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1 Sewage

Sewage is the mixture of liquid, faeces, toilet paper and food wastes produced by people. The liquid in sewage includes urine (piss) and wastewater which comes from the toilet, the kitchen, bathroom and laundry.

Sewage contains lots of disease-causing germs and parasites. Sewage is treated to get rid of as much of the solid matter as possible. The remaining liquid is called effluent.

2 Sewage disposal

Getting rid of sewage and effluent is called sewage disposal. If sewage is not disposed of or contained correctly people may come into contact with it and get very sick.

There are different ways to dispose of sewage. Whichever method is used, it is important to make sure that it does not:

- cause dangerous conditions which allow people to come into contact with disease-causing germs
- cause pollution of a water supply
- allow the breeding of insects such as mosquitoes or cockroaches which can carry disease-causing germs inside or on their bodies as a result of eating or walking in sewage
- produce bad smells.

3 Disease from sewage

Disease-causing germs can be spread from sewage if it is not disposed of properly or if people do not practise proper toilet hygiene (cleanliness). If a sewage disposal system is not properly maintained it will not be able to get rid of the sewage safely. For a sewage system to be properly maintained, all faulty (blocked, damaged, broken or worn-out) parts must be mended as soon as possible after they stop working correctly.
Diseases caused by germs:

Bacterial:
- salmonellosis
- shigellosis
- diarrhoea
- trachoma
- melioidosis.

Viral:
- gastroenteritis
- hepatitis A.

Diseases caused by parasites:
- giardiasis
- dwarf tapeworm infection
- threadworm infection
- hookworm infection
- strongyloidiasis.

These disease-causing germs and parasites can be spread:

- **directly** by people coming into contact with sewage or toilet waste (this can happen, for example, when people walk through sewage which has leaked onto the ground from broken sewage pipes)
- **indirectly** by people:
  - coming into contact with animals such as flies and cockroaches which carry the germs and parasites in or on their bodies. Dogs and cats can carry germs and parasites too
  - drinking water which has been contaminated by sewage.

This is a list of some of the conditions which make it easy for direct or indirect spread of germs and parasites from sewage:

- Not washing hands after going to the toilet.
Fig. 2.1: Not washing your hands after going to the toilet helps spread germs to food.

- Sewage or effluent collecting in pools as a result of an overflowing sewage lagoon or broken sewage pipes. This sewage and effluent contains disease-causing germs and parasites and allows mosquitoes to breed.
- Uncovered or broken septic tanks which allow effluent to escape, meaning that people or pets can directly be exposed.
 Blocked, overflowing toilets which make it easy for children to come into contact with germs.

 Leach drains from septic tanks which are too close to drinking water supplies so that effluent soaks through the soil into the water supply.

4 Pit, bucket and chemical toilets

4.1 PIT TOILETS

Any toilet in which the faeces and urine go directly into a hole in the ground is called a pit toilet. Pit toilets are also called latrines, drop-hole toilets and bore-hole toilets.

Toilets of this type are still in use in Australia, particularly in remote areas where water is in short supply. These toilets are always located away from the main dwelling and should always be located away from community water sources to prevent contamination of the water supply. To give privacy they are usually inside a properly constructed building. However, they are sometimes surrounded by roughly constructed walls and may not have a roof.

There are different kinds of pit toilet. The most common ones are described below.

Dry drop-hole toilets

This type of toilet is a hole in the ground which is only a few feet deep. There may or may not be a seat over the hole.

Fig. 2.2: Dry drop-hole toilet with roughly constructed seat and walls.
As the hole fills with sewage, bacteria will break down some of the materials into effluent. If the hole fills up too quickly, there is not enough time for the bacteria to break down any of the sewage.

Drop-holes can fill up quickly if a lot of people are using them. This is because they are not deep enough. When they are nearly full they must be filled up with soil. A new hole then needs to be dug, and the seat and walls transferred to the new site.

