Conveyance

C

The technologies in this section are responsible for moving or transporting Products from an onsite Collection and Storage/Treatment technology to a subsequent offsite treatment, use or disposal technology.

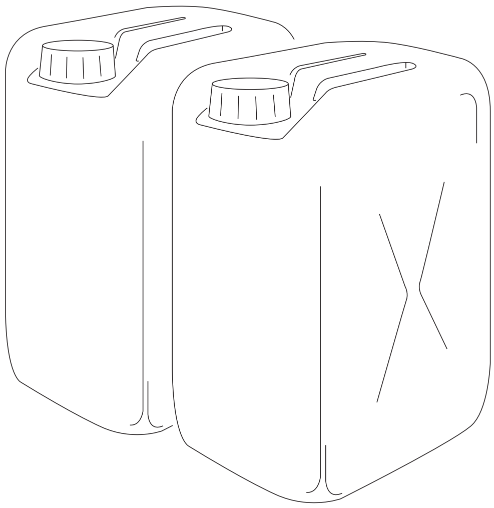
C

C.1 Jerrycan/tank

Applicable to:
System 4, 8

C.1

Application Level	Management Level	Inputs/Outputs:
★★ Household	★★ Household	Urine
Neighbourhood	★★ Shared	Stored Urine
City	★ Public	



Jerrycans are light, plastic containers that can be easily carried by one person and are readily available. When sealed, they can be used to store or transport urine easily and without spills. In case separated urine cannot be used near the point of production, it can be transported in a Jerrycan or tank to a central collection/storage facility or to agricultural land for application.

On average, a person generates 1.5 L of urine a day although this quantity may very significantly depending on the climate and fluid consumption. A family of 5 can be expected to fill a 20 L Jerrycan with urine in approximately two days. The urine can then be either stored on site or transported immediately.

For compounds or communities that all have urine diverting systems, it may be more appropriate to have a larger, semi-centralized storage tank that can be transported by other means. Where urine-diversion systems are common, a micro-enterprise may specialize in the collection and transport of Jerrycans using a bicycle, wagon or donkey and cart.

Adequacy A well-sealed Jerrycan is an effective way of transporting urine short distances. It is inexpensive, easy to clean and re-useable. This type of transport is only appropriate for areas where the points of generation and use (i.e. home and field) are close together, otherwise a more formalized collection and distribution system is necessary.

Jerrycans can be used in cold environments (where urine freezes) as long as they are not completely filled. Stored frozen urine can be then used in warmer months when it is needed for agriculture.

Because of safety concerns and difficulty with transport, no other liquids (blackwater or greywater) should be transported in Jerrycans

Health Aspects/Acceptance There should not be any health risks to those carrying a Jerrycan as urine is generally sterile and the Jerrycans seal well. While carrying a Jerrycan may not be the most pleasant activity, it is likely more convenient and less costly emptying a pit.

In some locations, urine has an economic value and it may be collected from the household for free. Families who invest the time to transport and use their own urine may be rewarded with increased agricultural production improving the families health and/or increasing their income.

Upgrading If urine is viewed as a commodity, locally run businesses may collect and transport it for free or for a small fee.

Maintenance To minimize bacterial growth, sludge accumulation and unpleasant odours, Jerrycans should be washed frequently.

Pros & Cons

+ Very low capital and operating costs
+ Potential for local job creation and income generation
+ Easy to clean and reusable
+ Low risk of pathogen transmission
- Heavy to carry
- Spills may happen

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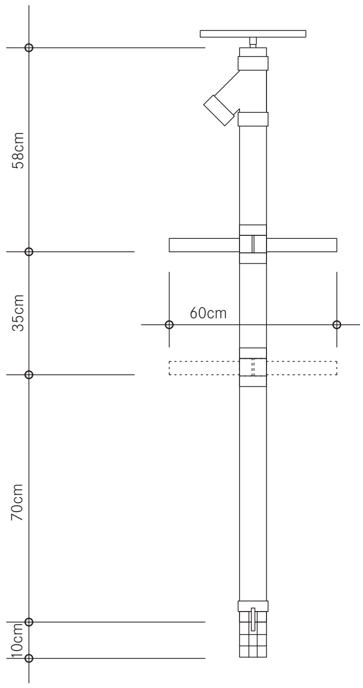
C.2	Human-Powered Emptying and Transport	Applicable to: **System 1, 2, 3, 4, 5**	C.2

Application Level	Management Level	Inputs/Outputs:
★★ Household	★★ Household	Faecal Sludge, Dried Faeces
★★ Neighbourhood	★★ Shared	Compost/EcoHumus, Blackwater
City	★★ Public	



Human-powered Emptying and Transport refers the different ways in which people can manually empty and/or transport sludge and septage.

Human-powered Emptying and Transport of pits and tanks can mean one of three things:

1) using buckets and shovels;
2) using a hand-pump specially designed for sludge (e.g. the Pooh Pump or the Gulper); and
3) using a portable, manually operated pump (e.g. MAPET: MAnual Pit Emptying Technology).

Some sanitation technologies can only be emptied manually, for example, the Fossa Alterna (S5) or Dehydration Vaults (S7). These technologies must be emptied with a shovel because the material is solid and cannot be removed with a vacuum or a pump. When sludge is viscous or watery it should be emptied with a hand-pump, a MAPET or a vacuum truck, and not with buckets because of the high risk of collapsing pits, toxic fumes, and exposure to the unsanitized sludge. The type of emptying that can, and should be employed, is very specific to the technology that needs emptying.
Manual sludge pumps like the Pooh Pump or the Gulper are relatively new inventions and have shown promise as being low-cost, effective solutions for sludge emptying where, because of access, safety or economics, other sludge emptying techniques are not possible. The pump works on the same concept as a water pump: the handle is pumped, the liquid (sludge) rises up through the bottom of the pump and is forced out of a tap (sludge spout). Hand-pumps can be made locally with steels rods and valves in a PVC casing. The bottom of the pipe is lowered down into the pit/tank while the operator remains at the surface to operate the pump, thus removing the need for someone to enter the pit. As the operator pushes and pulls the handle, the sludge is pumped up through the main shaft and is then discharged through the V-shaped discharge spout. The sludge that is discharged can be collected in barrels, bags or carts, and removed from the site with little mess or danger to the operator.
A MAPET consists of a hand pump connected to a vacuum tank mounted on a pushcart. A hose is connected to the tank and is used to suck sludge from a pit. When the hand pump is turned, air is sucked out of the vacuum tank and sludge is sucked up into the tank. Depending on the consistency of the sludge, the MAPET can pump up to a height of 3 m.

