

Onsite wastewater treatment systems

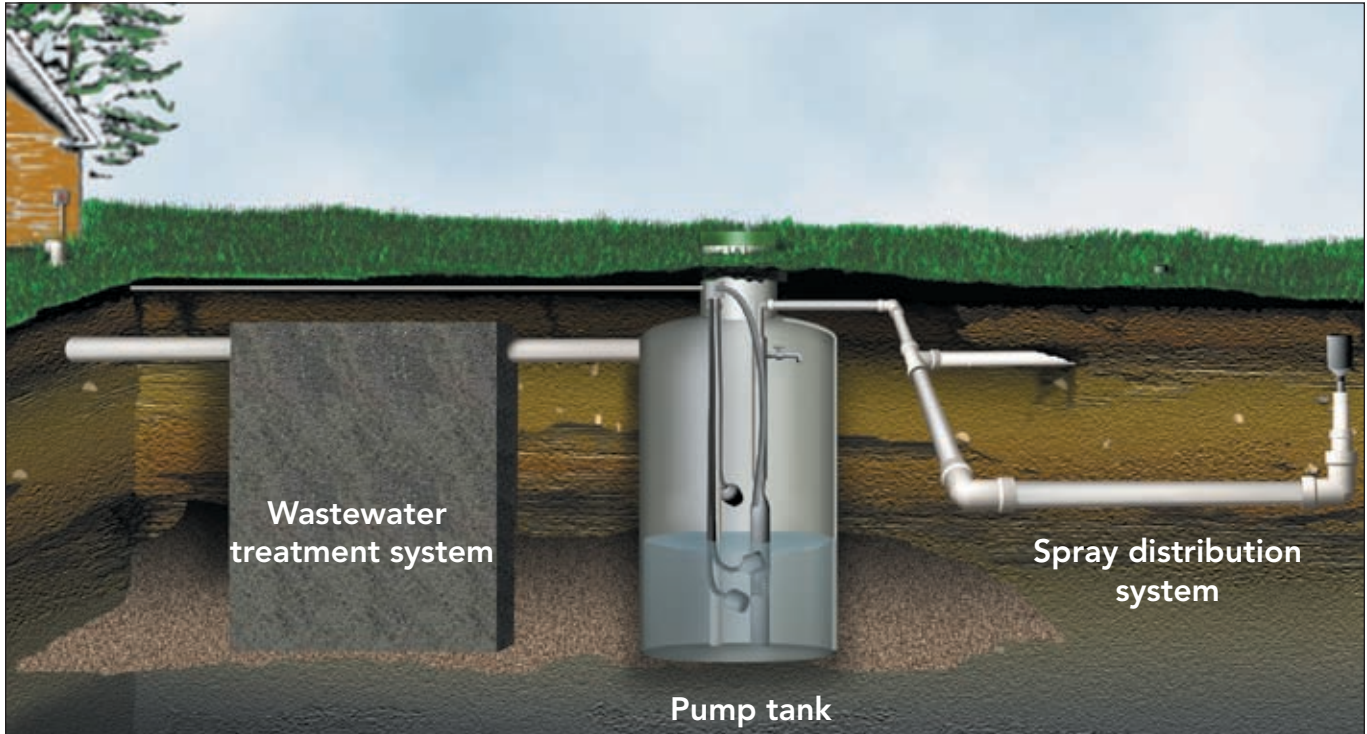


Figure 1: A pump tank collects and doses treated wastewater to the soil at intervals.

Pump tank

Bruce Lesikar and Russell Persyn

Professor and Extension Agricultural Engineer, Extension Assistant-Water Conservation
 The Texas A&M System

Pump tanks are concrete, fiberglass, or polyethylene containers that collect wastewater to be dosed into the soil at intervals. Pump tanks are a component of several types of onsite wastewater distribution systems, including low-pressure dosing, subsurface drip distribution, and spray distribution systems. Each of these includes a treatment device, a pump tank, and a distribution system (Fig. 1).