**Fig. 2.3: Dry drop-hole toilet with properly constructed walls and roof but without a seat.**

**Bore-hole latrines**

This type of toilet has a seat on top of a deep hole. These toilets can be used for a long time because they are slow to fill up. The sewage slowly breaks down because of the action of germs and any wastewater soaks into the ground.

When the hole is nearly full, a new one is dug and the old one filled up with soil.

The breakdown process can be assisted by adding half a bucket of water to the pit once a week.

**Fig. 2.4: A bore-hole toilet with a bucket for adding water to the disposal pit.**
VIP latrines

An enhanced version of the pit is the **vented improved pit (VIP) latrine**. This is a dry drop-hole toilet which has been specially designed so that any flies which enter the hole and crawl over the sewage cannot escape and carry disease-causing germs to people and food. Odours (smells) are reduced and any that do occur are directed away from the community by choosing the right site for the toilet.

The VIP latrine has a special snail-shape design. The walls meet the roof and the floor allowing no light into toilet area except through a special air-vent pipe which lets some light into the pit under the seat.

This light attracts flies up into the vent pipe. The top opening of the vent is covered by a fly-proof mesh and this prevents the flies from escaping. Attracted by the light they will stay here until they die. The darkness in the toilet area discourages them from returning back up through the hole in the seat.

![Fig. 2.5: A VIP latrine.](image-url)
Careful siting of VIP latrines is particularly important so that odours are blown away from nearby houses as much as possible. It is also important to site the latrine so that the doorway faces in the direction from which most of the prevailing wind comes. All light should be kept out of the toilet area when not in use.

4.2 PAN CLOSET TOILETS

Pan closet toilets were once common in Australian towns. However most, if not all, have been replaced by septic tank and leach drain or full sewage or effluent systems.

Pan closet toilets had a bucket under the toilet seat. These toilets were also called bucket latrines. The buckets containing the sewage (nightsoil) were taken away once a week, or more often if necessary, and a clean, empty bucket put in its place. Special contractors were employed by local authorities to do this work in towns. To stop flies getting into the bucket the toilet seat had a lid on it.

To keep the contents in the buckets during transport, lids were put on them. The buckets were then emptied into a special trench at the local rubbish tip. They were washed immediately with phenol or some other disinfectant ready for use again.

4.3 CHEMICAL TOILETS

This is a special type of toilet in which chemicals are used to break down the faeces and urine. It is not often used in dwellings, but is common in caravans and small leisure boats.

Chemical toilets are also used in portable (able to be moved) facilities, for example, in toilets on construction sites or at special public events, such as outdoor music festivals.

The chemical toilet has a tank attached to it to which chemicals are added. Where small capacity tanks are required, such as in caravans, the tanks are usually under the seat. However, where a number of toilets with a large capacity are needed, such as on a large building construction site, one large tank may be placed under the ground to receive the sewage from all of the toilets.

The chemicals treat the sewage to break down the solid materials to a liquid. When the tank is full, the effluent is pumped out and disposed of at an appropriate site, such as a rubbish tip. The tank is rinsed out and more chemicals are added before it is used again.
5 Flushing toilets

Over the years the toilet has developed into its present form, the flushing toilet. It has a flushing mechanism to wash the urine, faeces and toilet paper away with water. This type of toilet requires a constant and sufficient (enough) water supply.

The flushing toilet provides a comfortable, safe and hygienic method of sewage disposal. The force of the water from the flushing mechanism, which is called the cistern, washes the urine, faeces and toilet paper out into the septic tank or sewage system.

The flushing toilet consists of a seat on a pedestal pan made of vitreous china or metal and a cistern. Most modern cisterns are dual flush, so a bigger flush can be provided to get rid of faeces and a smaller flush can be given to get rid of urine and liquid wastes.
It is important that toilet cisterns work properly all the time. If they do not work, the sewage is left in the toilet pan. Sewage left in toilets will smell bad and will bring flies which can carry disease-causing germs to people. If people keep using the toilet without flushing it, the toilet pan will fill up with faeces and paper and will block.

If the cistern does stop working it must be repaired as soon as possible. However, the toilet can be flushed by pouring a bucket of water into the pedestal pan. This should be done every time the toilet is used until the cistern is fixed.

