

S

EPTIC TANK SYSTEM

Definition and Description

A **Septic Tank** means *any watertight, covered receptacle that is designed and constructed to receive the discharge of sewage from a building sewer or preceding tank, stores liquids for a detention period that provides separation of solids from liquid and digestion of organic matter, and allows the effluent to discharge to a succeeding tank, treatment device, or soil dispersal system.*

A **Sewage Tank** is defined as a *receptacle used in the containment or treatment of sewage and includes, but is not limited to, septic tanks, aerobic tanks, pump tanks, and holding tanks*

Purpose of the Septic Tank

The **purpose of the septic tank** is to provide

- ☑ An environment for the first stage of treatment in onsite and decentralized wastewater systems by promoting physical settling, flotation, and
- ☑ The anaerobic digestion of sewage. Additionally, the tank allows storage of both digested and undigested solids until they are removed.

Physical Processes

- ☑ Septic tanks allow the separation of solids from wastewater as heavier solids settle and fats, greases, and lighter solids float.
- ☑ The solids content of the wastewater is reduced by 60-80% within the tank.
- ☑ The settled solids are called sludge, the floated solids are called scum, and the liquid layer in between is called the clear zone as shown in Figure 1.
- ☑ Although the liquid in the clear zone is not highly treated, it is greatly clarified compared to the wastewater entering the tank, the larger particles having migrated to either the sludge or scum layers.
- ☑ Another important function of the tank is storage of these accumulated solids. The tank is sized large enough to hold solids until maintenance (i.e., tank pumping) is performed.
- ☑ The effluent, or wastewater, that leaves the septic tank comes from the clear zone to minimize the solids loading on the downstream components of the system.
- ☑ The baffle, tee, or effluent screen at the outlet is designed to draw from the clear zone retaining floatable or settle able solids in the tank.
- ☑ The settling process requires time to occur, so the tank must be large enough to retain the wastewater in a turbulence-free environment for **two to four** days.

- ☑ Excessive flow and turbulence can disrupt the settling process, so tank volume, size, shape, and inlet baffle configuration are designed to minimize turbulence.

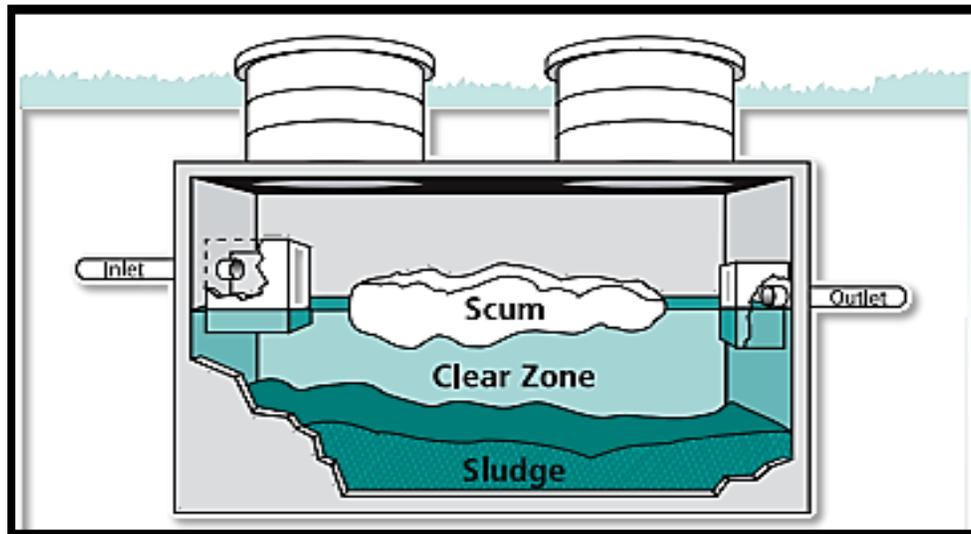


Figure 1.: Three Layers Form in a Properly Operating Septic Tank

Factors Affecting Septic Tank Performance

The **anaerobic digestion** processes in tanks are affected by temperature in the tank and by substances that have an adverse impact on biological organisms. Higher temperatures will enhance the rate of biological processes and inhibiting substances will reduce it. Too high of temperatures may liquefy fats, oils and greases (FOGs). Ideal temperatures in the tank allow for FOGs to solidify and bacterial activity to take place.

