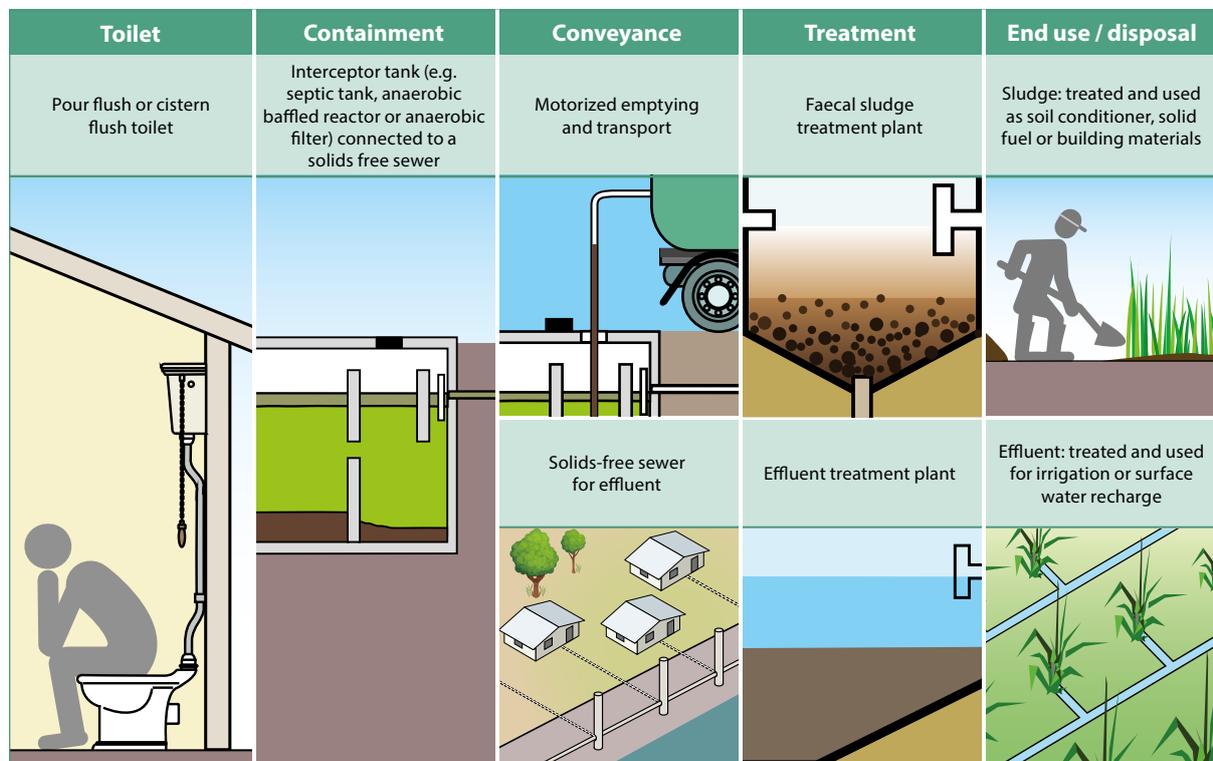


## Fact sheet 9

# Flush toilet with septic tank, sewerage and offsite treatment of faecal sludge and effluent



## Summary

This system is characterized by the use of a household-level containment technology to remove and digest settleable solids from the blackwater, and a sewer system to transport the effluent to a treatment facility.

Inputs to the system can include faeces, urine, flushwater, cleansing water, dry cleansing materials and greywater.

There are two toilet technologies that can be used for this system: a pour flush toilet or a cistern flush toilet. A urinal could additionally be used. This system is comparable to Fact sheet 7 (Flush toilet with septic tank, sewerage and offsite treatment of faecal sludge and effluent) except that the management of the effluent generated during containment of the blackwater is different: the effluent from septic tanks, anaerobic baffled reactors or anaerobic filters is transported to a treatment facility via a solids-free sewer.

The containment technologies serve as “interceptor tanks” and allow for the use of small-diameter sewers, as the effluent is free from settleable solids.

The sewer system transports effluent to a treatment facility where it is treated and will produce both sludge

and effluent, which may require further treatment prior to end use or disposal.

## Applicability

**Suitability:** This system is especially appropriate for urban settlements where the soil is not suitable for the infiltration of effluent. Since the sewer network is shallow and (ideally) watertight, it is also applicable for areas with high groundwater tables. This system can be used as a way of upgrading existing, under-performing containment technologies (e.g., septic tanks) by providing improved treatment.

There must be a constant supply of water to ensure that the sewers do not become blocked.

**Cost:** For the user, the capital investment for this system is considerable (excavation and installation of an interceptor tank), but several households can share the costs if the system is designed for a larger number of users. The maintenance costs may be considerable, depending on the frequency and method of tank emptying.

