Republic of the Philippines
Department of Health
OFFICE OF THE SECRETARY

OCT 29 2019

ADMINISTRATIVE ORDER
No. 2019 - 0047

SUBJECT: National Standard on the Design, Construction, Operation and Maintenance of Septic Tank Systems.

I. RATIONALE:

The National Government, through the Department of Health, is taking a big leap to make sanitation programs effective and sustainable to protect the environment and public health. In the past decades, sanitation has not been prioritized. The misconception that sanitation is just a human excreta disposal and management, limits the Department into the distribution of toilet bowls as the primary strategy in addressing sanitation related diseases and environmental related problems.

In compliance with Sustainable Development Goal # 6 which is *"Ensure availability and sustainable management of water and sanitation for all,"* a basic sanitation facility (toilet facility with a standard size of a septic tank) in every household is deemed necessary in preparation for the advance sanitation facilities to achieve the safely managed sanitation services.

At present, poorly designed septic tank and the lack of basic sanitation facilities and on-site sewage treatment makes the domestic sewage as the highest contributor to environmental pollution and impact negatively on public health (World Bank Monitor, 2003). The occurrence of diarrheal outbreaks from different regions of the country and other environmental sanitation related diseases manifests the real situation of the environment wherein the communities are exposed to. Pursuant to the roles and responsibilities of DOH as provided in Section 72 Chapter XVII of PD No. 856, otherwise known as the Code on Sanitation of the Philippines, the Department's scope of supervision shall include plans, design data and specifications of a new or existing sewerage system or sewage treatment plant; and method of disposal of sludge from septic tanks or other treatment plants.

II. OBJECTIVES:

To set a national standard on the design, construction/installation, operation and maintenance of septic tank as the major component of basic sanitation facilities and other alternative sanitation technology design.

III. SCOPE AND COVERAGE

This national standard on the design and construction of septic tank shall apply to all public and private sewage collection system project planned by any government agency or instrumentality including government-owned or controlled corporations, private organizations, firms, individuals or other entities.

This standard details the technical aspects, sets out requirements and guides all sanitation practitioners and designers for the approval of the designs. Further, it applies to all aspects of planning, construction, operation, maintenance, rehabilitation, replacement,

inspection and modification of on-site sanitation facilities for all existing and proposed establishments or residential building or institution.

IV. DEFINITION OF TERMS

1. ***Alternative Sanitation Technology*** - An onsite treatment system that includes components different from those used in a conventional septic tank and leaching field system. An alternative system is used to achieve acceptable treatment and dispersal/discharge of wastewater where conventional onsite systems may not be capable of meeting established performance requirements to protect public health and water resources. (e.g., at sites where high groundwater, low-permeability soils, shallow soils, or other conditions that limit the infiltration and dispersal of wastewater or where additional treatment is needed to protect groundwater or surface water quality).
2. ***Digestion*** - The biological decomposition of organic matter in sludge, resulting in partial gasification, liquefaction, and mineralization.
3. ***Leaching field*** - Shallow, covered, excavation made in unsaturated soil into which pretreated wastewater is discharged through distribution piping for application onto soil infiltration surfaces through porous media or manufactured components placed in the excavations. The soil accepts, treats, and disperses wastewater as it percolates through the soil, ultimately discharging to groundwater.
4. ***Effluent*** - Sewage, water, or other liquid, partially or completely treated or in its natural state, flowing out of a septic tank, subsurface wastewater infiltration system, aerobic treatment unit, or other treatment system or system component.
5. ***Exfiltration*** - is the sewage leakage out of the collection system through broken/damaged pipes or other components that may contaminate ground or surface water.
6. ***Freeboard or Airspace*** - The distance measured from the liquid level line to the inside to the inside top of the septic tank.
7. ***Influent*** - The untreated wastewater or raw sewage entering into a septic tank or any wastewater treatment facility.
8. ***Infiltration*** - seepage of groundwater into a sewage collection system that causes dilution of sewage resulting to decrease/reduction in treatment efficiency.
9. ***Scum*** - The accumulated floating material, including grease, oils and other low-density solid in a septic tank.
10. ***Septage*** - The liquid, solid, and semisolid material that results from wastewater pre-treatment in a septic tank, which must be pumped, hauled, treated, and disposed of properly.
11. ***Septic tank*** - A watertight rectangular receptacle designed and constructed to receive and partially treat raw wastewater. The tank separates and retains settleable and floatable solids suspended in the raw wastewater. Settleable solids settle to the bottom to form a sludge layer
12. ***Sewage*** - domestic sewage consisting of water and human excretions or other waterborne wastes incidental to the occupancy of a residential building or a non-residential building, as may be detrimental to the public health or the environment, but not including manufacturing process water, cooling water, wastewater from water softening equipment, blow down from heating or cooling equipment, water from basement or floor drains or surface water from roofs.
13. ***Sewage Disposal System*** - a system of collection, transportation, treatment, and disposal of sewage

14. ***Sludge*** - precipitated or accumulated solid matter with a highly mineralized content produced by domestic wastewater treatment processes that have settled to the bottom of the tank.
15. ***Sewage System Or Sewerage System*** - the pipelines or conduits, pumping stations, force mains, constructed drainage ditches, and all other constructions, devices, and appurtenances used for collecting or conducting sewage, and industrial wastes or other wastes to a point of treatment, discharge or ultimate disposal.

V. GENERAL GUIDELINES

The DOH shall prescribe standards and criteria for the design, construction/installation, operation and maintenance of septic tank systems aligned with Chapter XVII (Sewage Collection and Disposal, Excreta Disposal and Drainage) of the Code on Sanitation of the Philippines.