Some factors that affect the way a tank functions include:

- ☑ Strength (concentration) of the incoming wastewater;
- ☑ pH;
- ☑ introduction of harsh chemicals, drain cleaners, paint, photo processing chemicals or other inappropriate substances into the waste stream which may affect pH and biological activity;
- ☑ Introduction of fats, oils and grease (FOG);
- ☑ Highly variable flow patterns that affect detention time;
- ☑ Introduction of pharmaceuticals (especially those for chemotherapy and dialysis; long term use of antibiotics, etc.
- ☑ Introduction of process discharge, including backwash from a water softener, and;
- ☑ Lack of maintenance resulting in excess accumulation of solids, reducing effective volume and reducing detention time.

User education and care are important factors in maximizing the effectiveness of septic tank processes.

Typical Cross Section of a Septic Tank

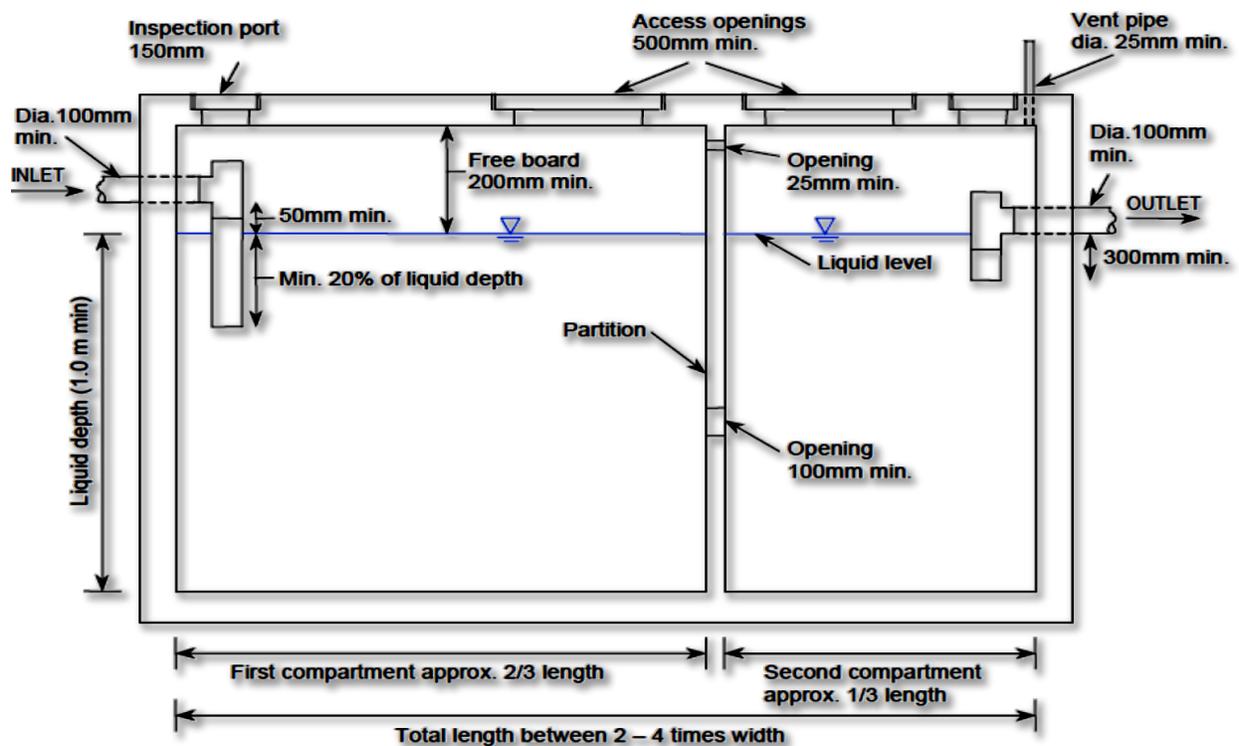


Figure 2.: Typical Cross Section of a Septic Tank

General provisions for Septic Tank

The main function of a septic tank is to separate, retain and partially digest settleable and floatable solids in wastewater. The working capacity of a septic tank shall be sufficient for all these functions to occur.