With the sewer-based transport of effluent to a treatment facility, the capital investment is considerable. However, the design and installation of solids-free sewers will be considerably less expensive than a conventional gravity sewer network.

The capital cost of the treatment plant may also be considerable, while the treatment plant maintenance costs will depend on the technology chosen and the energy required to operate it.

Overall, this system is most appropriate when there is a high willingness and ability to pay for the capital investment and maintenance costs and where there is an appropriate treatment facility.

## Design considerations

**Toilet:** The toilet should be made from concrete, fibre-glass, porcelain or stainless steel for ease of cleaning and designed to prevent stormwater from infiltrating or entering the tank.

**Containment:** This water-based system is suitable for cleansing water inputs, and, since the solids are settled and digested onsite, easily degradable dry cleansing materials can be used. However, rigid or non-degradable materials (e.g., leaves, rags) could clog the system and cause problems with emptying and should not be used. In cases when dry cleansing materials are separately collected from the flush toilets, they should be collected with solid waste and safely disposed of, for example through burial or incineration.

**End use/disposal:** Options for the end use and/or disposal of the treated effluent include irrigation, fish ponds, floating plant ponds or discharge to a surface water body or to groundwater<sup>2</sup>.

Treated sludge can be used in agriculture as soil conditioner, as a solid fuel, or as an additive to construction materials.

## Operation and maintenance considerations

**Toilet and containment:** The user is responsible for the construction of the toilet and interceptor tank, but they are most likely to pay a mason to carry out the work. The user will be responsible for cleaning of the toilet and will most likely pay an emptying service provider to empty the interceptor tank periodically.

At shared facilities, a person (or persons) to clean and carry out other maintenance tasks (e.g. repairs to superstructure) on behalf of all users needs to be identified as well as an emptying service provider.

**Conveyance, treatment and end use/disposal:** The success of this system depends on the conveyance systems. There must be an affordable and systematic method for emptying sludge from the interceptor tanks since one user's improperly maintained tank could adversely impact the entire sewer network.

Typically, the technologies may be operated and maintained by a combination of private and public service providers working together; for example, emptying and transport may be done by private and/or public service providers who maintain the sewer network and also deliver faecal sludge to treatment plants operated by public service providers.

Functioning, properly maintained sludge and effluent treatment technologies are a key requirement. In most situations these are managed at the municipal or regional level. In the case of more local, small-scale systems, operation and maintenance of the emptying and transport service, the sewer network and the treatment plant, are managed and organized at the community level<sup>3</sup>.

Importantly, for this system, all machinery, tools and equipment used in the conveyance, treatment and end use/disposal steps will require regular maintenance by the service providers.

## Mechanisms for protecting public health

**Toilet:** The toilet separates users from excreta and the impermeable interceptor tank isolates the blackwater and pathogens within it from physical human contact.

During rains, the slab and the impermeable interceptor tank contain the fresh excreta and prevent it from being washed away into surface water bodies, while the water seal reduces smells, nuisance and disease transmission by preventing disease carrying vectors from entering and leaving the tank.

**Conveyance:** The conveyance step removes the pathogen hazard from the neighbourhood or local community to a treatment plant. The watertight sewer network isolates the blackwater from physical human contact and ensures groundwater is not contaminated.

Motorized emptying using vacuum trucks (or similar) fitted with long-reach hoses is the preferred method of removing the sludge, as this reduces direct contact by emptiers. Nevertheless, emptying and transport workers must wear personal protective equipment and follow standard operating procedures. For instance, the wearing of boots, gloves, masks and clothing that cover the whole body is essential, as well as washing facilities and good hygiene practices. The emptiers should not enter an interceptor tank but use long handled shovels to remove any hard to shift sludge at the bottom<sup>4</sup>.

**Treatment and end use/disposal:** If correctly designed, constructed and operated, treatment technologies can be combined to reduce the pathogen hazard within the effluent or sludge by removal, reduction or inactivation to a level appropriate for the intended end use and/or disposal practice. For example, sludges require dewatering and drying followed by co-composting with organics before use as a compost-type soil conditioner, but for use as a solid fuel or building material additive, they only require dewatering and drying. Effluent will require stabilization and pathogen inactivation in a series of ponds or wetlands before use as crop irrigation water <sup>2,5,6</sup>.

In order to reduce the risk of exposure of the local community, all treatment plants must be securely fenced to prevent people entering the site; and to safeguard workers' health when operating the plant and carrying out maintenance to tools and equipment, all treatment plant workers must wear appropriate protective equipment and follow standard operating procedures <sup>4</sup>.

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## References

The text for this fact sheet is based on Tilley, et al. <sup>1</sup> unless otherwise stated.

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6. Stenström T A, Seidu R, Ekane N and Zurbrügg C (2011). *Microbial exposure and health assessments in sanitation technologies and systems*. Stockholm Environment Institute (SEI).