A manual of operations shall be issued for additional technical instructions and implementing mechanisms.

VI. SPECIFIC GUIDELINES

The National Standard for the design, construction/installation, operation and maintenance of septic tank systems shall consist of the following criteria:

A. Design Consideration and Computation

1. Minimum daily inflow or hydraulic load of 50 gallons per person per day (189.20 lcpd).
2. Daily inflow based on not less than ten persons. For a cluster of households with less than 100 occupants, a septic tank is still acceptable. For more than 100 person, an advanced sewage treatment system shall be applied.
3. Minimum effective liquid depth of the tank shall be 1.20 meters and additional freeboard of not less than 0.30 meter
4. Minimum detention time of 24 hours
5. A minimum of two chambers so that the effective capacity of the first chamber is twice that of the second chamber
6. Must be rectangular in shape, structurally sound and watertight.
7. Inlet and outlet connections shall be sanitary tees or baffles constructed of pre-cast concrete or PVC.
8. Connections for the inlet, outlet and inspection openings are integrally cast for concrete constructed septic tanks. For plastic type materials, the connections shall be mechanically and/or chemically sealed or bonded in order to make it water-tight and have strength equal to that of the parent material.
9. Desludging frequency shall be once in every three to five years.
10. Septic tank size and volume determination shall be based on the scientific formula as shown in Annex A.

B. Construction and Installation Considerations

Site Location

1. All tanks shall be placed on a level grade and at a depth that provides adequate gravity flow from the source. It should not be located at a large difference in elevation (low to high) to avoid facilitation of periodic pumping.

2. Where adequate flow from the source is maintained through pumping equipment, the impact of pumping rates and potential surge flows shall be evaluated so as to maintain the treatment efficiency of the septic tank unit.
3. The location of septic tanks shall be in an accessible area for the easement of desludging activities.
4. Septic tanks shall not be installed under the building, park, or driveways unless special provisions have been made such as structurally sound designs that can withstand heavy loads.
5. Septic tanks shall not be located in areas with high water table to avoid flotation of the tank and in areas where there is steep soil slope or prone to soil erosion or landslides

Installation

1. The excavation shall be large enough to allow safe, unencumbered working conditions but in no case shall be the size of the excavation be less than 0.60 meters beyond the perimeter of the tank.
2. The tank shall be placed on a firm, dry, granular, undisturbed soil that has been graded level. Gravel bedding shall be used on damp or fine-grained soils
3. Backfill material shall be placed and compacted, extending a minimum of 0.60 meters beyond the perimeter of the tank.
4. All tanks shall be tested to ensure watertight conditions and to check alignment and operation of inlet, inter-compartment and outlet connections prior to backfill. When tested, tanks shall be filled to overflowing with water to the observe operation of all connections and fittings. All visible leaks in the tank observed by the installer shall be repaired prior to backfilling.

C. Operation and Maintenance

Regular maintenance on the septic tank and other treatment systems shall be performed and observed by the household or the owner of the system to achieve its maximum efficiency and long life. Proper maintenance of these systems extends the service life and will continue to operate and function well for decades.

1. Septic tank must be desludged every 4 years to maintain its designed treatment efficiency.
2. Keep a record of pumping, inspections, maintenance, and repairs.
3. Inspect the tank for cracks, and check that baffles or tees are in place. Check for ponding of water near the treatment and disposal system.
4. Refrain from using septic starters, additives or feeders. i.e. enzymes
5. Practice water conservation to prevent overloading the septic tank system. Check for defective toilet tank valves, repair leaky fixtures, and install appliances and fixtures that use less water and avoid wasteful practices.
6. Divert excess rainwater runoff away from the septic tank and leaching field system.
7. Keep trees and deep-rooted plants and shrubs away from the immediate area that may intrude or clog the system.
8. Do not park or drive heavy vehicles or equipment over the septic system or any of its components.

D. Prohibited Discharge

The following shall not be discharged into a septic tank system.

1. Any sanitary napkin, clothing or plastic material or liner;
2. Flammable or explosive substance whether solid, liquid or gaseous;
3. Disinfectant or deodorant, antiseptic or germicide powder or fluid, unless specifically stated to be suitable for use in a septic tank;
4. Stormwater, including roof and rainwater tank overflow, and surface drainage waters;
5. Backflush waters from a swimming pool or water softener discharge from a spa bath/pool.
6. All large objects, food, oil, and grease shall not be conveyed into the septic tank; and
7. Any other matter or substance which, in the opinion of the Local Health Authority, would impair the effective function/purpose of a septic tank.

E. Alternative Septic System Design/ Disposal Fields and Seepage Pit

Where a septic tank effluent disposal scheme is not available, the site must be suitable for subsurface disposal within the allotment boundaries. For permissible alternative systems, refer to Annex B.

Alternative septic system designs shall be used for new or replacement of septic systems on difficult sites conditions where installation of a conventional septic tank and leaching field system is not possible. Some of the site conditions (factors) that lead to or require these alternative designs are:

1. Soil Condition
   a. Soil with very low or no percolation at all such as clay.
   b. Soil with fast percolation rate such as sandy soil.
   c. Rocky sites with bedrock and not enough topsoil to treat and dispose of wastewater.
2. Building Site Condition
   a. Site that lacks adequate space (small or limited area) or other constraints to install or repair conventional leaching field.
   b. Site on a steeply sloped location which does not permit installation of a conventional leaching field or sand bed.
   c. Flood-prone area.
3. Groundwater Condition
   a. Sites with a high groundwater table.
   b. Sites which are subject to surface runoff and cannot be fully diverted.