Adequacy Hand-pumps are appropriate for areas that are either not served by vacuum trucks, where vacuum-truck emptying is too costly, or where narrow streets and poor roads may limit the ability of a vacuum truck to access the site. The hand-pump is a significant improvement over the bucket method and could prove to be a sustainable business opportunity in some regions. The MAPET is also well suited to dense, urban and informal settlements, although in both cases, the distance to a suitable sludge discharge point is a limiting factor. These technologies are more feasible when there is a Transfer Station (C7) or Sewage Discharge Station (C8) nearby.

One government-run emptying programme implemented a manual emptying scheme with great success by providing employment to community members with adequate protection and an appropriate wage.

Health Aspects/Acceptance Depending on cultural factors and political support, manual emptiers may be viewed as providing an important service to the community.

Government-run programmes should strive to legitimize the work of the labourer and help improve the social climate by providing permits, licences and helping to legalize of the practice of manually emptying latrines.

The most important aspect of manual emptying is ensuring that workers are adequately protected with gloves, boots, overalls and facemasks. Regular medical exams and vaccinations should be required for everyone working with sludge.

Upgrading To save time, vacuum trucks can be used rather than manual labour if it is appropriate and/or available.

Maintenance The MAPET and Sludge Pumps require daily maintenance (cleaning, repairing and desinfection). Workers that manually empty latrines should clean and maintain their protective clothing and tools to prevent contact with the sludge.

If manual access to the contents of a pit require breaking open the slab, it may be more cost effective to use a Gulper to empty the latrine. The Gulper cannot empty the entire pit and therefore, emptying may be required more frequently (once a year), however, this may be a cheaper alternative than replacing a broken slab.

Pros & Cons:

+ Potential for local job and income generation
+ Gulper can be built and repaired with locally available materials
+ Low to moderate capital; variable operating costs depending on discharge point (sludge transport over 0.5 km is impractical)
+ Provides service to unsewered areas/communities
+ Easy to clean and reusable
- Spills may happen
- Time consuming: can take several hours/days depending on the size of the pit
- MAPET requires some specialized repair (welding)

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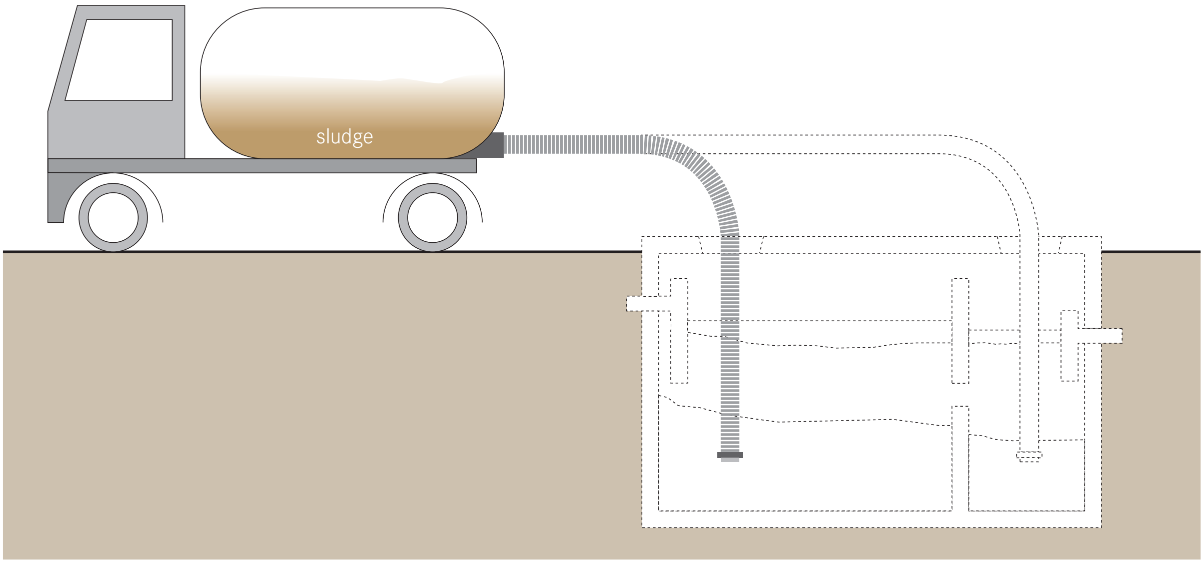
C.3 Motorized Emptying and Transport

Applicable to:
System 1, 5, 6, 8

C.3

Application Level	**Management Level**	**Inputs/Outputs:**
★★ Household	Household	Urine, Faecal Sludge
★★ Neighbourhood	★ Shared	Blackwater
★ City	★★ Public	



Motorized Emptying and Transport refers to a vacuum truck or another vehicle equipped with a motorized pump and a storage tank for emptying and transporting faecal sludge, septage and urine. Humans are required to operate the pump and manoeuvre the hose, but they do not lift or transport the sludge.

The pump is connected to a hose that is lowered down into a constructed tank (e.g. septic tank or aquaprivy) or pit, and the sludge is pumped up into the holding tank on the truck. Generally the storage capacity of a vacuum tanker is between 3,000 and 10,000 L. Multiple truckloads may be required for large septic tanks.
Both the agencies responsible for sewerage and private entrepreneurs may operate vacuum trucks, although the price and level of service may vary significantly. Some public operators may not service informal settlements, whereas some private operators may offer a reduced price, but can only afford to do so if they do not empty the sludge at a certified facility. The cost of hiring a vacuum truck can sometimes be the most expensive part of operating a sanitation system for some homeowners.