The most important part is the cistern. This begins the flushing process. Sometimes the cistern is set behind the wall in a duct or cavity to protect it from vandals.

### 5.1 PROBLEMS WITH CISTERNs

Cisterns can develop leaks which are caused by blockages or broken or worn parts. The parts which usually become worn or broken are the **ball float**, the **inlet valve** or the **outlet valve**.
When frogs or rubbish find their way into the cistern they can stop parts, such as the ball float or the outlet valve, from working properly. For example, frogs sitting on the ball float arm can prevent the inlet valve from closing and cutting off the water when the cistern is full. All rubbish and frogs should be cleaned out of the cistern.
Any of these problems in the cistern can cause an **overflow of water**. Modern toilet cisterns are made in such a way as to get rid of the overflow water without making a mess.

In some older cisterns this overflow of water drains to the toilet floor and is disposed of through a **floor waste**. This is a drain that will allow any overflow or other small amounts of water which get onto the floor, such as when it is washed, to flow outside the building. However, more modern cisterns are designed to allow the overflow to drain down the flush pipe into the pedestal pan.

If there is water leaking from the outlet drain or there is water continuously flowing into the pan, this means there is a problem with the cistern.

Some possible reasons for this continual flow of water into the pedestal pan or overflow of water on to the floor are:

The inlet valve stays open and allows the water flow because:

- the ball float is leaking and sinks
- the float arm is not correctly adjusted to cut off the inlet valve
- frogs are sitting on the float arm holding the float down
- the inlet valve rubber is worn.
Fig. 2.11: A crack in the ball float will cause it to fill up with water and sink. A leak in the ball float can often be fixed by filling the hole with a special glue.

When the ball float arm is not adjusted to cut off the inlet valve properly the water overflows into the cistern. The float arm can be adjusted so that it cuts off when the cistern is full.

- The inlet valve is faulty, such as when it is worn, and allows water to flow continuously
- The outlet valve is faulty, such as when rubbish stops it closing properly, and allows water to leak down the flush pipe
- The outlet valve becomes coated with mineral deposits from hard water and will not close
- The outlet valve becomes covered in slime and will not close

Fig. 2.12: A faulty inlet valve.

The inlet and outlet valves need to be checked occasionally. They sometimes need cleaning, adjusting or replacing.
5.2 LEAKING FLUSH PIPES

Behind the toilet pan is a pipe which joins the pan to the cistern. It is called the flush pipe and brings the water down to the pan when the toilet is flushed. This pipe can sometimes leak at the pipe/pan connection. This wets the floor and wastes water. If there is a wet patch on the floor behind the pan and the cistern is working properly, check the rubber cone connection.

5.3 THE DO’S AND DON'TS OF TOILET USE

Flush toilets need to be used and looked after properly so that they are healthy places. Here are some do’s and don’ts for the toilet:

- Do push the flush button after the toilet has been used.
- Do clean the toilet regularly.
- Do use toilet paper.
- Do wash hands after using or cleaning the toilet.
- Do get the toilet fixed if it is not working properly.
- Don’t use the toilet if it is blocked.
- Don’t put anything down the toilet except faeces, urine and toilet paper. Things like food scraps, cooking fat, bottles, cans, clothes, newspaper, and towels block the toilet.
Fig. 2.14: Push the button.

Fig. 2.15: Clean the toilet.
Fig. 2.16: Use toilet paper.

Fig. 2.17: Wash hands after going to the toilet.
Fig. 2.18: Toilets which are not working properly must be fixed.

Fig. 2.19: Never use a blocked toilet.
6 Plumbing

Nowadays, most houses and other buildings have some plumbing. Plumbing consists of the pipes which bring water to the building and take the sewage away.

The pipes cannot always be seen as they are often put between walls or under the ground.

Sinks, showers, hand basins, laundry tubs and toilets have metal or plastic pipes joined to them which go outside and connect into the sewage system under the ground. Older plumbing systems may have earthenware (clay) pipes.

The sewer pipe is the pipe which carries the sewage to the disposal system.