VII. ROLES AND RESPONSIBILITIES

A. Department of Health Central Office – Disease Prevention and Control Bureau and Ministry of Health-Bangsamoro Autonomous Region in Muslim Mindanao
   a. Develop systems, guidelines, and procedures through Manual of Operations to operationalize this Order.
   b. Conduct capacity development for Centers for Health Development, Provincial LGU, Building Officials and Local Health Authority.
   c. Provide technical assistance to DOH – CHDs, LGUs and other key partners.

B. Department of Health - Center for Health Development
   a. Formulate and develop plans and procedures to adopt and implement this AO.
   b. Conduct advocacy activities with different stakeholders, i.e. LGUs, NGOs, and other partners.
   c. Provide technical assistance and facilitate training to personnel of sanitation service providers and LGUs.
   d. Allocate funds for the staff capacity building of the Building Officials, Local Health Authority and Sanitation Service Providers.

C. Department of Public Works and Highways
   a. Guide the City and Municipal Building Officials in the performance of their duties and responsibilities pertinent to Building Codes of the Philippines and the provisions of this AO.
   b. Prescribe and adopt the rules and regulations necessary for carrying out the provisions of this AO
   c. Issue and promulgate additional rules and regulations in the form of Memorandum Circulars or guidelines to implement the provisions of this AO and ensure compliance with policies, plans, standards.

D. Department of Interior and Local Government
   a. Promulgate provisions of this AO through memorandum circulars to LGUs.
   b. Conduct compliance monitoring of LGUs on this Order.

E. Local Government Unit
   a. Enforce provisions of this Order through Building Officials and LHO.
   b. Conduct progressive inventory of septic systems.
   c. Facilitate education to households and system owners on their operation and maintenance responsibilities for all types of systems.
   d. Evaluate, review, approve and/or take final action on changes and/or amendments on plans, design, location, data and specification of new or existing septic tank or sewage collection and disposal system.
   e. Pass an ordinance for the implementation and enforcement of the provisions of this AO and prescribe fines and other penalties for violation.

F. Household and Building Owners
   a. Ensure that new or existing septic tanks shall conform to the standard set on this AO and its manual of operation.
   b. Provide accessible maintenance manhole for desludging with a minimum size of manhole of at least 0.50 meter x 0.50 meter.
   c. Ensure that septic tanks are regularly desludged within the designed cycle period.

VIII. PENAL PROVISION

As provided for under Section 103 of the Sanitation Code of the Philippines:

a. Unless otherwise provided in any Chapter or section in this Code, any person who shall violate, disobey, refuse, omit, or neglect to comply with any of the rules and regulations promulgated under this Code shall be guilty of misdemeanor and upon conviction shall be punished by imprisonment for a period not exceeding six (6)

months or by a fine not exceeding P1000.00 or both depending upon the discretion of the court.

b. Any person who shall interfere with or hinder, or oppose any officer, agent, or member of the Department or of the Bureaus and Offices under it, in the performance of his duty as such under this Code, or shall tear down, mutilate, deface or alter any placard, or notice, affixed to the premises in the enforcement of the Code, shall be guilty of a misdemeanor and punishable upon conviction by imprisonment for a period not exceeding six (6) months or by a fine not exceeding P1000.00 or both depending upon the discretion of the court

IX. REPEALING CLAUSE

Provisions from previous issuances that are inconsistent or contrary to this Order are hereby rescinded and modified accordingly.

X. SEPARABILITY CLAUSE

In the event that any provision or part hereof is declared unauthorized or rendered invalid by any court or competent authority, those provisions are not affected by such declaration shall remain valid and effective.

XI. EFFECTIVITY

This Order shall take immediately after its publication in the Official Gazette or in a newspaper of general circulation. Copies of this Order shall be filed with the U.P. Law Center pursuant to Book VII, Chapter 2, Sec. 3 of E.O. 292

FRANCISCO T. DUQUE III, MD, MSc
Secretary of Health

Annex A

SEPTIC TANK SYSTEM DESIGN CONSIDERATION/COMPUTATION

Septic tank is commonly used for onsite wastewater system as the first step to treat raw sewage before discharging to a sewerage system or if not available to a subsurface infiltration system, or any approved type of absorption system. The pre-treatment provided by the septic tank is equally important in ensuring the success of the subsequent treatment in lowering the pollution load. Properly designed, constructed and maintained septic tank may achieve of about 60 to 80 percent removal of many of the settleable solids, oils, greases, and floating debris and 30 to 50 percent in BOD removal (*Reference*: Mogol, et al).

The main purpose of a septic tank is the removal of suspended solids and FOG through sedimentation and flotation. The important factor in achieving good sedimentation is maintaining quiescent conditions and can be accomplished through a long wastewater residence time in the septic tank. Tank volume, geometry, and compartmentalization affect the residence time.

A. VOLUME

Septic tanks of sufficient volume will provide adequate hydraulic residence time for sedimentation. The recommended hydraulic residence time is 24-72 hours and can vary significantly as the size of the tank increases in geometry, depth, and length. Determination of the required volume is achieved using the wastewater flow per capita per day, the average number of family members per household and the number of hydraulic residence time desired.

