



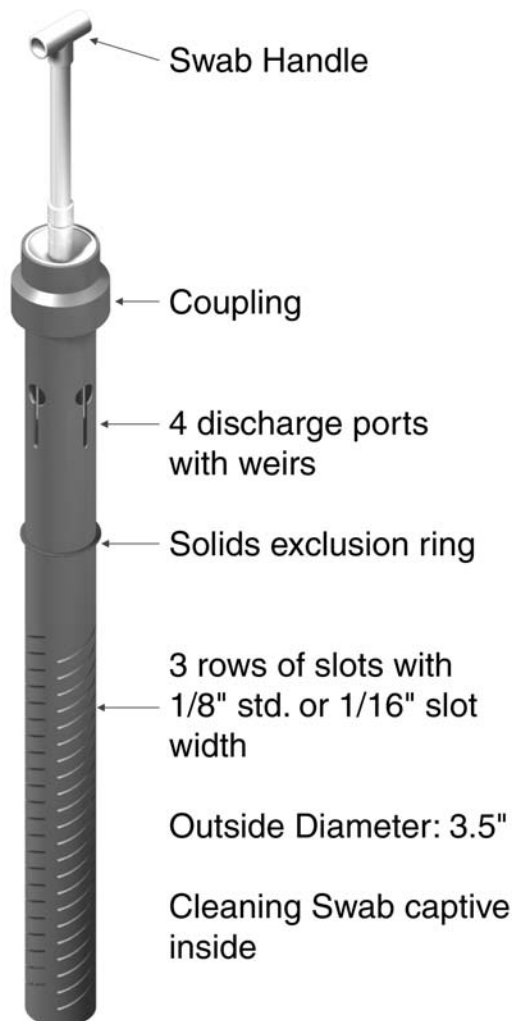
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SaniTEE™: An Ideal Septic Tank Wastewater Screen

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SaniTEE™ is an effluent wastewater screen (commonly known as an effluent filter) that reduces the gross suspended solids discharged in septic tank effluent. This helps extend the lives of drain fields, reduces clogging of orifices in effluent disposal systems, and allows use of non-solids handling effluent pumps. It is shown in Figure 1.

It fits inside a standard septic tank outlet tee by dropping in place something like a pistol fits in a holster, as shown in Figure 2. It is pictured in a single compartment tank but it fits just as well in a two-compartment tank.