A pump tank contains:

- ✓ A pump, which pushes the water out of the pump tank and into the distribution system.
- ✓ An On/Off pump control float, which allows electrical power to go to the pump when water in the tank reaches the normal dosing volume level, or when the pump has enough water to operate. It

also stops the power supply when the water level returns to the minimum operating volume.

- ✓ A high-water alarm float, which indicates that the tank has filled past the normal dosing volume. This float is connected to an alarm panel to alert the facility owner to the high-water condition.

- ✓ A low-water off float, which is used as a redundant off switch. This float stops power to the pump if the On/Off float fails to stop power when the tank does not have enough water. This float is used when a control panel operates the system.

The pump tank collects wastewater until it is dosed into the distribution system. The tank must be watertight to prevent wastewater from seeping out and groundwater from entering. It must be big enough to hold the amount of wastewater distributed during dosing. It also must be able to store a minimum amount

of wastewater for the pump to operate properly, and to store a certain amount of wastewater after an alarm is triggered.

Many residential pump tanks have a 500-gallon capacity. However, larger tanks (such as a 1,000-gallon tank) can be used to provide about 2 days of flow storage after an alarm is triggered, and to equalize the flow for dosing systems such as the subsurface drip distribution system.

The main component of the pump tank is the pump. The pump must be able to accommodate the amount, or flow, of wastewater, and the pressure at which it will be moved.

Each type of pump has a specific relationship between pressure and flow; generally, as the flow decreases, the pressure increases. For the system to operate properly, it is vital to choose a pump that delivers the desired flow of water at the right pressure. When replacing a failed pump, be sure that the new one operates with the same flow/pressure relationship as the old one.

The pump also must be able to handle the size of the solids in the wastewater. Some pumps can move raw wastewater; others can move wastewater that contains only minimal solids.

Typical residential wastewater pumps can move solids ranging from fine solids to those 2 inches in diameter. Pumps that can move larger solids are used to move wastewater before it reaches a septic tank; effluent pumps are used to move fine solids after the wastewater has been treated in a septic tank or an advance treatment device.

The type of pump chosen also depends on the requirements of the wastewater distribution system at the home or facility.

There are two types of pumps: low-head pumps and high-head pumps.

Low-head pumps are used in systems that move relatively large

volumes of water at low pressures; such systems include pumped effluent drain fields, low-pressure dosing systems, dosing of treatment systems, and alternative collection systems.

High-head pumps are used in systems that move water at lower flow rates and higher pressures; those systems include subsurface drip distribution systems, spray distribution systems, and alternative collection systems.

Other components of a pump tank include the floats. They monitor the water level in the tank and close and open the electrical circuits, using either mechanical or mercury liquid switches. Each float is rated based on the electrical current it can pass through the switch. If the pump carries more current than the float is rated to carry, the float will break, similar to the way a fuse breaks.

Pump tanks use “pump-down” floats that turn on in the up position when the tank is full, and turn off when the float is hanging down, when the tank is empty. Different types of floats have varying angle requirements for turning the pump off and on. Narrow-angle floats are generally used for alarm circuits; wide-angle floats are used to control the pump.

The high-water alarm float sounds an alarm to warn you when the pump or the system malfunctions. The alarm is triggered when the wastewater in the pump chamber rises above the On float. The alarm should consist of a buzzer and an easily visible light; it also should be on an electrical circuit separate from the pump’s.

All the floats are attached by cords to a float tree, which is a vertically standing pipe in the pump tank. The floats can be adjusted to close the pump circuit so that a specific amount, or dose, of wastewater is pumped. The flow can be adjusted by changing the length of the cord between the float bulb and the float tree. The float tree also makes it easy to remove and check the floats during maintenance.

For easier maintenance, the pump tank components should be accessible:

- ✓ The pump tank should have a riser extending above the ground surface.
- ✓ The pump discharge pipe should have a union or other quick-disconnect coupler that is easily reached through the riser and that is less than 12 inches below the riser’s top.
- ✓ A nylon rope or other noncorroding material should be attached to the pump and should connect near the riser so that it can be reached in the tank. The rope and the pump discharge pipe make it easy to remove the pump.
- ✓ Electrical components should be either inside the riser or buried just outside it.