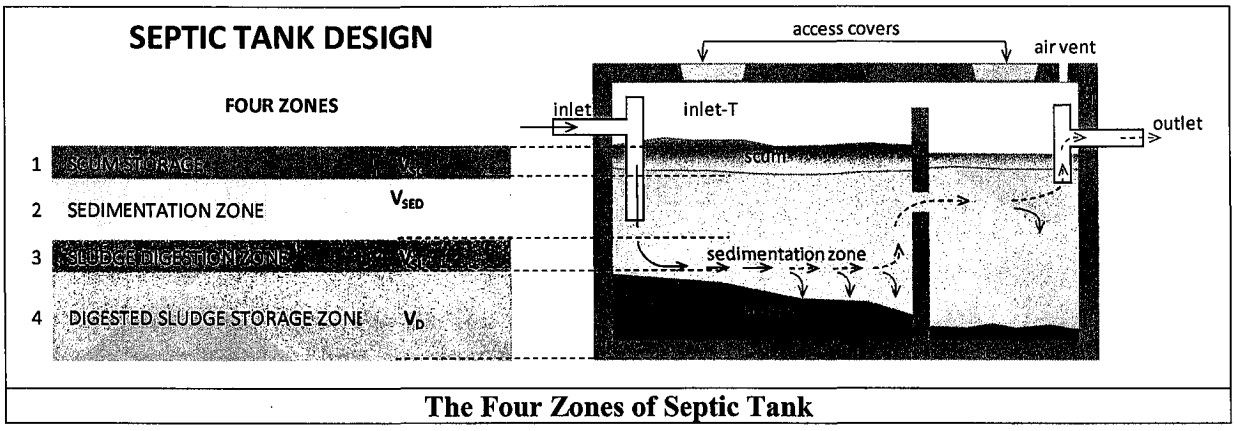
The septic tank shall be increased in size to accommodate the surges without causing sludge or scum to be discharged from the tank if large flow surges are anticipated.

B. GEOMETRY

B.1 Sewage flow: The flow rate for a single-family dwelling typically ranges from 151 to 227 lpcd or 40 to 60 gpcd. As specified in the PD 856, a flow rate of 50 gpcd is commonly being used as a design parameter. This value is used in calculation herein with an assumption of a minimum of ten persons per dwelling.

The capacity of the septic tank should be large enough to provide space for sedimentation of solids, digestion of settled sludge, and storage of sludge and scum accumulated between successive cleaning.

B.2 Capacity of the Tank: The total capacity of the septic tank can be determined through the consideration of its four zones illustrated below:



The Four Zones of Septic Tank

B.2.1 SEDIMENTATION ZONE (V_{SED})

The time required to permit sedimentation of settleable solids decreases with the number of people served (this reflects the reduced peak flows that occur as the population serve increases), according to the equation:

$$t_h = 1.5 - 0.3 \log (Pq)$$

where: t_h = hydraulic retention time required for sedimentation, days
P = contributing population
q = wastewater flow, liter per capita per day (lcpd)
but not less than minimum retention, $t_{h(min)} = 0.2$ day

The minimum detention time of 24 hours is provided for average flow conditions and can be increased up to 48 hours to allow for the much higher peak factors. This will yield to the following equation of the septic tank capacity required for settlement:

$$V_{SED} = 10^{-3} Pqt_h$$

B.2.2 SLUDGE DIGESTION ZONE (V_{SL})

Solids separated in the sedimentation zone will be digested anaerobically in the sludge digestion zone. The time needed for the anaerobic digestion of settled solids (t_d, days0 varies with temperature (T,□)and given by the following equation:

$$t_d = 1853T^{-1.25}$$

An alternative way of obtaining a value of t_d is to consider the process kinetics of a completely mixed anaerobic digester. The minimum retention time of the anaerobic biomass (θ_{MIN}, days) depends on how fast the bacteria can utilize their food supply, and how much food is needed to generate additional biomass. If "food" is taken to be organic matter, or biochemical oxygen demand (BOD), then:

$$\theta_{MIN} = 1/Yk_T$$

where: Y = yield coefficient, mg VSS produced per mg BOD utilized
k_T = maximum BOD utilization rate, per day.

The value of **Y** is around 0.04 for high lipid wastes. In the temperature range 20-35°C, k_T varies with temperature as follows:

$$k_T = 6.67\ (1.035)^{T-35}$$

Combining equation and with **Y**= 0.04, gives:

$$\theta_{MIN} = 3.75\ (1.035)^{35-T}$$

A fairly large factor of safety needs to be applied to equation to allow for the difference between a well-controlled anaerobic reactor and a septic tank (which is basically uncontrolled by comparison), so that t_d is given by:

$$t_d = 30\ (1.035)^{35-T}$$

A fairly large factor of safety needs to be applied to equation to allow for the difference between a well-controlled anaerobic reactor and a septic tank (which is basically uncontrolled by comparison), so that t_d is given by:

$$t_d = 30\ (1.035)^{35-T}$$

The volume of fresh sludge is around **1 liter per person per day**. This is digested in t_d days when it passes to the sludge storage zone. Since the sludge in digestion decreases in volume from one to zero lcpd, the average volume of digesting sludge, q_{SL}, present during the period t_d is 0.5 lcpd. Thus, the volume of the sludge digestion zone (V_{SL}, m3) is given by following formula:

$$V_{SL} = 10^{-3} P q_{SL} t_d$$

B.2.3 DIGESTED SLUDGE STORAGE ZONE (V_D)

The volume of the sludge storage zone depend on the accumulation of sludge in digestion zone and the residue of the digested sludge that settles to the bottom of the tank over a given period of time. It may be expressed with the following equation:

$$V_D = rPn$$

where: V_D = volume required for storage of digested sludge (m^3)

n = interval between successive desludging operations (years)

r = rate of accumulation of digested sludge (m^3 per capita per year), and can be obtained if:

n<5, r = 0.06 m^3/cap/year
n>5, r = 0.04 m^3/cap/year

B.2.4 SCUM STORAGE (V_{SC})

Scum accumulates at approximately 30-40 percent of the rate at which sludge accumulates.