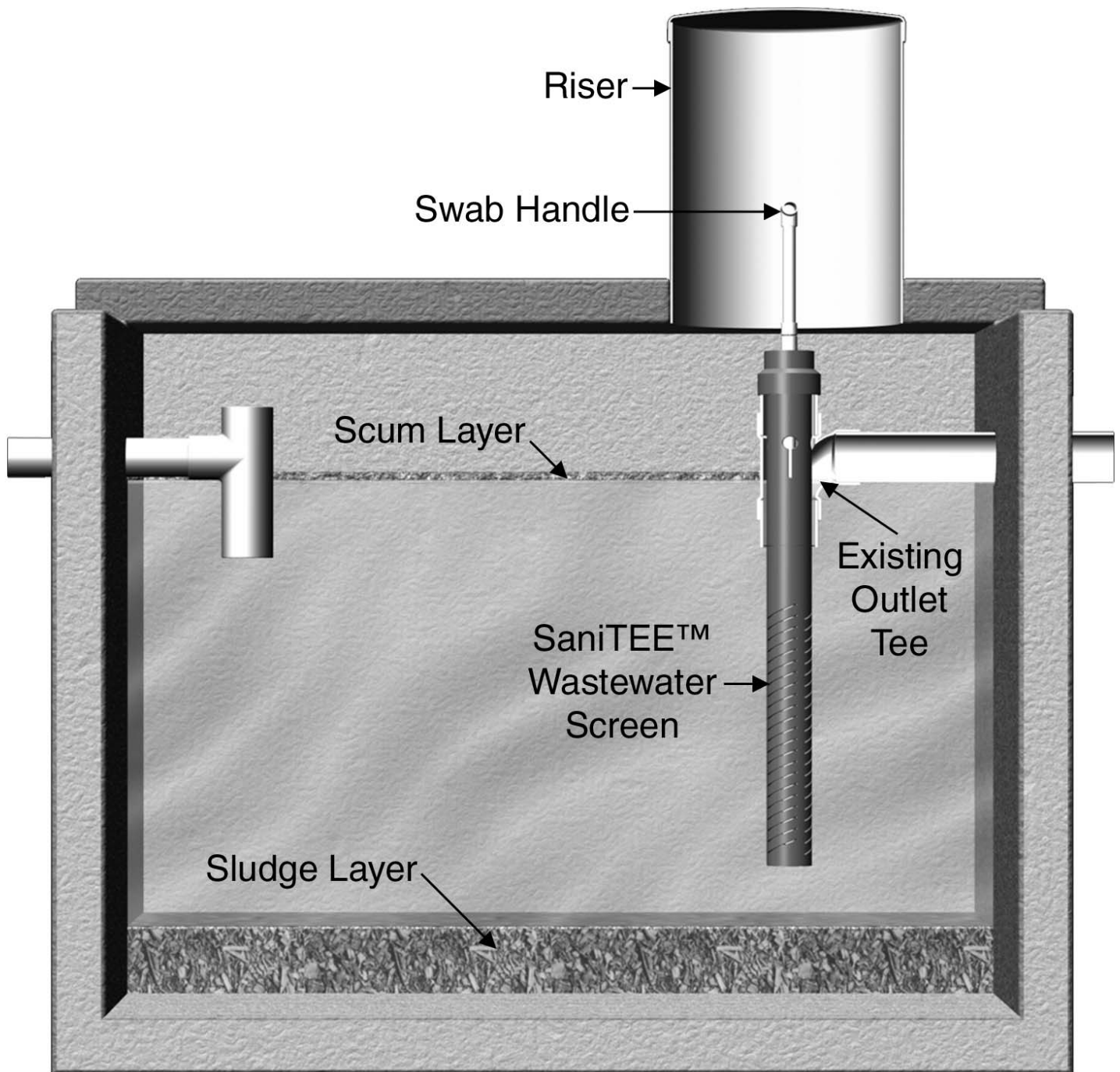
Effluent from the clear space between the sludge and scum layers enters the side of SaniTEE™, passing through the slots. Then the clarified effluent travels up through the inside of SaniTEE™, and out through the keyhole weirs to discharge via the standard outlet tee piping. Gross solids can not leave the tank by the usual path, through the septic tank outlet tee, because the solids exclusion ring blocks the annular space within the outlet tee.

SaniTEE™ works in three ways to improve the quality of effluent: (1) The slots are 1/16-inch wide and do not allow solids larger than that to pass. (2) The keyhole weirs provide flow attenuation to dampen surge flows that otherwise would scour solids out of the septic tank with the effluent. (3) Flow enters SaniTEE™ from the side, not the bottom, so the escape of gas-lifted solids is reduced.

Figure 1: SaniTEE™ component diagram

Due to technological progress, design and materials are subject to change without notice.

Figure 2: SaniTEE™ installed in a standard single-compartment septic tank.



It is easy to clean SaniTEE™ without removing it by operating the swab captive inside it. Or, SaniTEE™ can be lifted out of the septic tank outlet tee for cleaning and inspection. Since it is long and not within an exterior housing, it performs something like a dipstick in measuring sludge. When removed, the standard septic tank outlet tee naturally resumes its function since it has not been altered or damaged in any way.

