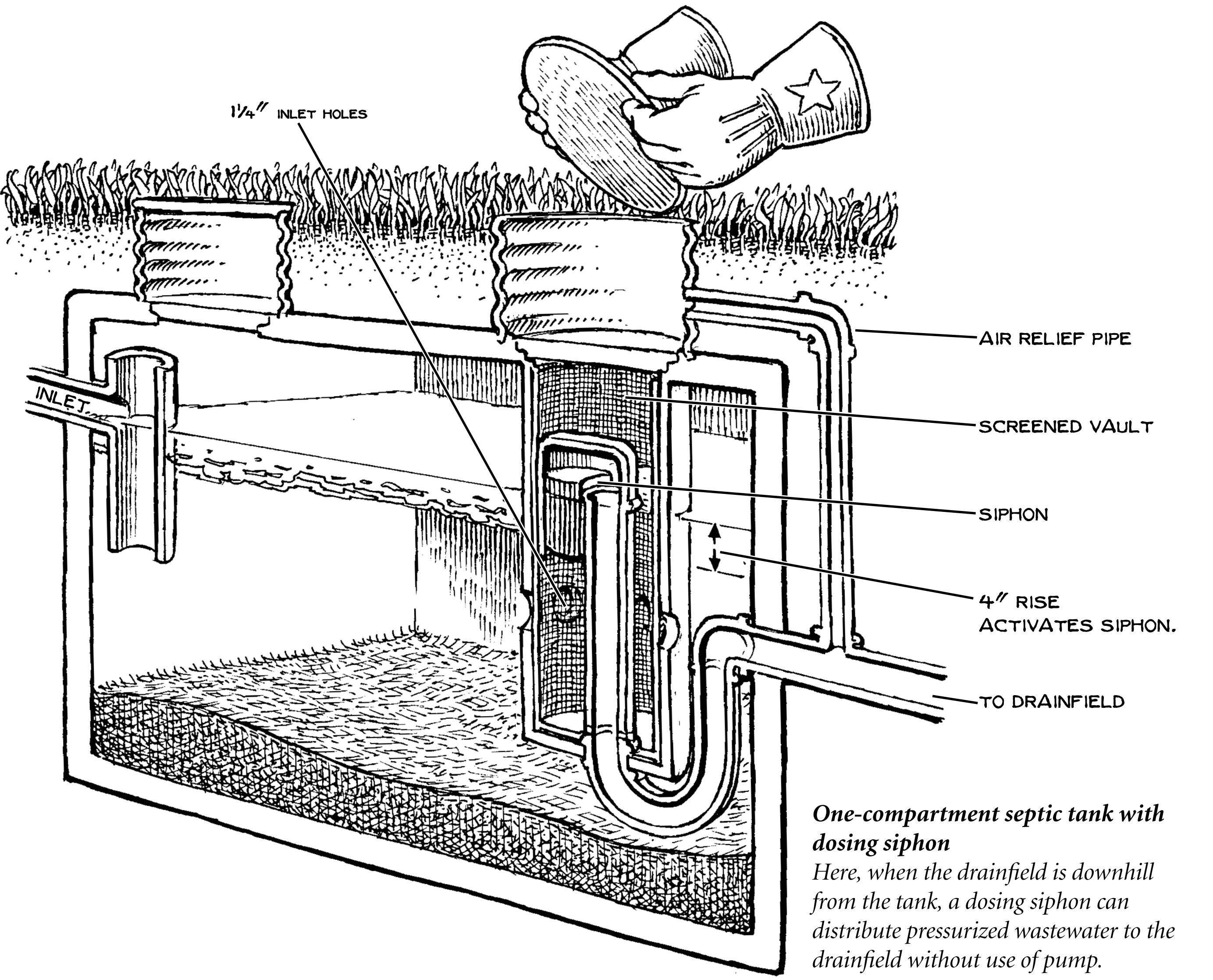
In the original version of this book, we described five advanced systems:

1. Dosed-flow systems
2. Mound systems
3. Sand filters
4. Gravel filters
5. Wetlands

The idea was to tell homeowners how each works, for two reasons:

1. So that if you were involved with construction of a new system you would understand some basic principles and be better informed when talking to regulators and engineers
2. Or in case you already had an advanced system, you would understand how to maintain it properly

In this revised edition we have amended the description of the above five systems, added a number of new (to us) advanced systems, and given references for more complete information.