B.3 Overall Design Capacity: Hence the total capacity of the septic tank will be equal to sum of the above four requirements, plus a minimum free board of 0.2 meter should be provided.

$$V_T = V_{SC} + V_{SED} + V_{SL} + V_{SD}$$

C. COMPARTMENTALIZATION

All septic tanks shall be of multi-compartment design with a minimum of two (2) compartments. The first of a (2) two-compartment tank shall contain two thirds (2/3) the liquid capacity of the total volume of the tank. Tanks shall be of rectangular design. The minimum depth of the tank shall not be lower than 1.2 meter.

D. INLETS AND OUTLETS

All inlet and outlet connections shall be sanitary tees or baffles constructed of pre-cast concrete or PVC. Inlet openings may have a minimum diameter equivalent to the diameter of the house sewer but in no instance shall the diameter be less than four (4) inches. The outlet invert shall be three (3) inches below the inlet invert. The inlet and outlet baffles or sanitary tees shall extend at least 12 inches below the liquid level, but to a level no deeper than 40% of the liquid depth.

All pipe cutouts for inlet and outlet connections shall be sealed with a watertight concrete (95%) & bentonite (5%) grout mix or standard rubber gaskets.

Connections between compartments of multi-compartment tanks shall consist of a four (4) inch diameter sanitary tee or baffle constructed of concrete. All compartment connections shall extend to a level no deeper than 40% of the liquid depth as measured from the liquid level.

All inlet, outlet and inter-compartment connections shall be located to provide a minimum air space of two (2) inches between the top of the connection and the underside of the tank cover.

E. TANK ACCESS/MANHOLE

Septic tanks shall have removable covers or manholes to provide access for the purpose of inspection and cleaning. Each tank compartment shall be equipped with an access opening and cover. The opening shall be located to provide access to each tank compartment as well as providing access to the inlet and outlet connections for routine inspections. Access openings shall be at least 0.50 meter in diameter.

F. CONSTRUCTION MATERIALS

All septic tanks shall be constructed of material as approved and be of sufficient strength so that there will be no structural failure or undue distortion under pressure when either full or empty and be protected from, or designed to withstand, loadings imposed by vehicles, buildings, soil and or ground waters and the internal loadings.
Pre-cast reinforced concrete or other suitable material (pre-fab, fiberglass, plastic, etc.) approved as equal by and at the sole discretion of the Department.

The septic tank must 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* as follows:

- be 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.

All septic tanks, unless otherwise approved by the Department or the Local Health Authority, shall be designed and constructed so that

- The septic tank will be watertight and retain structural integrity during transportation, installation and operation
- Pre-cast reinforced concrete tanks shall have a minimum wall thickness of two and one half (2½) inches.
- Each septic tank shall be constructed with a watertight access riser for each compartment and shall extend above grade at the time of installation. The riser and lid shall be made of concrete, masonry or an equivalent durable material approved by the Department or LHA.
- If multiple concrete risers are needed then water tight gaskets or hydraulic cement must be placed between each riser.
- All tanks shall be watertight, non-corrosive, durable and structurally sound

All above finished grade access covers shall be water tight and secure from vandalism.

G. WATERTIGHTNESS

All tank joints must be sealed properly. The joints should be clean and dry before the application of the joint sealer. After all joints have been made and cured, a watertightness test should be performed using hydrostatic or vacuum tests. Manway risers and inspection ports should be included in the test. Leaks, whether exfiltrating or infiltrating, are serious. Infiltration of clear water to the tank from should be designed for water tightness. Exfiltration can threaten ground water quality with partially treated wastewater and can lower the liquid level below the outlet baffle so it and subsequent processes can become fouled with scum. Also, leaks can cause the tank to collapse.