Features of SaniTEE™:

- the slotted screen reduces the discharge of gross solids
- weirs attenuate surge flows to improve effluent quality
- works as a gas-deflection baffle
- easy to clean with the swab
- easy to install or remove
- dipstick feature to measure sludge
- does not require modification of septic tank outlet tee

Materials and dimensions – SaniTEE™ is made from plumbing grade ABS and/or PVC plastic, and is 3-1/2 inches in diameter, 46 inches long. The swab disc is Buna N. Slots are 1/16-inch wide, and 3-inches long. There are 3 rows of slots, 22 slots per row. The 4 keyhole weirs are 1/4-inch wide, 2 1/2 inches tall, topped with a 1-inch diameter hole. Custom designs are available.

Details and dimensions are subject to change without notice.

Solids in septic tank effluent – Where screens have been used on septic tank systems, captured solids have been identified as shown in the following table. All solids are detrimental to the degree they impart a loading to the treatment and disposal facilities. Larger solids are particularly troublesome if small diameter orifices are used in the treatment or disposal piping, such as with many pressurized systems, since the solids can cause clogging. When effluent pumps are used that are not capable of passing gross solids, screening is needed for obvious reasons.

Solids Screened from Septic Tank Effluent:

- | | |
|---------------------------------|---------------------------|
| ▪ sanitary napkins and products | ▪ bits of paper and cloth |
| ▪ cigarette filters | ▪ seeds |
| ▪ plastic sandwich wrap | ▪ clumps of detergent |
| ▪ condoms | ▪ lint |
| ▪ vegetable and fruit peelings | ▪ hair |
| ▪ chewing gum | |

Causes for discharge of solids from septic tanks – As sewage enters the septic tank, grease, oils, and solid particles lighter than water rise to join the scum layer that floats at the surface. Heavier solids settle to the bottom to join the sludge layer. In between these layers is a space of relatively clean effluent, the area from which effluent is discharged. There are some fine particles and a few larger solids in the effluent since some solids have neutral buoyancy and because the sedimentation process is not 100 percent efficient.

From experience, it has been clearly seen that gross solids are regularly discharged from septic tanks at some installations but not others, depending on the habits of the home occupants. These practices include disposing of chewing gum, plastic and rubber materials, sanitary napkins and products, and so forth.

As the sludge on the bottom of the tank digests, considerable gas is formed and released as bubbles. These bubbles often become attached to sludge particles and lift them to the surface where they may stick to the scum layer and remain there, or when the bubble breaks the particle may settle back down to the sludge layer. As the “gas lifted” solids pass through the clear space, some of them rise into the bottom of the septic tank outlet tee and are carried out with effluent.

A simple experiment can be done to see the gas-lifting of solids. Put 4 or 5 raisins in a clear glass of 7-Up. The raisins are heavier than the 7-Up and will sink to the bottom of the glass. Gas bubbles, from the carbonation (simulating sludge gas) will attach to the raisins and lift them to the surface. The gas bubbles will then break and the raisins will fall back to the bottom. (The process will repeat for hours.)

There are also periods of malfunction sometimes called “boiling” when some septic tanks discharge many more solids in the effluent than is present in the influent. These periods can be when there has been a rapid sludge accumulation, such as can be caused by excessive disposal of ground garbage. In other cases this kind of upset has followed very cold temperatures when digestion is retarded and sludge accumulates. It is also known that sometimes part of the scum will sink to temporarily join the sludge layer, or vice versa. During such times effluent quality is poor due to the incidental carryover of solids.

Another cause for the discharge of scum from septic tanks is when a high groundwater condition exists in the drain fields, temporary or otherwise. The high groundwater may be due to high rainfall, or due to high effluent levels in the drain field trenches that cannot be absorbed fast enough through the biomat. Either way, these conditions can cause the liquid level in the septic tank to be at a higher elevation than the invert of the outlet piping. If it is high enough, a discharge of floating scum can exit the tank over the top of the outlet tee.

Similarly, if a septic tank exfiltrates (leaks) during low groundwater periods, the liquid level can drop below the invert of the outlet piping. If it drops low enough, the scum layer can pass below the bottom of the outlet baffle and be discharged to the drain field when normal liquid levels are restored. The amount of scum is discharged in this way can be especially significant if the tank outlet is formed out of the entire end of the septic tank.