6.1 Inspection Openings

Inspection openings (IOs) are covered holes in sewer pipes which allow access to the inside of the pipe so that blockages can be cleared. IOs are usually placed in the pipe where it comes out of the building, where the pipe changes direction, or at regular points in a straight length of pipe. One is also placed just before the septic tank if there is one.
If there is a problem with the plumbing and the pipes get blocked these IOs must be found. IOs are usually marked on the plumbing plan for the building, however, several holes may need to be dug before the IO is found. The best place to start is outside the wall near the blocked fixture. (The toilet, handbasin, bath, laundry tub and kitchen sink are called fixtures because they are firmly fixed to the building.)

The local Environmental Health Practitioner can assist you in locating IOs.

6.2 TRAP WATER SEAL

Nearly all sewer pipes and fixtures in a building will have a trap water seal. These seals are very important as they stop the gases which form in sewer pipes from coming into the building. Fixtures sometimes will have an IO at the base of the water seal pipe which allows it to be cleaned.

![Fig 2.21: Water seal.](image)

There are several different types of trap water seal design. Here are two of them.
6.3 DISCONNECTOR TRAP

The disconnecter trap (DT) is a pipe coming out of the ground which is sealed off with a grate to stop rubbish getting into it.

It is a very important pipe as it allows the wastewater to escape if the plumbing system gets blocked. It is always found outside the house, so that any overflow water would be released outside the building.

It is also very important to make sure that the people in the building know that they must not put anything down the DT. For example, children must not drop sand or rubbish into it, and people must not pour cooking fat or other food waste into it.

It is very important to know where the disconnecter trap is.
Wastewater pipes coming from the tub, hand basin or kitchen sink may go directly to the DT. They will join the DT below the level of the grate. Toilet waste never goes into a DT and this means that a DT is never on the pipe coming from the toilet.

6.4 HOUSE PLUMBING DESIGN

This is an example of a house plumbing design showing the fixtures, inspection openings, disconnector trap, “S” or “P” traps and the sewer pipe.

![House Plumbing Design Diagram]

*Fig. 2.24: A house plumbing design.*

Sometimes in a bathroom the wastewater from the shower, hand basin, and bath can flow to a central drain. This drain may be the shower drain or a separate gully set in the bathroom floor, commonly called a **floor waste gully**.

A bathroom floor waste gully taking all the wastewater from the bathroom fixtures must go to the sewer pipe. This central drain will have a grate at floor level. The bathroom floor must be sloped towards the shower recess drain or the central gully so that water cannot pool.

Another way of taking away water on the floor is a dry floor waste. These can be placed in other rooms containing plumbing fixtures, such as the laundry or toilet, to assist in draining water from the floor.
A dry floor waste discharges the water directly into the ground just outside the room, because the amount of wastewater, usually from floor washing, should not be large and cause pooling.

![Fig 2.25: Typical floor waste gully.](image)

**7 Unblocking pipes and fixtures**

**7.1 COMMON BLOCKAGE MATERIALS**

Toilets and toilet pipes get blocked when people put the wrong things down the toilet. Some of the things which should never be put down the toilet are foodscraps, paper, rags, cans, bottles, grease and fat.

Wastewater pipes from sinks, basins and laundry tubs can get blocked if people put food waste, especially tea leaves, hot fat and other rubbish down them. If hot fat is poured down an outlet pipe, it will set in the pipe when it cools and cause a blockage.
In addition to blockages caused by these materials, main sewer pipes can get blocked in other ways, for example, tree roots growing into the pipe joints and soil blocking the pipe when it is broken by vehicle traffic.

### 7.2 PLUMBING RODS

Plumbing rods are pieces of equipment used to remove most blockages from sewer pipes. However, when sewer pipes are broken plumbing rods are not effective and the damaged pipe must be replaced.

The rods screw together so that they can be made as long as needed. They have different kinds of endings to help remove the blocking objects.

![Plumbing rods](image)

To unblock the sewer pipe it is important to find an inspection opening (IO) **below** the blockage and push the rods **up** the pipe to the blockage.