The UN-HABITAT Vacutug Project was conceived in 1995 with the goal of developing 'fully sustainable system for emptying pit latrines in unplanned, peri-urban areas and refugee camps in the developing countries'. The Vacutug consists of a 0.5 m^3 steel vacuum tank connected to vacuum pump which is connected to a gasoline engine. On level ground, the vehicle is capable of around 5 km/h. The waste sludge can be discharged under gravity or by slight pressurization from the pump. Recent results indicate that under certain circumstances (constant number of pits, transfer station, short transfer distance, etc.) the Vacutug can be sustainable and cover its operating and maintenance costs.

Adequacy Although smaller more mobile vehicles have been developed, large vacuum trucks remain the norm for municipalities and sanitation authorities. Unfortunately, large trucks cannot access all pits/septic tanks especially in areas with narrow or non-driveable roads. Also, vacuum trucks can rarely make trips to peri-urban or rural areas since the income generated from emptying, may not offset the cost of fuel and time.

Depending on the collection or treatment technology, the material that needs to be pumped can be so dense that it cannot be pumped easily. In these situations it is necessary to thin the solids with water so that they flow more easily, but this may be inefficient and costly. If water is not available, it may be necessary for the waste to be manually removed. In general, the closer the vacuum can be to the pit, the easier it is to empty. The critical velocity of the sludge required for pumping is dependent on the distance from, and strength of, the vacuum pump; sludge is extremely site specific. Garbage and sand also makes emptying the pit much more difficult.

Health Aspects/Acceptance The use of a vacuum tanker for emptying a pit latrine or septic tank presents two health improvements: (1) emptying maintains the Collection and Storage/Treatment technology and reduces the risk of overflows and (2) the use of a tanker reduces the need for manual emptying, which is quite unsafe and unhygienic. Still, those who operate vacuum trucks may be demonized by the community and may face difficulties with finding appropriate locations to dump and treat the collected sludge.

Maintenance Maintenance is a crucial part of vacuum truck operation. Trucks are not usually brand new and they often require constant attention to prevent breakdowns. The lack of preventive maintenance is often the cause for major repairs.

Most pump trucks are manufactured in North America or Europe. As such, it is difficult to locate spare truck parts and a local mechanic to repair broken pumps and trucks. New trucks are difficult to obtain, very expensive and thus rarely purchased. Local trucks are commonly adapted to serve as vacuum trucks by equipping them with holding tanks and vacuums.

Maintenance accounts for at least one quarter of the costs incurred by the operator of a vacuum truck. Fuel and oil account for another quarter of the total operating costs. Owners/operators must be conscientious to save money for the purchase of expensive replacement parts, tires and equipment, whose replacement could be essential to the working of the vacuum truck.

Pros & Cons:

+ Fast, and generally efficient
+ Potential for local job creation and income generation
+ Provides essential service to unsewered areas
- Cannot pump thick dried sludge (must be manually removed or thinned with water)
- Garbage in pits may block hose
- Very high capital costs; variable operating costs depending on use and maintenance
- Pumps can usually only suck down to a depth of 2 to 3 m and the pump must be located within 30 m of the pit
- Not all parts and materials may be available locally
- May have difficulties with access

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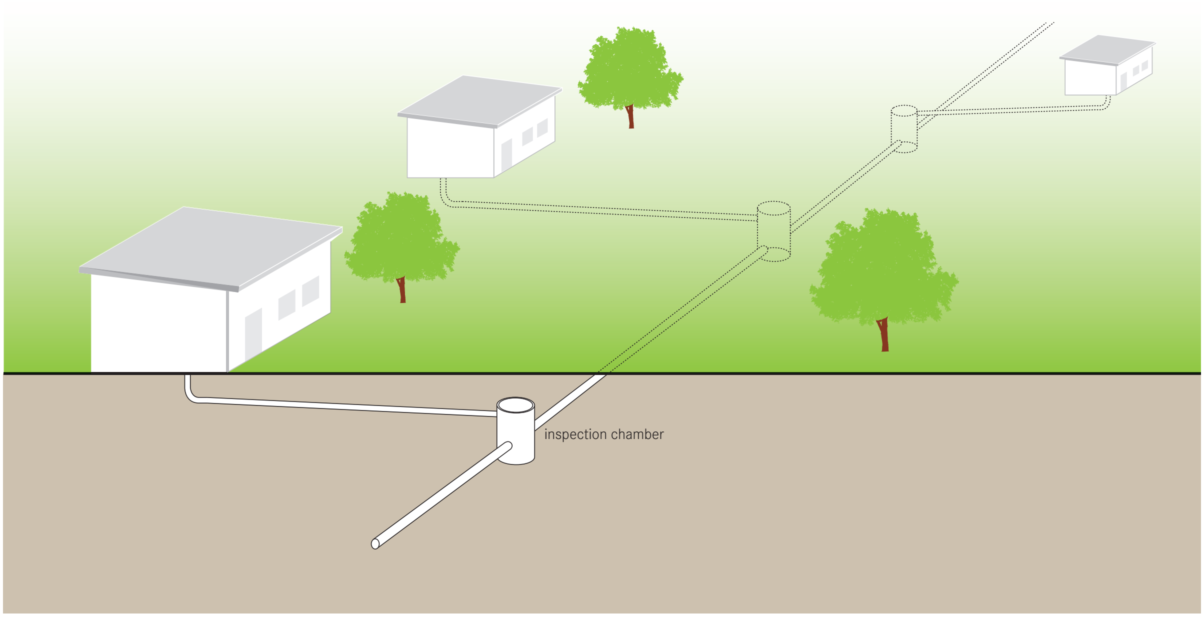
C.4	Simplified Sewers	Applicable to: **System 6, 7, 8**	C.4

Application Level	Management Level	Inputs/Outputs:
Household	★★ Household	Blackwater, Greywater
★★ Neighbourhood	★★ Shared	
★ City	★★ Public	



Simplified Sewers describe a sewerage network that is constructed using smaller diameter pipes laid at a shallower depth and at a flatter gradient than conventional sewers. The Simplified Sewer allows for a more flexible design associated with lower costs and a higher number of connected households.