Design

The pump tank volume can be divided into three components: minimum operating volume, dosing volume, and alarm volume.

The minimum operating volume is the portion of the tank below the top of the pump. Water remains there because the pump cannot pick up the water below this level. Generally, the bottom 14 to 18 inches of the tank functions as the minimum operating volume.

The dosing volume is the amount of water distributed at one time, or dosing event. The dosing volume is determined by the amount of daily wastewater flow from the house or business, the type of distribution system being used, and the number of doses each day. A spray distribution system can be set to dose either when a set volume is collected (“demand-dosing” system) or at one time during the night (“night dosing”).

A demand-dosing system requires less storage than a night dosing system, because the night system must be big enough to store the total amount of wastewater the facility produces every day. For example, a

three-bedroom house with a flow of 240 gallons per day could dose three times a day at 80 gallons per dose, thus requiring a demand-dosing volume storage of only 80 gallons. The night dosing system must be big enough to store all 240 gallons of water until nighttime.

Demand-dosing or electronic controllers can be used in low-pressure dosing systems, which can dose several times during a day.

Electronic timers allow several small doses throughout the day. This is a good management option for sub-surface drip distribution systems.

The alarm volume is based on the design flow for the facility. For facilities handling less than 1,000 gallons per day, Texas regulations require that the alarm volume be one-third of the total daily flow. For example, a three-bedroom house with a flow of 240 gallons per day would require an alarm volume of 80 gallons. When the alarm sounds, the homeowner can use only 80 more gallons of water before the tank is full.

Some people choose to install a larger pump tank so that when the alarm is activated, they have more than the minimum storage available.

Facilities that handle more than 1,000 gallons of wastewater per day are required to have a duplex pump system. Duplex pump systems have two pumps that alternate in operation; the first pump doses wastewater to the distribution system during one cycle; and the second pump operates for the next dosing cycle.

Alternating the pumps helps keep them working properly. If a pump breaks, the water level continues to rise in the tank until the alarm is activated. Then the second pump doses the water into the distribution system.

Because the duplex system has two pumps, the alarm volume can be only one-sixth, rather than one-third, of the design flow. Therefore, a facility with a design flow of 1,200 gallons a day must have an alarm volume of only 200 gallons. However, the owner

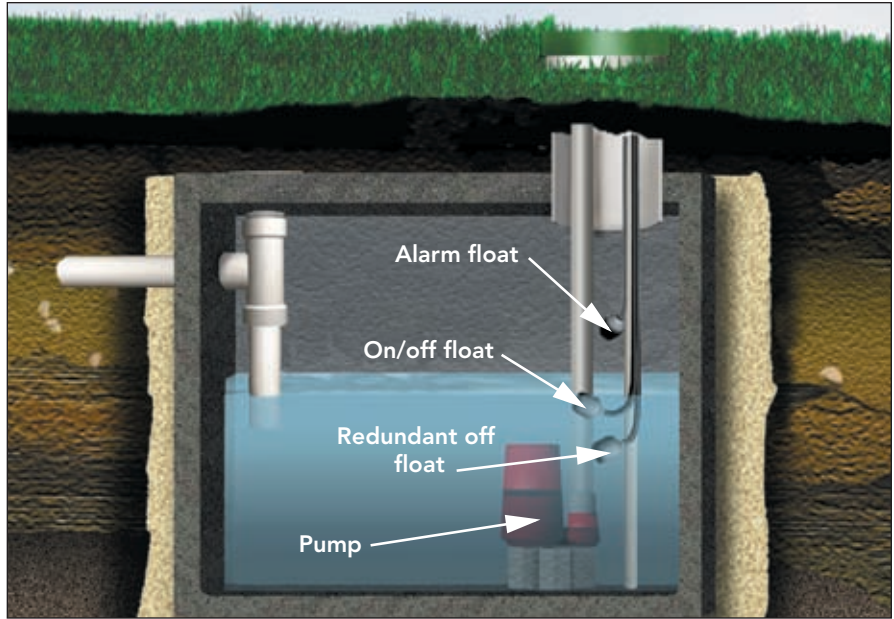


Figure 2: Floats in the pump tank signal the pump to start or stop dosing wastewater to the drain field.

can choose a larger alarm volume during the design process if desired.