**Always remember which way the rods and endings have been screwed together and always twist the rods in the same direction.**

If this is not done, the rods are likely to become unscrewed and be left in the sewer pipe. This will create a worse problem because the rods will also block the pipe. If this happens it will probably be necessary to dig up the sewer pipe and break it to unblock the pipe and get the rods back. This would have to be done by a licensed plumber.
7.3 UNBLOCKING SEWER PIPES

The larger sewer pipes have manholes set in them allowing access to the pipe. They are often about a metre underground and are large boxes which usually have walls made of concrete. The pipe opens into the box on one side and starts again on another side.

The lids, which are made of metal, can be lifted to allow someone to look down into the sewer to see if there is evidence of a blockage, for example, wastewater build-up in the manhole.

![Diagram of a manhole with a blockage](image)

**Fig. 2.27: A blockage in the sewer pipe can cause the wastewater to build-up in the manhole.**

Extreme care must be taken when opening the lids of sewer pipes as poisonous and explosive gases can build up in these pipes.

Before attempting to unblock a sewer pipe it is important to remember:

- Before making an inspection, always wait several minutes to allow any poisonous or explosive gases to escape.
- Never smoke while doing this work.
- Never do this work alone.
- Never enter a manhole without proper safety measures. It may be necessary to wear breathing equipment or to ventilate (add fresh air) to the manhole and sewer pipe. **The gases in it can kill.**
It is always safest to check with the Water Authority, the local government EHO or supervisor before opening the lid or entering the manhole.

If there are no manholes, then there will be IOs with cement or plastic caps on the pipes. There may be a concrete box around the inspection opening. Sometimes these are below the ground and are not easy to find. It may be necessary to dig to find them.

It is a good idea to get the sewer pipe plans for your community so that you can refer to the plans before starting to dig.

7.4 UNBLOCKING FIXTURES

For the plumbing system to work, the pipes must be free of blockages. If the pipes are blocked, the toilet, shower, laundry tubs and/or the kitchen sink will not carry the wastewater away properly.

If a fixture is blocked, the wastewater may flow onto the floor of the house. If the sewer pipe is blocked, the wastewater may flow from the DT onto the ground outside. Contact with this wastewater may cause disease.

To unblock a sink, shower recess or any tubs, first remove any larger pieces of rubbish and then try using a plunger or a mop to finish unblocking the pipe. Pipes from sinks, basins and tubs and the small waste pipes leading to the larger sewage pipes outside the building will have small IOs.
These may be sealed with a screw plug, either close to the fixture or on a bend. The plugs on these IOs can be removed to allow access to blockages.

A plunger consists of a heavy rubber cup which is attached to a handle on the closed side. It is used by placing it over the opening to the blocked outlet pipe and then thrusting it up and down quickly over the hole. The suction caused by this action will help to move the blockage.

A mop can be used to unblock a pipe in the same way. It is best to use a mop to unblock a toilet pan.

If using a plunger or a mop does not work, the pipes will need to be examined through IOs or a manhole to find the blockage. This can then be removed with plumbing rods. If these are not available, a hose may work.

Fig 2.29: Unblocking fixtures.
8 Methods of sewage treatment

Every community should have a way of disposing of sewage so that people, animals and flies cannot touch it. This is called a sewage system.

There are different types of sewage systems which can be described as on-site systems and sewage or effluent systems.

An on-site system is one which treats the sewage in a septic tank so that most of the sewage becomes effluent and is disposed of in an area close to the house or buildings. An example of an on-site disposal system consists of a septic tank and leach drains.

A sewage or wastewater system disposes of the effluent from a community at a central place usually called a sewage lagoon or effluent pond. The sewage can be treated:

- in a septic tank at each building
- just before the lagoon in a large septic tank or macerator system, or
- in the lagoon itself.

8.1 ON-SITE DISPOSAL SYSTEMS

All the liquid waste from the toilet, bathroom, laundry and sink goes into pipes which carry it to a septic tank. The effluent from the tank is then disposed of through effluent disposal drains often referred to as leach or French drains. Both of these methods of disposing of liquid waste are on-site disposal systems. They must be installed and maintained properly.