Expensive manholes are replaced with simple inspection chambers. Each discharge point is connected to an interceptor tank to prevent settleable solids and trash from entering the sewer. As well, each household should have a grease trap before the sewer connection. Another key design feature is that the sewers are laid within the property boundaries, rather than beneath the central road. Because the sewers are more communal, they are often referred to as condominial sewers. Oftentimes, the community will purchase, and connect to, a single legal connection to the main sewer; the combined effluent of the condominal sewer network flows into the main sewer line.
Because simplified sewers are laid on or around the property of the users, higher connection rates can be achieved, fewer and shorter pipes can be used and less excavation is required as the pipes will not be subjected to heavy traffic loads. However, this type of Conveyance technology requires careful negotiation between stakeholders since design and maintenance must be jointly coordinated.
All greywater should be connected to the Simplified Sewer to ensure adequate hydraulic loading. Inspection chambers also function to attenuate peak discharges into the system. For example, a 100 mm diameter sewer laid at a gradient of 1 m in 200 m (0.5 %) will serve around 200 households of 5 people (10,000 users) with a wastewater flow of 80 L/person/day.
Although watertight sewers are the ideal, they may be difficult to achieve, and therefore the sewers should be designed to take into account the extra flow that may result from stormwater infiltration.
Blocks of community-based Simplified Sewers are connected to an existing Conventional Gravity Sewer or routed to a Simplified Sewer main constructed with pipes of a larger diameter. A Simplified Sewer main can still be placed at a shallow depth providing it is placed away from traffic.

Adequacy Where the ground is rocky or the groundwater table is high, the excavation of trenches for pipes may be difficult. Under these circumstances, the cost of installing sewers is significantly higher than in favourable conditions. Regardless, Simplified Sewerage is less expensive than Conventional Gravity Sewerage because of its shallow installation depth.
Simplified Sewers can be installed in almost all types of settlements and are especially appropriate for dense, urban settlements. To prevent clogging and maintain the sewers, good pre-treatment is required. It is recommended that the scum from greywater, heavy solids and garbage be removed from the wastewater prior to entering the sewer.

Health Aspects/Acceptance If constructed and maintained well, sewers are a safe and hygienic means of transporting wastewater. Users must be well educated about the health risks associated with maintaining/cleaning blockages and inspection chambers.

Upgrading Household inspection chambers can be upgraded to septic tanks so that fewer solids enter the Simplified Sewer network, but this will increase maintenance costs associated with emptying the septic tank.

Maintenance Pre-treatment with interceptor tanks and a grease trap is essential. The homeowner must maintain the interceptor tanks and the grease trap. Ideally, households will also be responsible for the maintenance of the sewers, however in practice this may not be feasible. Alternatively, a private contractor or users committee can be hired to assume responsibility for the maintenance as inexperienced users may not detect problems before they become severe, and therefore, more costly to repair. A related problem is that households may drain stormwater into the sewer. This practice should be discouraged whenever possible.
Blockages can usually be removed by opening the sewer and forcing a length of rigid wire through the sewer. Inspection chambers must be emptied periodically to prevent grit overflowing into the system.

Pros & Cons:

+ Can be built and repaired with locally available materials
+ Construction can provide short-term employment to local labourers
+ Capital costs are between 50 and 80% less than Conventional Gravity Sewers; operating costs are low
+ Can be extended as a community changes and grows
- Requires expert design and construction supervision
- Requires repairs and removals of blockages more frequently than a Conventional Gravity Sewer
- Effluent and sludge (from interceptors) requires secondary treatment and/or appropriate discharge

References

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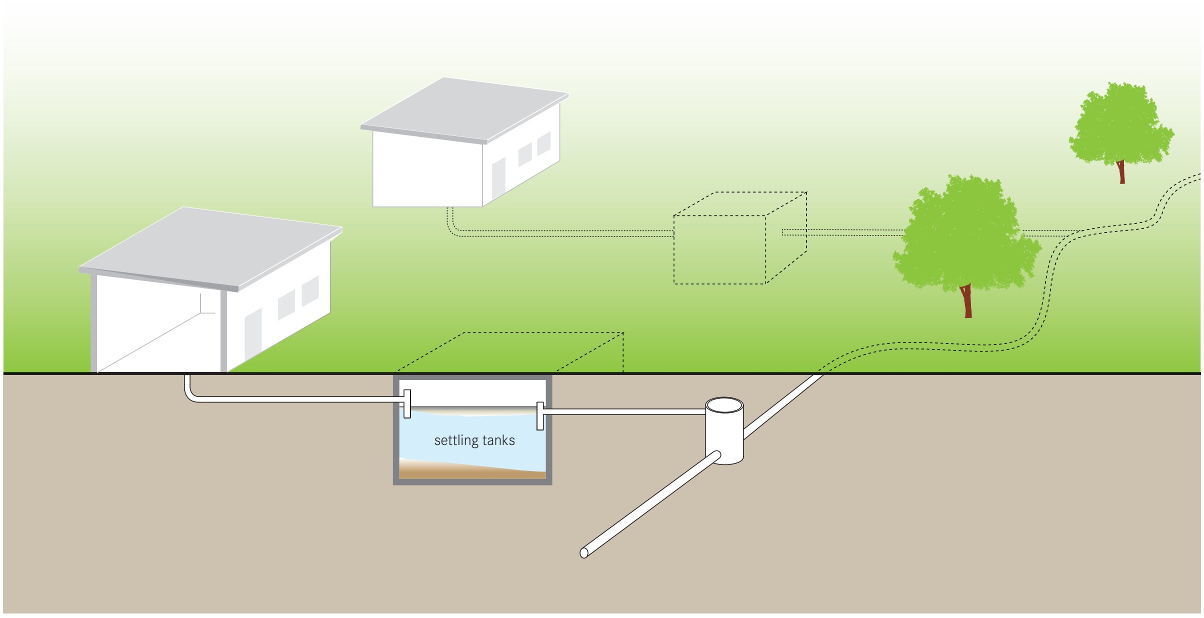
C.5 Solids-Free Sewer

Applicable to:
System 6

Application Level	**Management Level**	**Inputs/Outputs:**
Household	★★ Household	Effluent
★★ Neighbourhood	★★ Shared	
★ City	★★ Public	



A Solids-Free Sewer is a network of small diameter pipes that transports solids-free or pre-treated wastewater (such as septic tank or settling tank effluent) to a treatment facility for further treatment or to a discharge point. Solids-Free Sewers are also referred to as settled, small-bore, small-diameter, variable-grade gravity, or septic tank effluent gravity sewers.