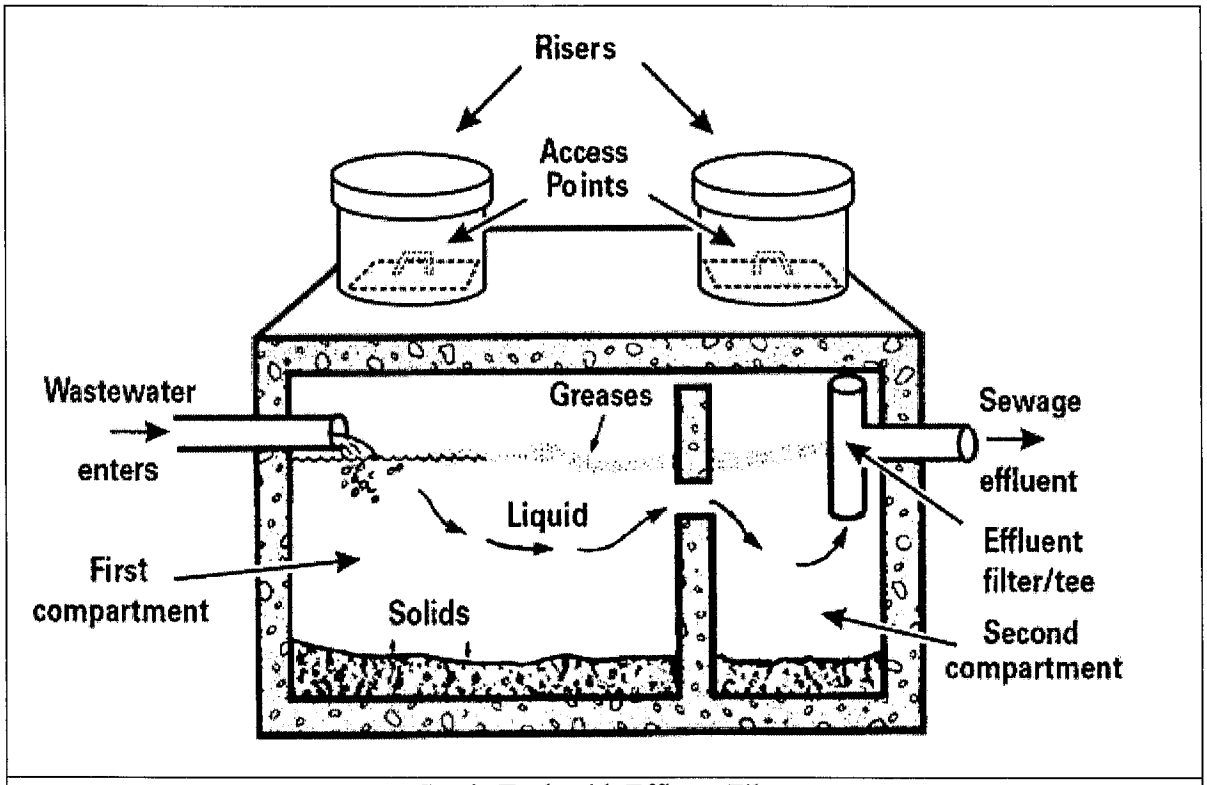
H. ADDITIONAL TREATMENT PROCESS AFTER SEPTIC TANK

All septic tanks, if sewer is not available, shall be connected for further treatment process. To complete the septic tank system, additional treatment processes such shall be applied i.e. subsurface disposal field, effluent filter, sand filtration and/or disinfection system.

Subsurface Disposal Field: The onsite subsurface disposal field must be designed appropriately to ensure safe disposal of septic tank effluent. The disposal site must be suitable and capable of achieving effective long term subsurface effluent disposal. Where it is known that the site characteristics are not favorable, an alternative method of disposal for subsurface effluent disposal should be considered.

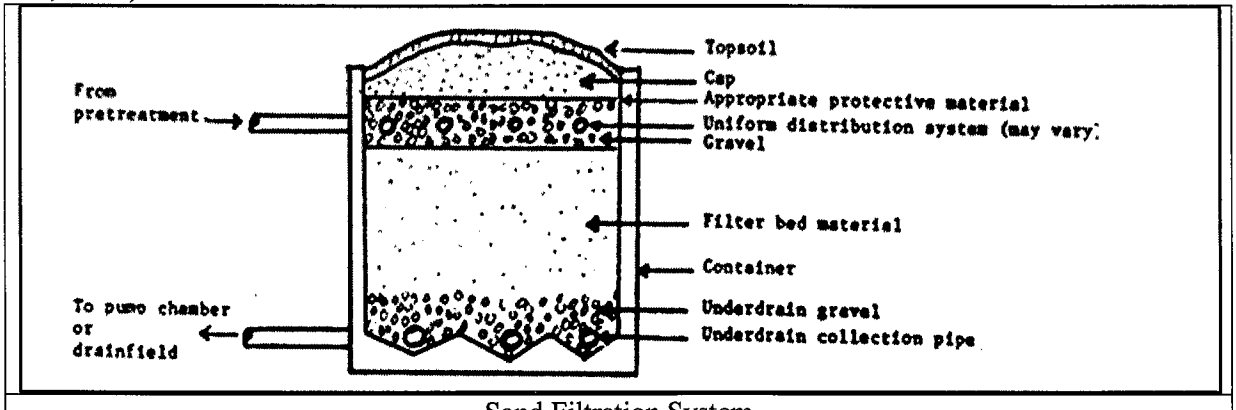
Many factors are associated with the determination of site suitability and the following aspects need to be investigated in assessing the site.

Effluent Filters: Septic tanks may be equipped with any outlet effluent filter approved by the Department or the LHA. The maintenance of these filters is the responsibility of the property owner and must remain in service for the life of the septic tank. This unit must be maintained in accordance with the manufacturer's service instructions.



Septic Tank with Effluent Filter

Sand Filtration: Many sand filter designs have been installed on an experimental basis for residential onsite use (Ronayne et al., 1984). In general, sand filters operate by directing pretreated effluent into or onto a layer of sand, allowing it to drain through the sand (where aerobic decomposition of waste products takes place) and collecting the filtrate in a perforated pipe at the bottom of the filter (figure __). Filters can be constructed above or below the ground. Systems constructed below the ground can be contained in a watertight vault or uncontained in direct contact with the surrounding soil. Some designs recirculate part of the filtrate back through the filter for further treatment. The liquid filtrate is ultimately disposed of in a soil absorption field. Sand filters can produce effluent of very high quality with reported BOD and SS reductions of 99 percent and 97 percent, respectively (Ronayne et al., 1984).



Sand Filtration System

Disinfection System: Use of disinfectant such as chlorine or UV light as a final treatment may discharge effluent to the surface water, ground water, streams or waterways.

Annex B

TYPES OF ALTERNATIVE SANITATION TECHNOLOGY OPTIONS

Not all sites are suitable for conventional subsurface effluent disposal, therefore, it is important to carry out the necessary investigations to determine the suitability of the site and design the system accordingly. In areas where site conditions are not satisfactory for subsurface disposal, an alternative disposal system must be considered.

"Alternative Sanitation Technology Design" refers to any onsite wastewater disposal method other than the widely used conventional septic tank and leaching field. This must be designed by a professional sanitary engineer and submitted to the local health department for approval.