In these systems, the effluent is soaked into the surrounding soil. Some soils don’t allow good soakage such as clay or similar soils; if there are any problems with this disposal system a local government EHO should be consulted to talk about the problem.

Fig. 2.30: Plan view (top) of an on-site sewage disposal system.
On-site disposal systems cannot be installed in all situations. For example, they cannot be installed:

- in areas that flood regularly
- in areas that have a high water table (that is, where the underground water is close to the surface)
- where the amount of wastewater to be disposed of is large
- near to drinking water supplies.

### 8.2 EFFLUENT (WASTEWATER) DISPOSAL SYSTEM

In this method the effluent from the community is carried by large pipes to the lagoon. These pipes serve all the houses and other buildings in the community. The sewage may be either be treated in septic tanks at the houses or buildings or at the lagoon. There are no leach or French drains.

![Diagram of wastewater disposal system](image)

**Fig. 2.31: Plan view of a wastewater disposal system.**

### 8.3 FULL SEWAGE SYSTEM

All the sewage from the toilet, shower, laundry and other areas enters waste and sewer pipes directly and is pumped to a lagoon. There are three types of full sewage system:

- The sewage enters the lagoon without treatment.
- The sewage goes through a series of cutting blades which help break up the solid matter before it enters the lagoon. These blades are called macerators.
The sewage may be treated in a large septic tank just before it enters the lagoon.

A septic tank can be used to treat the sewage from individual buildings at the building itself or for the whole community, at the lagoon. The sewage will pass through sewer pipes to the septic tank either at the house or at the lagoon.

The septic tank is a sealed round or rectangular container which is used to break down the sewage so that it becomes effluent through the action of bacteria living on the waste matter.
9.1 SEPTIC TANK DESIGN

A household septic tank usually consists of two round concrete tanks with lids placed close to each other. They are connected by a pipe. This type of septic tank is designed to be used by up to 10 people. Round tanks are constructed (built) at a factory and transported to the site (place) where they are to be used.

Fig. 2.34: A round septic tank system.

A septic tank can also be a single rectangular concrete tank with a dividing wall in it. A rectangular septic tank is designed to be used by more than 10 people and is often used for sewage treatment at a lagoon. The tank is constructed on the site where it is to be used.

Fig. 2.35: A rectangular septic tank system.
Septic tanks are always divided into two sections, the first being twice the size of the second. In round septic tanks, the separation into two tanks provides this division. In rectangular tanks the dividing wall provides the division. This wall will have a hole in it below the level of the sewage to allow effluent to pass from the first to the second section.

Round septic tanks have concrete bottoms and lids. Rectangular tanks usually have concrete bottoms and lids, but some may have metal lids. The lids can be lifted off for maintenance and will have IOs in them.

There are many regulations (rules) which require septic tanks to be constructed, positioned and installed in a particular way. These rules are controlled by local authorities.

It is very important to find out if the regulations are being followed by contractors or anyone else installing (putting in place) new septic tanks in the community. It is a good idea to contact the local EHO to check that the necessary approval has been given to construct and/or install the septic tank disposal system.

If anyone wants to know anything about septic tanks, including the rules relating to their construction, or there are any problems with these tanks in the community, contact the EHO or Environmental Health Practitioner.

### 9.2 HOW A SEPTIC TANK WORKS

A septic tank must be filled with water before it is used. The water helps start the treatment of the sewage by the bacteria.

The sewage treatment by the bacteria turns the waste matter into effluent (wastewater) and a solid substance called sludge. The effluent gets carried to the leach drain, French drain or lagoon.

The material in the septic tank gets covered by a hard crust known as a scum blanket. This blanket acts as an air seal keeping air away from the sewage. The lack of air helps in the breakdown of the sewage by the bacteria.

The sludge gathers at the bottom of the tanks. Eventually there will be too much sludge in the tank and it must be pumped out and the sludge disposed of correctly.