The slotted screen – SaniTEE™ uses slots like industrial well screens because they resist blinding (clogging) better than a mesh. This is due to the one-way bridging action of the accumulated solids, which break more easily over the 3-inch span, than solids blanketing a mesh. Also, some stringy solids become woven into mesh, which is less common with slots if the slots are not too closely spaced.

The slots are placed on an angle for a reason: It has been found that many solids are flat, not round as might be imagined. Flat solids in suspension most often float horizontally, like a leaf at the water surface or when the leaf has settled to the bottom. Those solids that are not horizontal are more often near vertical, the position the solids sometimes take as they release from the surface or from the bottom. Least common is that the solid is suspended at an angle. Consequently, the orientation most likely to block entrance of suspended solids is angled.

Solids touching the vertical surface of the screen tend to slough off, falling back into the septic tank, not held captive within any kind of housing. In this way, SaniTEE™ is somewhat self-cleaning.

The purpose of the SaniTEE™ is more to exclude larger, troublesome solids than it is to polish effluent by removal of fine suspended solids which encourages clogging of the filter. If nuisance clogging occurs, the filter is likely to be removed and no useful purpose will be achieved.

Keyhole weirs – High peak (surge) flows occur commonly, often due to the simultaneous discharge from several fixtures of the home. When this happens, a higher-than-usual concentration of suspended solids is swept out with the discharge.

To reduce surge flows, SaniTEE™ uses weirs to throttle the discharge. Even though peak flows from the home may be considerable, the surge will be temporarily stored in the tank and the flow rate out of the tank will be much reduced.

Assume for example that 20 gallons is discharge from the home and that it reaches the septic tank in 1 minute (this and greater discharge rates have a high probability of occurrence). The liquid level in the septic tank rises about 1 inch in response to this surge assuming a typically dimensioned septic tank which holds 20 gallons per inch of depth. The flow rate out of the tank is restricted by the weirs. If a 1 inch wide weir is used (or 4, 1/4 inch wide weirs) the highest peak flow rate to leave the tank is only 3 gallons per minute. The flow rate is reduced as the head decreases, and the 20 gallons is discharged over a period of more than one hour.

Clogging of the weirs is not expected because solids have been excluded when the flow passed through the slotted screen. If a weir is temporarily clogged, the flow would overtop the blockage via the 1-inch hole and tend to wash it out. And, the weirs are removed when SaniTEE™ is removed, allowing for correction of even the most unusual clogging situation. The holes atop the weirs provide more than adequate ventilation.

Gas deflection features – It has been known for over 50 years that gas lifting of solids is common in septic tanks, causing the solids to rise into the end of the outlet tee and to be carried out with the effluent. Gas deflection baffles have been effectively used to deflect the solids, some in the form of plates and others resembling inverted cones, both placed directly under the outlet.

In recognition of this, SaniTEE™ does not draw effluent from the bottom, but rather from the side where far fewer gas-lifted solids will enter.

Filters – Effluent screens are sometimes called filters, which might imply that they provide secondary treatment and substantially reduce soluble biochemical oxygen demand (BOD) like a trickling filter, slow sand filter, or rotating biological contactor. This is in contrast to primary treatment such as sedimentation and screening. SaniTEE™ was designed primarily to screen and to improve effluent quality by promoting sedimentation (controlling surge flows), and by excluding gas lifted solids. While the term filter is often applied to it by the industry, no claims are made regarding secondary treatment.

When a screen is sufficiently matted with captured solids it may restrict the passage of even fairly small suspended solids. This might be interpreted as providing good performance, but not if blinding is imminent.