Septic tanks shall be watertight, with sufficient structural strength and integrity to withstand external soil pressures, internal and external water pressures and any likely imposed loading. Septic tanks situated under driveways and parking areas shall be designed to carry the appropriate vehicle loads.

All septic tanks either precast concrete septic tank or cast in-situ septic tank, unless otherwise specified by the competent authority, shall be designed and constructed as follows:

- ☑ septic tanks over 2500 liters shall be divided into two chambers so that the effective capacity of the first chamber is twice that of the second chamber;
- ☑ the length to width ratio shall be not less than **2:1** and a length to depth ratio of approximately **2:1**;
- ☑ the effective liquid depth shall be not less than **900mm**;

- ☑ connections for the inlet, outlet and inspection openings shall be integrally cast for concrete constructed septic tanks;
- ☑ the septic tank shall be installed on a compacted, level base and the top of the tank shall terminate at least 50mm above the finished ground surface level, with the surrounding surface graded away from the septic tank and be provided with access covers constructed of a material as approved and be of sufficient strength to withstand all imposed loadings including vehicle loads where situated in vehicle access areas, be constructed so as to be child proof and effectively sealed to prevent the ingress and/or egress of water or gas and be removable for maintenance purposes, be positioned centrally over the dividing compartment wall and have an access opening of at least **900mm long and 500mm wide**, or be positioned over the inlet and outlet fittings and have dimensions to ensure an access opening of at least DN500 or **500mm x 450mm**;
- ☑ for septic tanks over **5000 liters** capacity, they shall be provided with access opening of at least 900mm long and 500mm wide and be positioned centrally over the dividing wall or have access openings of at least DN600 and be positioned to permit inspection of the inlet and outlet fitting and enable access to each compartment for maintenance.

Cast in situ concrete septic tanks should be generally used where larger capacity septic tanks are required e.g., greater than **10, 000 litres**. The tank shall be structurally sound, smooth internally, watertight and the concrete used shall have a compressive strength of not less than **25 MPa** at **28 days**.

The Soak-away or Leach Field

A **soakaway** (*also known as a **leach field** or **drain field***) receives partially-treated effluent from a septic tank or grey water drain.

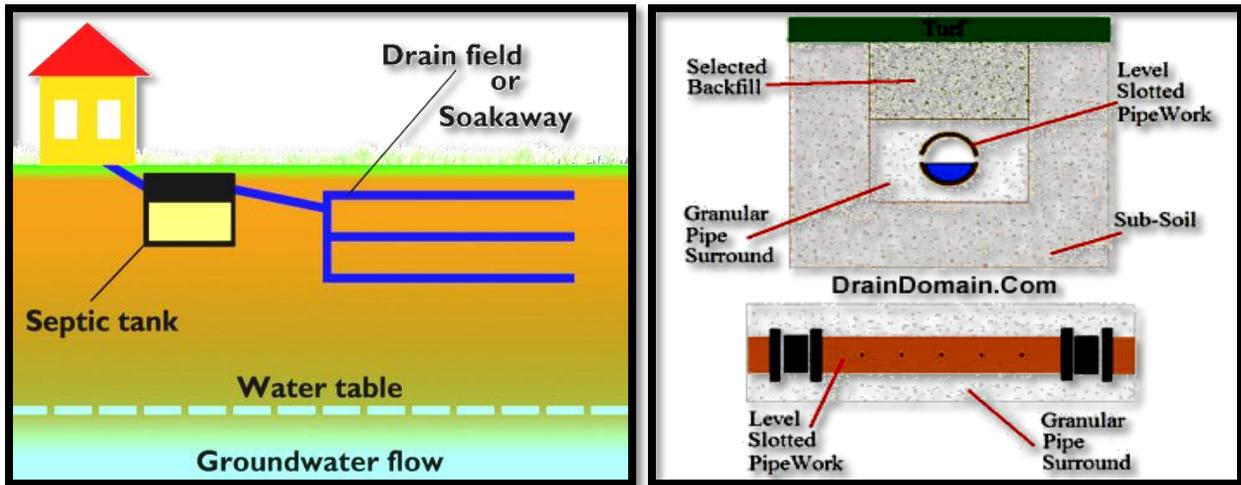
Its **purpose** is to *complete the job initiated in the septic tank. It cleans the dirty water by organically breaking down the suspended wastes and impurities through the surrounding soil to a degree that makes it suitable for discharge into the underlying water table.* From here the 'cleaned' water is collected in boreholes (or artesian wells) and piped to the surface for re-use by others.