By having two tanks or a rectangular tank divided into two sections, most of the sludge stays in the first tank or section. In the second tank or section, the sewage undergoes further treatment to remove solid matter.

The effluent is then piped to the effluent disposal system, such as the lagoon. **This water still contains germs and parasites.**
9.3 PROBLEM SIGNS IN SEPTIC TANKS

The septic tank will need to be checked if there are signs that it is not working properly.

Some signs that a septic tank is not working properly are:

- The sewage in the toilet or the liquid waste from other fixtures flows away very slowly.
- Liquid waste overflows from the disconnector trap.
- Wet areas are seen at the top of the septic tank.
- There is a strong unpleasant smell near the septic tank.
- The grass around the tank is very green and growing well.

In the case of on-site disposal systems, it is important to remember that some of these signs may indicate problems with the leach or French drain. Therefore, these drains will need to be checked at the same time as the septic tanks are checked.

If the septic tank and the leach or French drain need to be pumped out, both should be done at the same time.

9.4 PUMPING OUT SEPTIC TANKS

Septic tanks should be pumped out every five years to keep the disposal system working properly. However, this may need to be done more often, for example, if they overflow or become blocked.

If there are any signs of a problem with the septic tank (see Section 9.3), it will need to be checked.

The inside parts of the tank system which will need to be checked are:

- the scum blanket (as it may become too thick and block the inlet pipe)
- the inlet or outlet pipes (as they may be blocked by solid matter)
- the sludge (as it may have accumulated so that it fills most of the tank)
- the tank’s bottom, sides or lids (as one or more of these may have been cracked or broken. For example, vehicle movements over septic tanks are likely to damage the lids and sides).

For the first few times an EHP pumps out a septic tank, it is important to always check with the local EHO or Environmental Health supervisor before any pump-out work is commenced.

These people will provide information on disposal sites and the correct pump-out methods as well as technical help in assessing the inside parts of the septic tank.
Emptying a septic tank

Before commencing Pump-out

(a) Find out if the community has or can obtain a pump-out tank or tanker. Make sure the sludge pump (pump-out equipment) is available and working.

(b) Locate an appropriate disposal site.

If a tank or tanker is used, the disposal site must be a place which is suitable for getting rid of the dangerous sludge and effluent and be able to take all the pumped out materials. For example, the site must be well away from water supplies, children’s play areas, camp places, rivers and streams, and downwind if possible. Often this place will be a hole dug in a separate part of the community rubbish tip.

If there is no tank or tanker available, the pumped-out material must be disposed of in a hole near the septic tank.

The distance between the septic tanks and the disposal hole will depend upon the length of the pump-out hose. The hole must be away from water supplies.

(c) Where possible, remove any tins, bottles, rags, newspaper and other rubbish that may be in the septic tank. This material can either be disposed of in the pump-out hole at the site or at the rubbish tip.

All sewage material which is to be taken to the tip should be transported in sealed drums.

Fig. 2.36: Removing solid materials.
When pumping out the septic tank:

(a) Pump out the sludge into the tanker or the hole.

If using a tanker the sludge can be deposited at the appropriate site away from the community.

If the disposal site is near the septic tank and the pump-out has commenced, the hole must be guarded at all times even if the pump-out stops for some reason, for example, for a lunch break or because of an equipment breakdown. The sewage must be covered with soil if the pump-out is not finished by the end of the day.

After covering the sludge with this layer of soil there may still be space in the hole to complete the pump-out the next day.

When covering the sludge with soil, remember that some time must allowed for the liquid to soak away before putting soil in the hole.

(b) When the job is finished the hole should be filled with a thick layer of soil.

(c) Once the septic tank has been completely emptied, it must be filled with water before it is used again.

Fig. 2.37: Pumping out a septic tank.
Note: When pumping out a septic tank using this method, great care must be taken and it is suggested that a local EHO should be consulted.

10 Effluent disposal drains (leach and French drains)

Effluent disposal drains such as leach drains and French drains are used to get rid of effluent that comes from the septic tanks. It is better to have these disposal systems put in two at one time (dual), so that one can be in use while the other one is rested. Resting one drain system lets oil and grease that has collected in the surrounding soil be broken down. These dual systems also last longer than a single system the same size.