Easy installation and removal – SaniTEE™ drops right in a standard 4-inch septic tank outlet tee of iron pipe size (IPS), drain, waste and vent (DWV), or sewer and drain (S&D) sizes. See Figure 3. There are no tools required and it is light and easy to lift, not filled with sewage. Neither is it very messy, and it is robust and does not tear or collapse.

The coupling on SaniTEE™ should not be glued to the stub pipe in the top of the outlet tee; leave it unglued so SaniTEE™ is easy to remove. In rare cases, such as when the owner of a rental property wishes to provide the maximum possible protection for the drain field, the SaniTEE™ coupling can be glued (solvent welded) to the stub pipe. This makes a tamper resistant installation, but the SaniTEE™ cannot then be removed for any reason.

SaniTEE™ can otherwise be removed by lifting it out of the outlet tee as simply as a pistol lifts out of a holster. When removed the outlet tee resumes its usual function.

There will probably be some solids that had been captured in the small annular space between SaniTEE™ and the outlet tee, below the solids exclusion ring, that may be discharged when SaniTEE™ is removed. SaniTEE™ is removed infrequently enough and the volume of solids is so small in that annular space that the discharge of solids is usually insignificant.

Dipstick feature – Periodically SaniTEE™ should be removed and the surface examined. The examination may suggest changes in household waste practices, or in septic tank maintenance. For example, if a person removed SaniTEE™ and saw fruit peelings on the surface it should serve as a notice that peelings should be disposed as compost or solid waste, not discharged to the sewer. If sludge is seen near the bottom of SaniTEE™, but none had been seen in inspections made in prior years, septage should be pumped from the tank.

Cleaning – To clean SaniTEE™ move the swab handle up and down to pass the swab through the center several times (Figure 4). This is the same way slotted screens are professionally cleaned in water well practice. Or, the screen can be removed and hosed off, if water is readily available. (With district maintenance the service person normally has

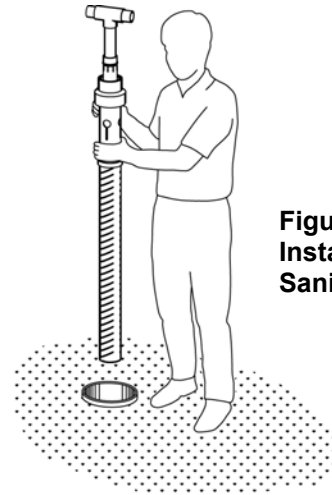


Figure 3:
Installation of
SaniTEE™

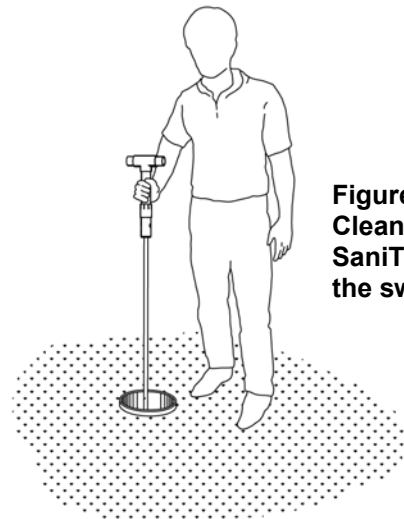


Figure 4:
Cleaning
SaniTEE™ with
the swab

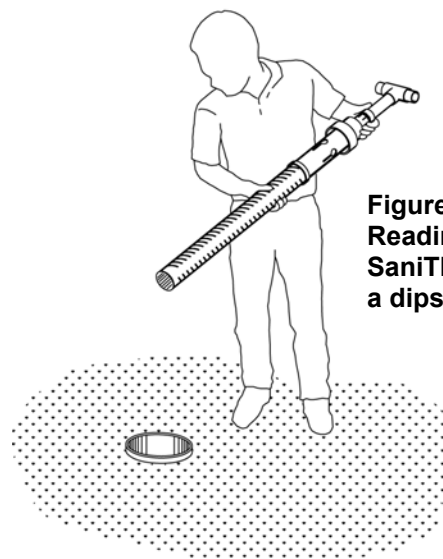


Figure 5:
Reading
SaniTEE™ like
a dipstick

no right to use the homeowners' water or hose, and residents sometimes object to messy and unsanitary cleaning been done in their yards.)