Typically soakaways contain a hard, insoluble media such as crushed stone, clay brick ends or old car tyres.

This hard substance hosts a bacterial biofilm (slime) that progressively degrades COD (organic impurities) as the effluent passes slowly over and around it and then seeps out to the surrounding soil. Here further natural soil microorganisms, adapted to the fractionally higher organic load contained in the nearly cleaned water; polish the liquid to near potability (ultimately you can drink it). Once in the earth the purification process is gradually continued by bacteria in the soil.

The exponentially cleaned water then rejoins the underlying water table. Consequently, the design and position of the soakaway in relation to the slope of the natural ground and the

porosity of the soil, as well as the proximity of the underlying water table, are essential to the efficacy of the system.

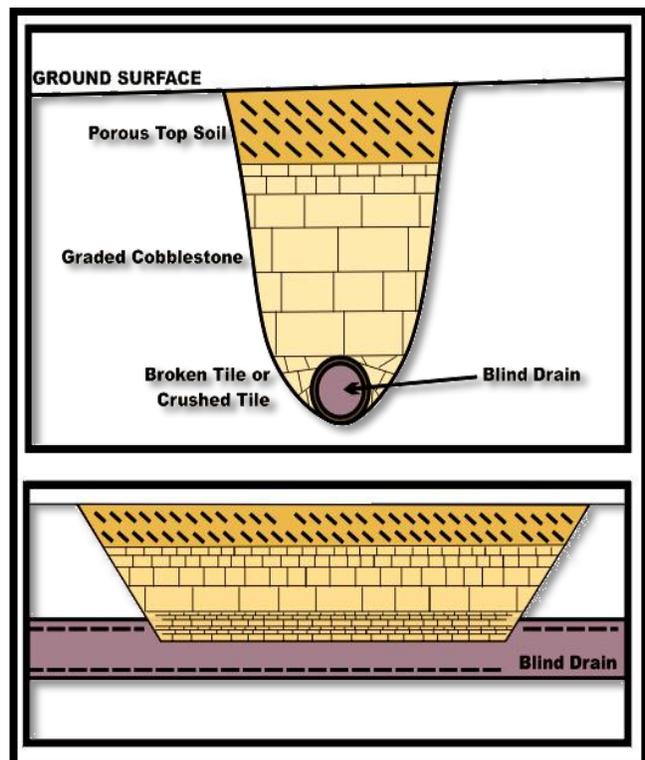


Soakage Pits

Soakage pits are used *to soak septic tank effluent in to the surrounding soil*. They do not provide any direct treatment and are based on the principle that the effluent gets treated as it passes through the surrounding soil before entering the ground water table or other water body. Therefore following shall be noted in building and using soakage pits.

Soakage pits shall be

- ☑ at least 18 m away from a well or other drinking water source
- ☑ at least 5 m from the nearest building
- ☑ at least 10 - 20 m from any other soakage pit
- ☑ at least 1.5 m shall be kept between the bottom of the tank to the seasonal ground water table
- ☑ Adequate contact area with the surrounding soil to absorb the effluent in to the soil. In clayey soil, larger pits will be needed.
- ☑ Adequate openings shall be left in the walls of the pit to have the contact with



the surrounding soil

If a soakage pit cannot be constructed due to above reasons there are following measures in place of a soakage pit

- Seepage beds
- Seepage trenches
- Anaerobic bio filters