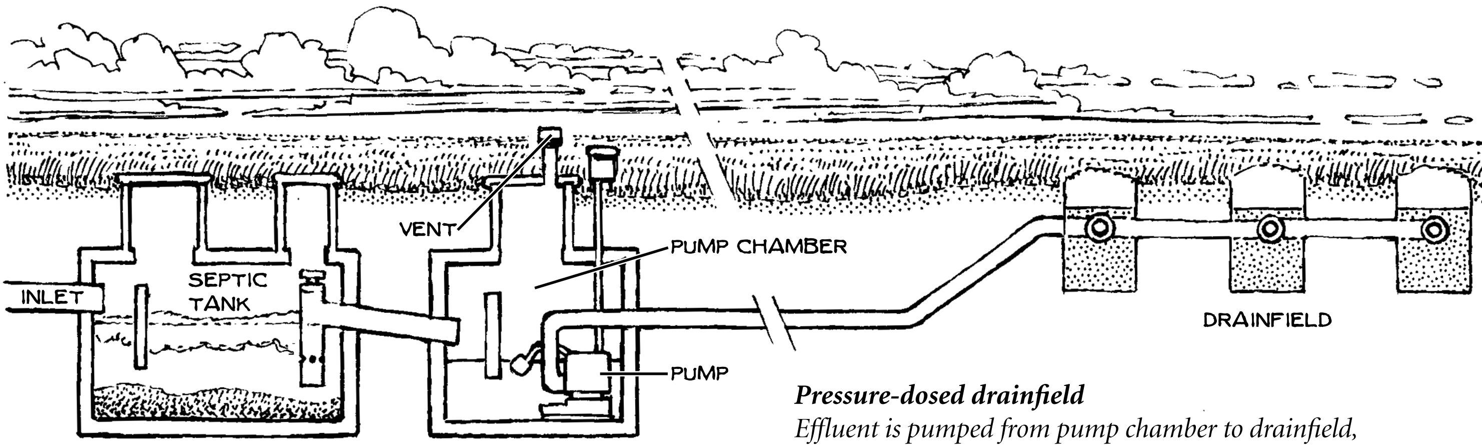
One-compartment septic tank with dosing siphon
Here, when the drainfield is downhill from the tank, a dosing siphon can distribute pressurized wastewater to the drainfield without use of pump.

DOSED-FLOW DRAINFIELDS

"Dosed-flow" refers to controlling the flow of effluent to the drainfield, as opposed to the continuous gravity flow of conventional systems. In addition to evenly distributing the water in the drainfield, timed doses allow the system to rest and recover between loadings, and avoid peak hydraulic loads on the drainfield. This helps maintain a stable biomat and prevents the oxygen in the vadose zone (area where air is available to soil) from being depleted. New systems of tanks, level sensors, controllers and pumps have made the systems more reliable than they were in the past.

Dosing Without Pressure

Here effluent is distributed to the drainfield in periodic, large-volume doses. Dosing is achieved by a pump *(see p. 88)* or, if the drainfield is located far enough downhill from the tank,

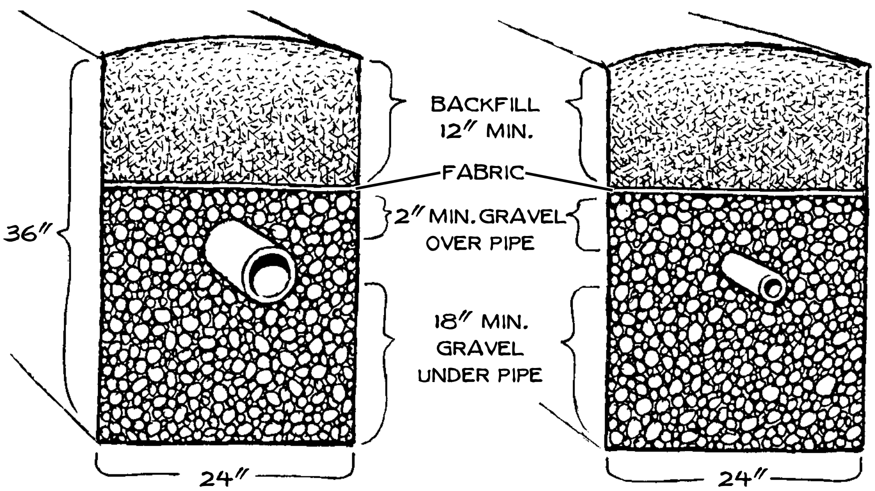


Pressure-dosed drainfield
Effluent is pumped from pump chamber to drainfield, where it is distributed under pressure in trenches.

with an energy-free dosing siphon. Effluent accumulates in the dosing tank (pump chamber) up to a predetermined volume, at which point the pump or siphon is activated, and the accumulated effluent goes to the drainfield in a single dose. The pump or siphon then shuts off until enough effluent has again accumulated in the dosing tank. There are also dosing systems with timers that dose periodically. There is also the "flood-dosed" system that is designed so that the pump fills all the pipes at once, thus utilizing the entire field. Some tanks are designed with the pump chamber in the same tank instead of using two separate tanks.