A precondition for Solids-Free Sewer networks is efficient pre-treatment at the household level. The interceptor, septic or settling tank removes settleable particles that could clog small pipes. A grease trap should also be added. Because there is little risk of clogging, the sewers do not have to be self-cleaning (i.e. no minimum flow velocity) and can therefore be laid at shallow depths, can have fewer inspection points (manholes), can follow the topography more closely and have inflective gradients (i.e. negative slope). When the sewer roughly follows the ground contours, the flow in the sewer is allowed to vary between open channel flow and pressure (full-bore) flow. However, care should be taken with negative slopes as they may lead to surging above the ground level during peak flows. Inspection points should be provided at major connection points or when the size of the pipe changes.

Despite the presence of inflective gradients, the downstream end of the sewer must be lower than the upstream end. When choosing a pipe diameter (at least 75 mm), the depth of water in the pipe during peak flow within each section must be less than the diameter of the pipe. In sections where there is pressure flow, the invert of any interceptor tank outlet must higher than the hydraulic head within the sewer just prior to the point of connection otherwise the liquid will backflow into the tank. If this condition is not met, then either select the next larger pipe diameter for the sewer or increase the depth at which the sewer is laid.

Adequacy Solids-Free Sewers are appropriate for both full and partially filled flows. Although a constant supply of water is required, less water is needed compared to the Simple Sewer because self-cleansing velocities are not required.

Septic Tanks and Solids-Free Sewers can be built for new areas, or a Solids-Free Sewer can be connected to an existing primary treatment technology where

local infiltration is inappropriate. A Solids-Free Sewer can be built for 20% to 50% less than Conventional Gravity Sewerage.
This technology must be connected to an appropriate (Semi-) Centralized Treatment technology that can receive the wastewater. It is appropriate for densely populated areas where there is no space for a Soak Pit (D6) or Leach Field (D7). This type of sewer is best suited to urban and less appropriate in low-density or rural areas.

Health Aspects/Acceptance This technology requires regular maintenance on the part of the users and is therefore, not as passive as Conventional Gravity Sewers. Users must assume some level of responsibility for the technology and accept that some potentially unpleasant maintenance may be required. Also, users should be aware that, because the system is community based, they may have to work with and/or coordinate maintenance activities with other users. The system will provide a high level of service and may offer a significant improvement to non-functioning Leach Fields (D7).

Upgrading Solids-Free Sewers are good upgrading options for Leach Fields (D7) that have become clogged and/or saturated with time as well as for rapidly growing areas that would not accommodate more Septic Tanks with Leach Fields.

Maintenance The septic/interceptor tank must be regularly maintained and desludged to insure optimal performance of the Solids-Free Sewer network. If the pre-treatment is efficient, the risk of clogging in the pipes is low, but some maintenance will be required periodically. The sewers should be flushed once a year as part of the regular maintenance regardless of their performance.

Pros & Cons:
+ Greywater can be managed at the same time
+ Can be built and repaired with locally available materials
+ Construction can provide short-term employment to local labourers
+ Capital costs are less than Conventional Gravity Sewers; low operating costs
+ Can be extended as a community changes and grows
- Requires expert design and construction supervision
- Requires repairs and removals of blockages more frequently than a Conventional Gravity Sewer
- Requires education and acceptance to be used correctly
- Effluent and sludge (from interceptors) requires secondary treatment and/or appropriate discharge

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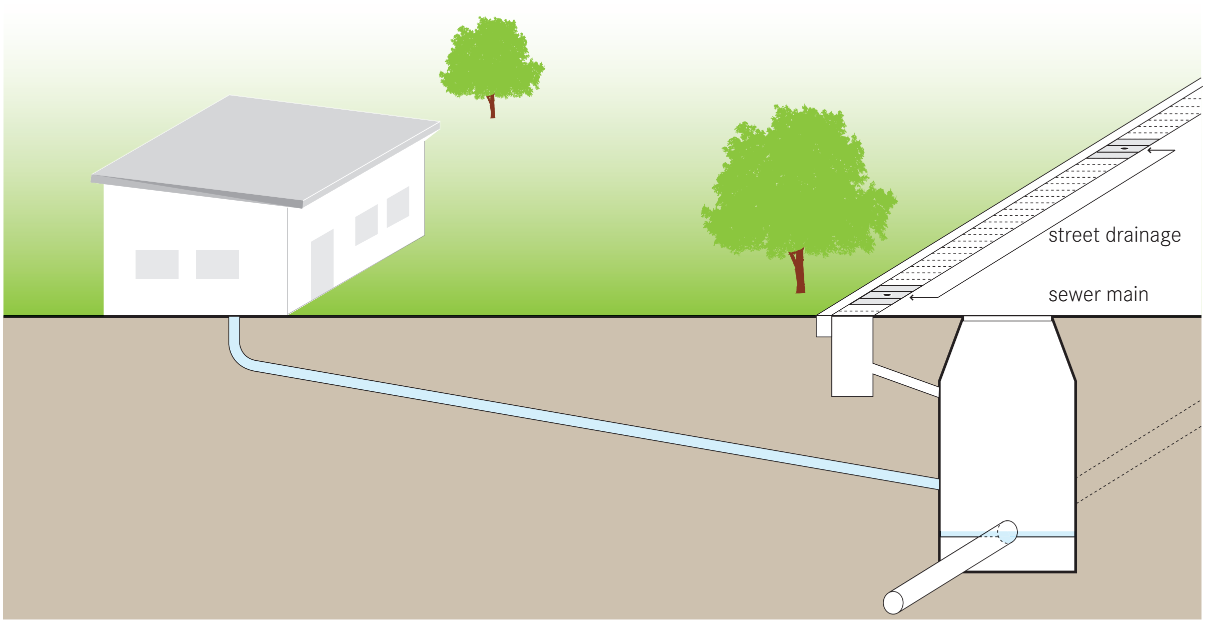
C.6 Conventional Gravity Sewer