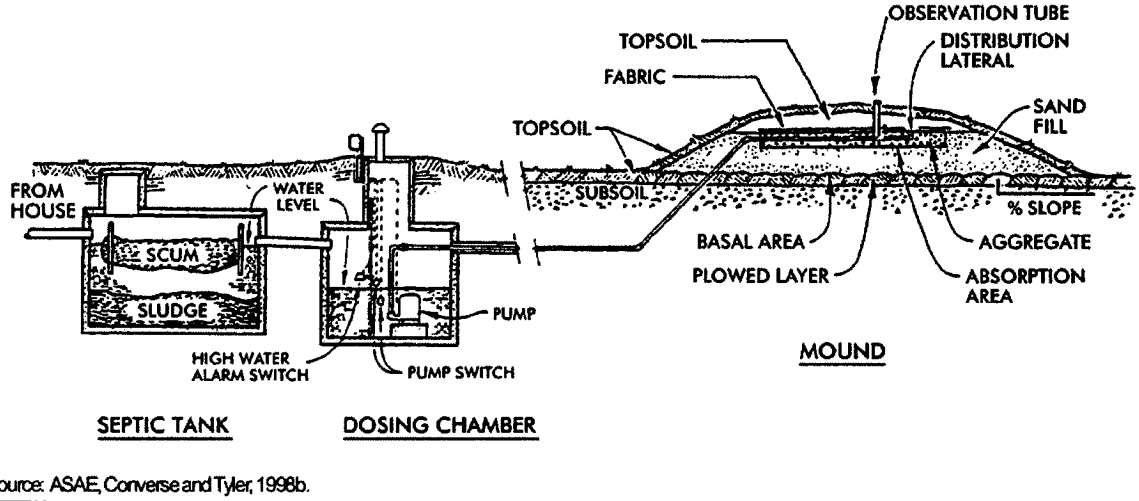
Alternative onsite wastewater disposal systems can reduce the soil absorption area or leaching field size requirement. These are also important for difficult areas where space or soil conditions make it difficult to install a conventional leach field or where an existing septic system has failed.

1. MOUND SEPTIC SYSTEMS AND RAISED BED SEPTIC SYSTEMS

A septic mound is an engineered system involving fill to create a soil absorption system for the disposal of septic effluent. Septic mound systems are used where local soils are not suitable for effluent disposal.

A raised bed septic bed on the other hand is similar in design to a mound system but uses the original local soils. It is an absorption trench system constructed in fill material with acceptable permeability placed above the natural soil or building lot.

In the sketch shown below, effluent is discharged to the septic mound by a pumping chamber. (Source: US EPA) Alternatively a septic mound or raised bed component, if suitably located, may be supplied effluent by gravity feed.



Source: ASAE, Converse and Tyler, 1998b.

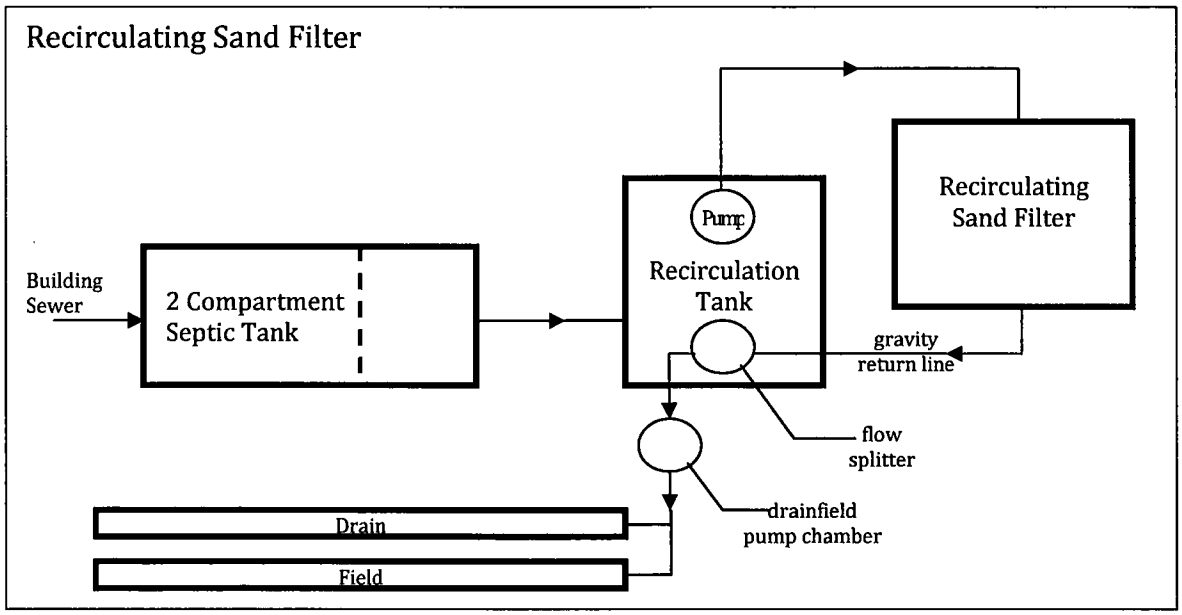
Mound Septic Systems and Raised Bed Septic Systems

2. MEDIA FILTER SEPTIC SYSTEMS

Media filter septic systems use a conventional septic tank followed by several approach to further filter and treat effluent before disposal. When using a septic media filter system, effluent treatment is by both actual filtration and ultimately by a biochemical process as the filter "matures" and includes its own biomass. Both natural media filter septic systems (such as sand, gravel, or peat) and synthetic media filter septic systems (foam cubes, glass, slag) are used, and both single-pass and effluent recycling systems may be employed.