Dosing with Pressure

A pressure-dosed system, also called a pressure distribution system, provides for periodic dosing of large volumes of effluent. All of the pipes within the drainfield are filled during each dosing cycle, and a uniform volume of effluent is distributed out of each hole in the network; this allows the soil to drain between applications. Drainage brings air into the drainfield, and reduces excessive biomat growth and soil clogging. This even distribution of effluent over the entire drainfield length provides more contact with soil organisms and, therefore,



Comparison of typical gravity-flow drainfield (l) and pressure-dosed system (r)
Left: Pipe is 3"–4" diam. with one or two rows of ½"–⅝" diam. holes along bottom, spaced 3"–6" apart.

Right: Pipe is 1"–2" diam. with one row of ¼"–½" diam. holes along bottom, spaced 1"–3" apart.

CHAPTER TEN

Excessive Engineering and Regulatory Overkill

You might say it all started with the Clean Water Act of 1972, when billions of dollars were allocated to clean up America's water. With all that money floating around, it didn't take long for some engineers and some regulators to devise a methodology for extracting the maximum amount of grant money available. It was all so easy. First, septic systems are underground and out of sight; low visibility. Second, who could argue with the idea of "clean water"?

So 15–20 years ago, engineers and regulators (some of them) decreed that simple gravity-fed septic systems were inadequate. They tightened up requirements, instituted new regulations, and thus began the new world of overblown, over-expensive septic systems. I got personally involved in a typical such scam in my hometown in 1989, and it was actually this experience (fighting against an albatross of a plan) that led to this book.

I considered writing about this situation when this book was first published in 2000. But the amounts of money were so huge, and the schemes so well orchestrated, I didn't think anyone would believe it. This was corruption completely missed by the media. The sums were huge. No one had an inkling. Well now, almost seven years later, the same things are going on, and more so. In this chapter, we'll give you the background, the history, and then case studies of small towns caught up in distorted engineering and excessive onsite wastewater disposal costs. In Chapter 11, "The Tale of Two Sewers," John Hulls describes how two California towns took two very different approaches in dealing with over-inflated wastewater projects. This leads into Chapter 12, "Small Town System Upgrades," where we describe how a community can take control of its own wastewater destiny and utilize local power in dealing with engineers and regulators.

A BRIEF HISTORY OF THE CLEAN WATER ACT AND THE EPA VALIDATION OF ONSITE WASTEWATER TREATMENT

There was very little national regulation of waste discharge until the Clean Water Act of 1972, which was spurred by the Cuyahoga River in Cleveland actually catching fire from pollutants, and the Santa Barbara oil spill, which coated the beaches of California with 250 million gallons of crude oil. The act required anyone discharging wastes to obtain a permit and properly treat the effluent from all point sources of pollution. It started a massive federal program to upgrade sewers and waste treatment plants, allocating over $250 billion by 1990. Citizens of Cleveland now enjoy dozens of dragon boats racing down the Cuyahoga River at the annual Burning River Festival, and many rivers and lakes in the nation have been restored to the point that the public can enjoy them once again.

CHAPTER ELEVEN

A Tale of Two Sewers

by John Hulls

A precautionary tale for small communities in which we look at two very different ways to approach onsite waste disposal.

For the first group of folks it happened suddenly: regulatory agencies breezed into town, and announced that everyone was going to have to reduce the bacteria in the local bay by 75 percent . . . *or else!* And the agencies knew exactly who the culprits were, even before they did any tests: *septic tanks and farmers!* On one side of the bay, there was a small town and several houses strung right along the shoreline, some sitting on pilings over the water. Many of these houses had been there since the turn of the century so there were a lot of old septic tanks, and some houses had very limited land for the drainfields. But other homes in the community had adequate land for wastewater disposal, with septic systems apparently working fine. Regulators were talking about a major wastewater project, hooking up all the houses on the bay. Some people started asking questions . . . the local paper got interested. It would be the start of a long struggle.

In the other town, alongside a river, the first time most townsfolk heard about it was when they got notes in their mailboxes. After ten years of study by a small group of citizens, (including real estate interests), public officials (friends of the real estate interests), and engineers (who had already been paid hundreds of thousands of dollars), townspeople were finally called together and put things to a vote. Pollution had been detected in a stream leading into the river and even though no DNA testing was done to determine if the pollution was animal or human, they knew exactly what was causing the problem . . . *septic tanks*!