The swab is a Buna-N disk fastened to a PVC pole, and is captive inside the SaniTEE™ (when used with a pump the swab is not captive).

When cleaning SaniTEE™ some deterioration of effluent quality will occur for a brief time due to the disturbance of fine solids. This is not much concerning, however, because cleanings are infrequent and in the big picture the volume of solids discharged due to cleaning is insignificant. And, no large and troublesome solids are discharged.

Commercial Installations – Without knowing the specifics of an installation it is impossible to give accurate guidance, but in general SaniTEE™ should be limited for use on systems producing residential strength wastewater, having flows of 5,000 gallons per day or less, and with sustained peak flows of 30 GPM or less. This assumes that a properly sized and properly designed and maintained septic tank is used, that proper care is exercised in the use of the system, and that corrections in waste disposal practices are taken as suggested by visually monitoring the SaniTEE™. Grease, as at restaurants, hair, peelings, sanitary products, plastics, rubber products, lint, cigarette filters, and seeds are examples of matter that may be seen in excess on the SaniTEE™ and may require abuse control.

Inspection and cleaning of SaniTEE™ is infrequently needed in single family residential use. With commercial installations monthly examinations are suggested at first, tapering off if the condition of the filter justifies it. The need for maintenance will depend on the adequacy of the septic tank and the effort the user applies to restricting discharge of inappropriate matter, guided by inspections of SaniTEE™.

Partial summary of features –

1. Easy to install in new septic tanks or to retrofit old septic tanks. SaniTEE™ drops into the existing outlet tee something like a pistol fits in a holster. Can be removed in a minute without tools and without a mess. Does not tear, collapse, or corrode.
2. Can be cleaned with the swab provided. No running water required and SaniTEE™ doesn't have to be removed to be cleaned.
3. Slotted screen excludes troublesome solids but is not nuisance-blinded by smaller solids. Angled slots are more effective at blocking solids than horizontal or vertical slots.
4. Has the feature of a gas deflection baffle. Flow enters SaniTEE™ from the side. Solids cannot float into it from the bottom. Solids do not accumulate within the screen or within a housing and are not discharged to the drain field when SaniTEE™ is removed. Scum cannot overtop SaniTEE™.
5. Draws effluent from the clearest zone in the septic tank.
6. Can be read like a dipstick to see if the septic tank needs pumping or if waste disposal practices should be modified.

7. Flow attenuation weir slows surge flows through the septic tank for better settling. Reduces peak flows to small diameter gravity sewers. Weirs self-clean, and are easy to maintain.

Suggested references –

1. Baumann, E.R. and H.E. Babbitt. *An Investigation of the Performance of Six Small Septic Tanks*. University of Illinois Engineering Experiment Station, Bulletin No. 409, 1953.
2. Weibel, S.R., C.P. Straub and J.R. Thoman. *Studies on Household Sewage Disposal Systems, Part 1*. U.S. Public Health Service, 1949.
3. Bendixen, T.W., M. Berk, J.P. Sheehy and S.R. Weibel. *Studies on Household Sewage Disposal Systems, Part II*. U.S. Public Health Service, 1950.
4. Weibel, S.R., T.W. Bendixen and J.B. Coulter. *Studies on Household Sewage Disposal Systems, Part III*. U.S. Public Health Service, 1954.
5. Bowne, W.C. *Audit of Septage Accumulation on the Glide, Oregon STEP Pressure Sewer System*, 1990.
6. U.S. EPA. *Alternative Wastewater Collection Systems*. EPA/625/1-91/024, 1991.
7. Winneberger, J.H.T. *Septic Tank Systems, a Consultant's Toolkit*. Butterworth Publishers, 1984.