Applicable to:
System 7, 8

Application Level	Management Level	Inputs/Outputs:	
Household	Household	Blackwater	Greywater
★ Neighbourhood	Shared	Brownwater	Stormwater
★★ City	★★ Public		



Conventional Gravity Sewers are large networks of underground pipes that convey blackwater, greywater and stormwater from individual households to a centralized treatment facility using gravity (and pumps where necessary).

The Conventional Gravity Sewer system is designed with many branches. Typically, the network is subdivided into primary (main sewer lines along main roads), secondary, and tertiary networks (network at the neighbourhood and household level).

Conventional Gravity Sewers do not require onsite pretreatment or storage of the wastewater. Because the waste is not treated before it is discharged, the sewer must be designed to maintain self-cleansing velocity (i.e. a flow that will not allow particles to accumulate). A self-cleansing velocity is generally 0.6–0.75 m/s. A constant downhill gradient must be guaranteed along the length of the sewer to maintain self-cleaning flows. When a downhill grade cannot be maintained, a pump station must be installed. Primary sewers are laid beneath roads, and must be laid at depths of 1.5 to 3 m to avoid damages caused by traffic loads.

Access manholes are placed at set intervals along the sewer, at pipe intersections and at changes in pipeline direction (vertically and horizontally). The primary network requires rigorous engineering design to ensure that a self-cleansing velocity is maintained, that manholes are placed as required and that the sewer line can support the traffic weight. As well, extensive construction is required to remove and replace the road above.

Adequacy Because they carry so much volume, Conventional Gravity sewers are only appropriate when there is a centralized treatment facility that is able to receive the wastewater (i.e. smaller, decentralized facilities could easily be overwhelmed).

Planning, construction, operation and maintenance require expert knowledge. Conventional Gravity Sewers are expensive to build and, because the installation of a sewer line is disruptive and requires extensive coordination between the authorities, construction companies and the property owners, a professional management system must be in place.

When stormwater is also carried by the sewer (called a Combined Sewer), sewer overflows are required. Sewer overflows are needed to avoid hydraulic surcharge of treatment plants during rain events. Infiltration into the

sewer in areas where there is a high water table may compromise the performance of the Conventional Gravity Sewer.
Conventional Gravity Sewers can be constructed in cold climates as they are dug deep into the ground and the large and constant water flow resists freezing.

Health Aspects/Acceptance This technology provides a high level of hygiene and comfort for the user at the point of use. However, because the waste is conveyed to an offsite location for treatment, the ultimate health and environmental impacts are determined by the treatment provided by the downstream facility.

Maintenance Manholes are installed wherever there is a change of grade or alignment and are used for inspection and cleaning. Sewers can be dangerous and should only be maintained by professionals although, in well-organised communities, the maintenance of tertiary networks might be handed over to a well-trained group of community members.

Pros & Cons:
+ Stormwater and greywater can be managed at the same time
+ Construction can provide short-term employment to local labourers
- A long time required to connect all homes
- Not all parts and materials may be available locally
- Difficult and costly to extend as a community changes and grows
- Requires expert design and construction supervision
- Effluent and sludge (from interceptors) requires secondary treatment and/or appropriate discharge
- High capital and moderate operation cost

References

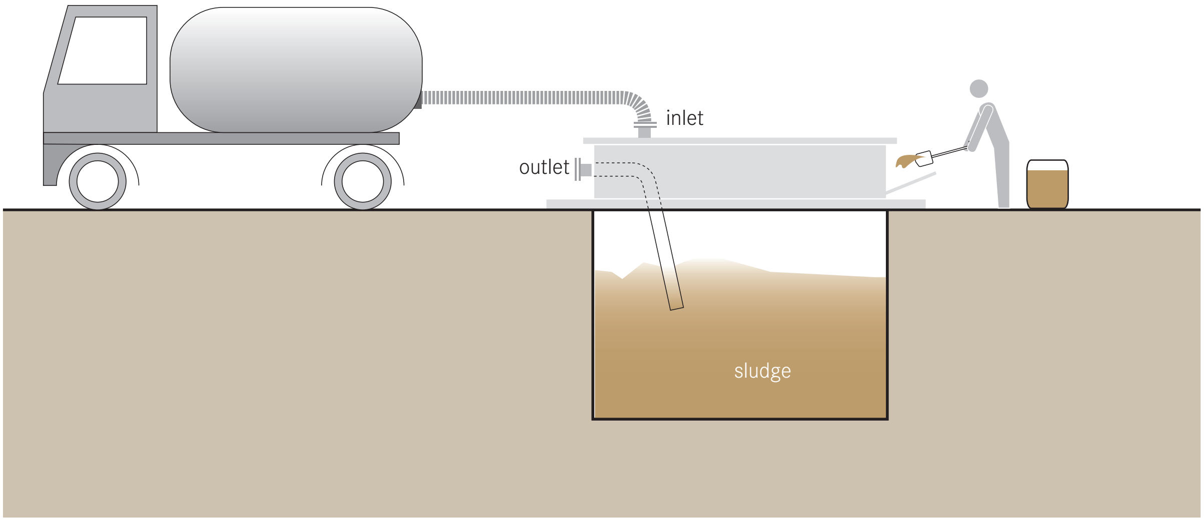
_ ASCE (1992). *Gravity Sanitary Sewer Design and Construction, ASCE Manuals and Reports on Engineering Practice No. 60, WPCF MOP No. FD-5.* American Society of Civil Engineers, New York.
(A standard design text used in North America although local codes and standards should be assessed before choosing a design manual.)