IS THERE REALLY A PROBLEM?

IT IS VERY IMPORTANT TO UNDERSTAND THAT THERE ARE POLLUTION PROBLEMS, AND BUREAUCRAT PROBLEMS. THE EPA WANTS ALL WATERWAYS TO MEET "FISHABLE/SWIMMMABLE" STANDARDS. IF A BODY OF WATER IS "IMPAIRED", THE STATES MUST PUT IT ON A LIST CALLED A 303(D), AND ESTABLISH A "TMDL" (FOR TOTAL MAXIMUM DAILY LOAD) FOR VARIOUS POLLUTANTS.

SOMETIMES, AGENCIES INVOLVED WILL SAY THERE IS A PROBLEM EVEN WITHOUT PROPER SCIENTIFIC PROOF BECAUSE IT ENABLES THEM TO GET REGULATORY AUTHORITY OVER AN AREA, OR EVEN WORSE, JUST TO GET FUNDING.

IF YOU'RE IN A SMALL COMMUNITY, DON'T TAKE THE WORD OF LOCAL REGULATORS AND ENGINEERS; YOU'LL OFTEN FIND THAT LOCAL AGENCIES ARE NOT FOLLOWING NATIONAL GUIDELINES. CHECK OUT NATIONAL STANDARDS AT THE EPA'S TMDL HOME PAGE:

HTTP://WWW.EPA.GOV/OWOW/TMDL/INTRO.HTML

Further, it was not a one-person/one-vote ballot. Businesses got more than one vote (such as ten for a restaurant), and the real estate developer who was part of the original group got 20 or 30 votes, one for each of his undeveloped lots. There were 200 undeveloped lots in all, each with a vote.

"The subject is a peculiar one."

–George Jennings, 1851

Our stone age ancestors apparently lived by the waterside: the earliest Paleolithic tools discovered were found in gravel alongside rivers. Since these people had no way of bringing water to their homes, they brought their homes to the water.

Once people moved away from the riverside (or lake, stream, waterfall, etc.), and water had to be carried, it obviously became more precious. Drinking and cooking would have come first, with bathing at home rare. The exertion of carrying water even a short distance would have outweighed the refreshing effects of bathing in it.

At some point in history, there came the revolutionary concept of channeling running water to human dwellings, and then, of using running water to carry away wastes. And with greater concentrations of populations and people settling in fixed locations, disposal of household (and later, industrial) wastes became increasingly important.

And so our short history begins.

In this book we are concerned with onsite and (in most cases) waterborne waste disposal, and in this regard, we will consider a bit of the historical background on the subject. This is by no means a comprehensive history, for that would require a book in itself. Rather, it is a collection of significant—or interesting, or amusing—practices and inventions that have led to present-day practices.

It is also admittedly Anglocentric; we cover mainly English and American history, since all of our references were in the English language. However, it is worth noting that England was at the forefront of European sanitation inventions of the last 400 years.

BUILDING/HOME

"The subject is a peculiar one . . ."
– George Jennings, London, 1851

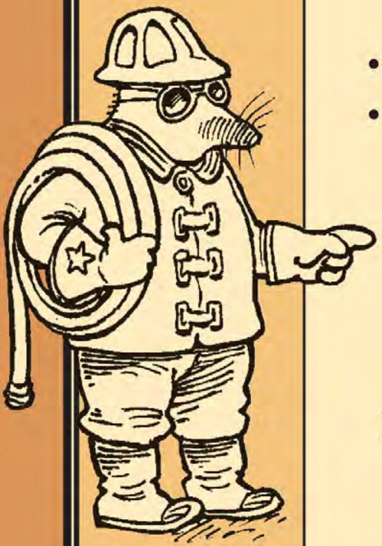
THE SEPTIC BASICS

What's going on underground:

Tanks • Drainfields • Soil • Microorganisms
Gravity power • Tank pumping
Inspections • System failure

What you can do:

- To promote and maintain a healthy system
- To upgrade or make repairs when needed



What this book is:

A straightforward, easy-to-understand, non-scholarly book on small-scale residential wastewater disposal

New advanced systems:

Dosed-flow drainfields • Trickling biofilters
Recirculating sand filters • Effluent filters
Shallow drainfields • Drip irrigation
New solutions for failed drainfields

The new overpriced septic systems:

Excessive engineering • Overzealous regulation
Now happening all over the country
Read it and weep!

Small-town activism:

How homeowners in small towns can control their own wastewater destiny

Lloyd Kahn is the author of *Shelter* and *Home Work: Handbuilt Shelter.*

Artist **Peter Aschwanden** illustrated John Muir's classic *How to Keep Your Volkswagen Alive*.

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