2.1 TYPES OF ADVANCE D MATERIAL MEDIA FILTRATION SYSTEM

- Sand Beds
- Filter Beds
- Peat Filters
- Synthetic Textile Filters
- Rotating Biological Contactors Systems
- Trickling Filters
- Foam Media Filters



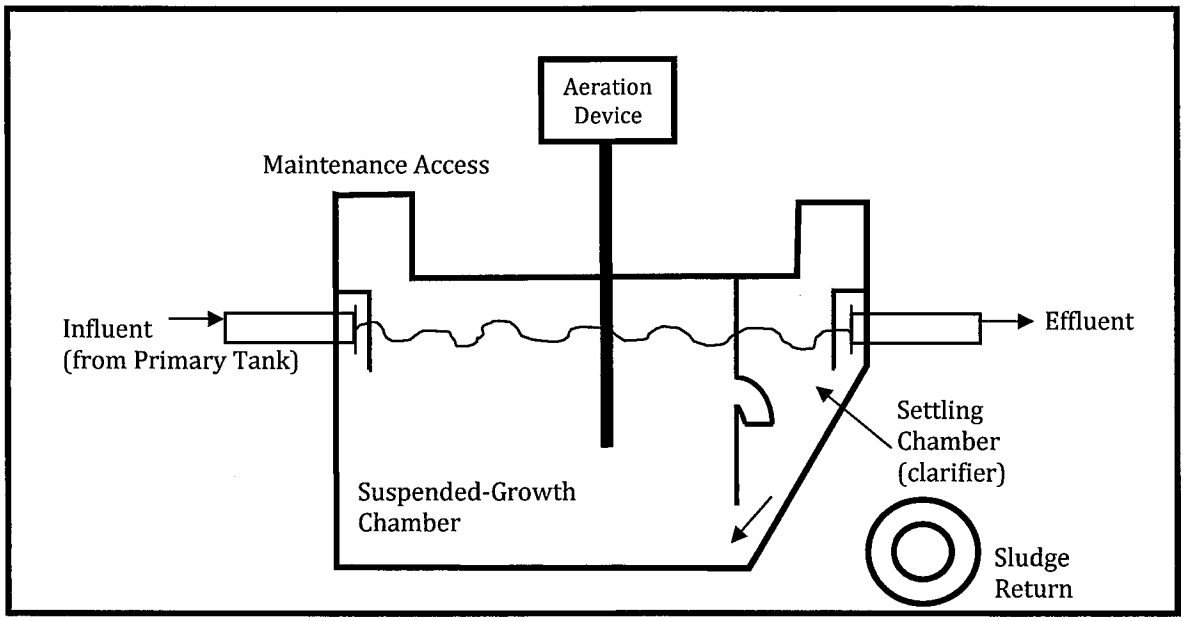
3. AEROBIC SEPTIC SYSTEMS

Aerobic Septic Systems, also known as fine bubble aeration systems, insert additional oxygen into and agitate sewage in the primary treatment tank. This will work as a mini-wastewater treatment for home use and will produce a better-quality wastewater effluent for discharge into the absorption system for final treatment and disposal.

Aerobic Septic Systems can be used in areas where conventional septic tanks are not possible. Examples are wet soils or very rocky conditions. Other reasons for installing aerobic septic system includes lot areas close to lakes, streams and other bodies if water or lot

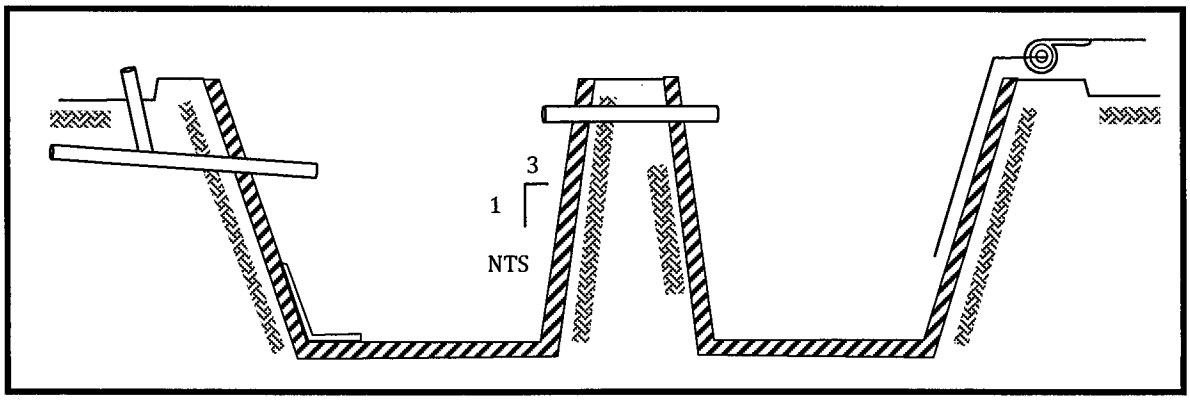
areas that are too small for conventional septic system.

Aerobic Septic System may still require for a leaching field, but can reduce the area and capacity of the leaching field significantly. This is also more expensive than the conventional because it will use or require electrical power and frequent desludging of the tank.



4. LAGOON SEPTIC SYSTEMS

Lagoon systems or pond systems are less often use as wastewater treatment for single dwelling unit because it requires quite large area. It is recommended in areas where common wastewater treatment has been designed to serve multiple dwellings.



Refererences:1. Rational Design of Septic Tank in Warm Climates, Engineering University of Leeds (1986), 2. USEPA Guide to Septage Treatment and Disposal (1994), 3. EPA Onsite Wastewater Treatment Systems Manual (2003)