_ Tchobanoglous, G. (1981). *Wastewater Engineering: Collection and Pumping of Wastewater.* McGraw-Hill, New York.

_ Tchobanoglous, G., Burton, F.L. and Stensel, H.D. (2003). *Wastewater Engineering: Treatment and Reuse, 4th Edition.* Metcalf & Eddy, New York.

C.7	Transfer Station (Underground Holding Tank)	Applicable to: **System 1, 5, 6**	C.7

Application Level	**Management Level**	**Inputs/Outputs:**
Household	Household	Faecal Sludge
★★ Neighbourhood	★ Shared	
★★ City	★★ Public	



Sometimes termed Underground Holding Tanks, Transfer Stations act as intermediate dumping points for faecal sludge when it cannot be easily transported to a (Semi-) Centralized Treatment facility. A vacuum truck must empty Transfer Stations when they are full.

Manual, or small scale sludge emptiers who use the MAPET or the Gulper, for example, dump the sludge in a local transfer station rather than either a) dumping it illegally or b) trying to travel to a distant collection point.

When the Transfer Station is full, a vacuum truck empties the contents and takes the sludge to a suitable treatment facility. If the municipality or sewerage authority is operating the Transfer Station they may charge for permits to dump in the Transfer Station to offset the cost of maintaining the facility.

The Transfer Station consists of a parking place for the vacuum truck or sludge cart, a connection point for the discharge hose, and a storage tank. The dumping point at the Transfer Station should be built low enough to minimize spills when labourers are manually emptying their sludge carts. Additionally, the Transfer Station should include a vent, a trash screen to remove large debris (garbage) and a washing facility for vehicles.

A variation is the Sewer Discharge Station (SDS), which is like a Transfer station, but is directly connected to a Conventional Gravity Sewer main (for more information, refer to Technology Information Sheet C8: Sewer Discharge Stations). Sludge emptied into the SDS is released either directly or at timed intervals into the sewer main to optimize the performance of the sewer and the wastewater treatment plant, and/or reduce peak loads.

Adequacy Transfer Stations are especially appropriate for dense, urban areas where there is no alternative discharge point (e.g. faecal sludge thickening pond). Multiple Transfer Stations in a city may help to reduce the incidence of illegal sewage dumping. The quality and quantity of the faecal sludge will significantly affect the treatment technology that is subsequently required.

Transfer stations are adequate when there are many locations where small-scale sludge emptying is practiced. The construction of a Transfer Station may also stimulate the independent-emptying market. The site for the Transfer Station should be easily accessible, conveniently located, and easy to use. The underground holding tank must be

well constructed to prevent leaching and/or surface water infiltration. Depending on the maintenance of the facility, odours can be unappealing to local residents. However, the benefits gained compared to open-air dumping would likely offset the odour nuisance.
The system for issuing permits or charging access fees must be carefully designed so that those who most need the service are not excluded because of high costs, while still generating enough income to be sustainable and well-maintained.

Health Aspects/Acceptance Transfer Stations have the potential to significantly increase the health of a community by providing an inexpensive, local solution to faecal sludge and septage disposal. By providing a Transfer Station, independent or small-scale emptiers are no longer forced to dump sludge illegally; homeowners are more motivated to have their pits emptied. Transfer Stations can be a low-cost, effective Conveyance technology for faecal sludge. When pits are emptied regularly and illegal dumping is minimized, the overall health of a community can be improved significantly. The location must be carefully chosen to maximize efficiency, while minimizing odours and disturbances to nearby residents.

Upgrading Transfer stations are relatively common in North America. There, they are equipped with digital data recording devices to track quantities, input types and origin, as well as collect data from the individuals who dump there. In this way, the facilitators can collect detailed information and more accurately plan and adapt to the changing loads.

Maintenance Racks (screens) must be cleaned frequently to ensure a constant flow and prevent backups. Sand and grit must also be periodically removed from the holding tank. There should be a well-organized system for emptying the transfer-station; if the holding tank fills up and overflows it is no better than an overflowing pit. The pad and loading area should be cleaned regularly to minimize odours, flies and other vectors from becoming a nuisance.

Pros & Cons:

\+ Reduces transport distance and may encourage more community-level emptying solutions
\+ May reduce illegal dumping of faecal sludge
\+ Moderate capital and operating costs; can be offset with access permits
\+ Potential for local job creation and income generation
\- Requires expert design and construction supervision
\- Sludge requires secondary treatment and/or appropriate discharge

References

_ African Development Fund (2005). *Accra sewerage improvement project- appraisal report.* Infrastructure Department Central and West Regions. Available: www.afdb.org

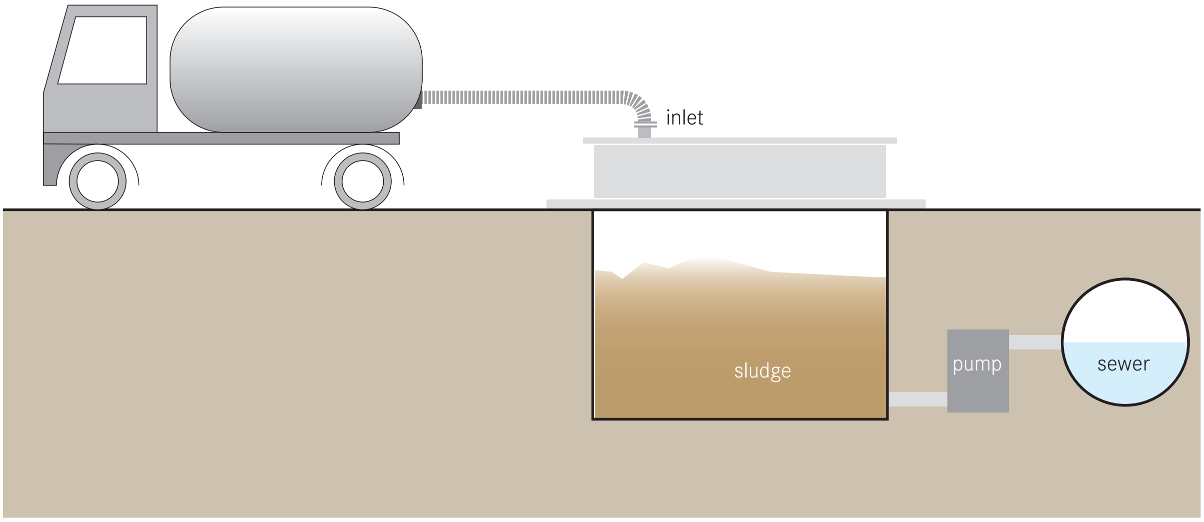
_ Boot, NLD. and Scott, RD. (2008). *Faecal Sludge in Accra, Ghana: problems of urban provision.* Proceedings: Sanitation Challenge: New Sanitation Concepts and Models of Governance. Wageningen, The Netherlands.