Because the gases that develop in a wastewater system are very corrosive, the electrical components should be made of PVC materials. All openings to the components of the system should be built with airtight connections or sealed with silicone or another compound that will provide an airtight seal. Connections that are not airtight can allow wastewater gases to travel to the electrical control panels and corrode the connections.

How to keep it working

To maintain your pump tank, follow these guidelines:

- ✓ Check the pump tank, pump, and floats every year, and replace or repair worn or broken parts.
- ✓ Follow the manufacturer's recommendations for pump maintenance.
- ✓ Check the electrical parts and conduits for corrosion.
- ✓ If the alarm panel has a push-to-test button, test it regularly.
- ✓ For systems using a septic tank for pretreatment, install a septic tank effluent filter or pump screen if your system does not have one. Screening or filtering

the wastewater as it leaves the septic tank removes the large solids that can clog the pump and pipes. Inspect the screen or filter and clean it when necessary; these quick, easy steps can prevent costly damage from solids entering the system.

- ✓ After a prolonged power outage or pump failure, take action to protect the drain field, where the wastewater is distributed, from flooding. To prevent the field from flooding, you may need to manually control the volume of water dosed. Wastewater will continue to collect in the pump tank until the pump begins working again. If extra wastewater is in the tank, the pump may dose more than the drain field can handle.
- ✓ When a pump needs to be replaced, make sure the new one pumps out the same volume of wastewater and at the same pressure as the old one. The wrong pump could provide too little pressure or volume, causing the system to operate improperly. It also could provide too much flow at too great a pressure, causing the system to break.

- ✓ To remove fine materials that collect in the bottom of the pump tank, pump it out when your maintenance provider pumps the other system components. Pump on the normal pumping schedule of every 2 to 3 years.

What to do if the alarm sounds

If you have a power failure or if the alarm on the pump tank is activated, the tank can hold only the wastewater that can fit in its alarm

volume. If you use more water than the alarm volume, the plumbing in your home can back up.

Take these steps if your pump tank alarm is activated:

- ✓ Contact your maintenance provider to repair the system.
- ✓ If a new pump is required, make sure the new pump provides the same flow rate and pressure as the old pump. This is critical for your distribution system to operate properly.
- ✓ Reduce your water use to a minimum. The alarm volume

generally can store one-third of its normal daily water flow.

Remember: A pump tank designed for a three-bedroom house and with the capacity to handle 240 gallons a day can store only 80 gallons of water after the alarm sounds.

If you selected a larger pump tank during the design process, you may have more storage.

- ✓ Do not operate appliances that use much water, such as washing machines and dishwashers.

The Onsite Wastewater Treatment Systems series of publications is a result of collaborative efforts of various agencies, organizations and funding sources. We would like to acknowledge the following collaborators:

Texas State Soil and Water Conservation Board	USEPA 319(h) Program
Texas On-Site Wastewater Treatment Research Council	Texas AgriLife Extension Service
Texas Commission on Environmental Quality	Texas AgriLife Research
Consortium of Institutes for Decentralized Wastewater Treatment	USDA Natural Resources Conservation Service

Texas A&M AgriLife Extension Service

AgriLifeExtension.tamu.edu

More Extension publications can be found at *AgriLifeBookstore.org*

Educational programs of the Texas A&M AgriLife Extension Service are open to all people without regard to race, color, sex, disability, religion, age, or national origin.

The Texas A&M University System, U.S. Department of Agriculture, and the County Commissioners Courts of Texas Cooperating.

Produced by Texas A&M AgriLife Communications