_ USEPA (1994). *Guide to Septage Treatment and Disposal: EPA/625/R-94/002.* United States Environmental Protection Agency, Office of Research and Development, Cincinnati, Ohio, USA. Available: www.epa.gov

C.8 Sewer Discharge Station (SDS)

Applicable to:
System 1, 5, 6

Application Level	Management Level	Inputs/Outputs:
Household	Household	Faecal Sludge
★★ Neighbourhood	Shared	
★★ City	★★ Public	



A Sewer Discharge Station (SDS) is a point along the sewer main that can be legally accessed and used for discharging septage and sludge directly into the sewer so that it can be transported to a (Semi-) Centralized Treatment facility. SDSs are intermediate transfer points for sludge that cannot easily be transported to a dedicated treatment facility. Sludge can be dumped in a local SDS rather than either a) dumping it illegally or b) trying to travel to a distant collection point.

Sludge is dumped into the SDS and then either released directly to the sewer or held in a temporary storage tank before being released to the sewer at a set time. Timed release can help prevent solids from building up in the sewer line and also help optimize the treatment efficiency of the treatment technology by reducing peak loading.

A SDS consists of a parking place or discharge dock for the vacuum truck or sludge cart and a connection point for the discharge hose. The SDS may also have a storage tank and pumping system. The dumping point should be built low enough to minimize spills when labourers are manually emptying their sludge carts. Additionally, SDS should include a vent, a trash screen to remove large debris (garbage) and a washing facility for vehicles. The station should be well protected and maintained to prevent random dumping into the sewer and to ensure the safety of the users.

A variation is a stand-alone Transfer Station that is not connected to a sewer main (for more information, refer to C7: Transfer Station (Underground Holding Tank) Technology Information Sheet). When the Transfer Station is full, a vacuum truck must empty the stored contents and take the sludge to a suitable treatment facility. If the municipality or sewerage authority is operating the Transfer Station they may charge for permits to dump in the Transfer Station to offset the cost of maintaining the facility.

Adequacy SDSs are especially appropriate for dense, urban areas where there is no alternative discharge point (e.g. faecal sludge thickening pond) and where there is a sewer main. Multiple SDSs in a city may help to reduce the incidence of illegal sewage dumping. The quality and quantity of the faecal sludge will significantly affect the treatment technology that is receiving the sludge.

SDSs are adequate when there are many locations where sludge is manually removed from pit latrines. The construction of an SDS may also stimulate the independent-emptying market. The site for the SDS should be easily accessible, conveniently located, and easy to use. If there is an underground holding tank for timed releases of sludge, it must be well constructed to prevent leaching and/or surface water infiltration. Depending on the maintenance of the facility, odours can be unappealing to local residents. However, the benefits gained compared to open-air dumping would likely offset the odour nuisance.

The system for issuing permits or charging access fees must be carefully designed so that those who most need the service are not excluded because of high costs, while still generating enough income to be sustainable and well-maintained.

Health Aspects/Acceptance SDSs have the potential to significantly increase the health of a community by providing an inexpensive, local solution to faecal sludge and septage disposal. Many informal settlements are located near to, if not directly on top of, a sewer line. By building a legitimate access point, the risk of sewer damage and illegal access points may be reduced. When pits are emptied regularly and illegal dumping is minimized, the overall health of a community can be improved significantly.

The location must be carefully chosen to maximize efficiency, while minimizing odours and disturbances to nearby residents.

Upgrading SDSs are relatively common in North America, especially in rural communities where septic tanks are common. There, they are equipped with digital data recording devices to track quantities, input types and origin, as well as collect data from the individuals who dump there. In this way, the facilitators can collect detailed information and more accurately plan and adapt to the changing loads.

Maintenance Racks (screens) must be cleaned frequently to ensure a constant flow and prevent backups. Sand and grit must also be periodically removed from the holding tank. The pad and loading area should be cleaned regularly to prevent smells, flies and other vectors from becoming a nuisance.

Pros & Cons:

+ Reduces transport distance and may encourage more community-level emptying solutions
+ May reduce illegal dumping of faecal sludge
+ Moderate capital and operating costs; can be offset with access permits
+ Potential for local job creation and income generation
- Requires expert design and construction supervision
- May cause blockages and disrupt sewer flow
- Sludge requires secondary treatment and/or appropriate discharge

References

_ African Development Fund (2005). *Accra sewerage improvement project- appraisal report.* Infrastructure Department Central and West Regions.
Available: www.afdb.org

_ Boot, NLD. and Scott, RD. (2008). *Faecal Sludge in Accra, Ghana: problems of urban provision.* Proceedings: Sanitation Challenge: New Sanitation Concepts and Models of Governance. Wageningen, The Netherlands.

_ USEPA (1994). *Guide to Septage Treatment and Disposal: EPA/625/R-94/002.* United States Environmental Protection Agency, Office of Research and Development, Cincinnati, Ohio, USA.
Available: www.epa.gov