10.1 LEACH DRAINS

A leach drain is a tube-like structure which is made of concrete or plastic and buried in the ground. There are holes in the sides. Its width can vary and its length depends upon the size of the leach drain being used, the amount of liquid waste to be disposed of, the type of soil (dirt) around it, and how it is built.

![Diagram of Septic tanks and brick leach drain]

Fig. 2.38: Septic tanks and brick leach drain.

The liquid waste enters the leach drain at one end then slowly seeps down through the open base and out the sides through holes into the surrounding soil.
10.2 FRENCH (RUBBLE) DRAINS

The French drain is also used to dispose of the liquid waste coming from the septic tank. It is a pipe with holes or slits cut in it, laid on a bed of round rocks. The holes or slits in the pipe face downwards. It is usually about 20 m long but the length depends upon the amount of effluent to be disposed of and the soil type around the drain.

The drain is covered with plastic or some similar material and is then covered with a protective layer of sand or gravel. This helps prevent the pipe holes or the gaps between the rocks from blocking up with the protective sand or gravel.
10.3 LEACH/FRENCH DRAIN MAINTENANCE

It is very important to remember that leach and French drains have a limited life (they do not last forever) because the surrounding soil can become clogged with oil and grease.

By using the dual drain systems, only one half of the system is being used at any one time. By alternating the use of these dual systems, the half that is not being used can dry out, the air breaks down the oil and grease so that the drain can be used again once the soil has become unclogged.

It is important to make sure that these alternating drains have their diversion valve switched over regularly so that the drains give a long life use.

By making sure septic tanks are regularly pumped out there is less solids entering the drains and they will have a much longer life.

All leach and French drain sizes are determined by the EHO who follows a set of regulations. These take into account surrounding soil types and the amount of effluent which needs to be disposed of each day. These rules also detail siting and construction requirements.

If there are any enquiries regarding these drains, contact the local EHO or Environmental Health Practitioner.

11 Sewage lagoons

A sewage lagoon is a large pond into which the sewage or effluent from the sewage system flows. Sewage lagoons are also called effluent ponds.

The sewage and effluent are broken down by germs in the lagoon. The sun and wind play an important role in the working of the lagoon. They provide light, warmth and oxygen to the water. This is necessary for the growth of the bacteria in the water.

The light, warmth and oxygen also aid the growth of algae in the water. The algae give the lagoon its greenish flecked colour. The algae helps the bacteria to break down the sewage and effluent.

The wind helps with the evaporation of the water and serves to get oxygen into the water. It also creates waves which help stop insects from breeding and living in the water. Disease-causing mosquitoes, for example, need still water to breed.
For a lagoon to be able to break down the sewage or effluent properly and to be a healthy place it must meet the following requirements:

- It must not be more than 1 m deep.
- The banks need to be sloped at approximately 15 to 20 degrees and made of concrete, gravel or rock. This stops the wave action from eroding (breaking down) the banks.
- There must be no grass, trees or other vegetation on the banks or surrounding area which would stop the sun and wind action needed by the lagoon.
- The water must be free of vegetation or objects which stop the lagoon’s surface wave action or create still patches.
- It must be surrounded by a high fence with a lockable gate to keep children and animals out.

11.1 LAGOON OVERFLOWS

Where there is only one lagoon in the sewage disposal system, it will have an overflow situated directly opposite where the pipe carrying the sewage or effluent enters the lagoon. If there is more than one lagoon in the system, the overflow will be in the last lagoon.

![Fig. 2.41: This is how the overflow from sewage lagoon contaminates the community drinking water supply. This is the wrong way.](image-url)
The overflow releases water from the lagoon system which has not been removed by evaporation. New lagoon systems are required to be designed so disposal occurs by evaporation only. They should not rely on overflow, except during very heavy rainfall periods. However, where an existing lagoon system uses an overflow method, the overflow should not create a flooded or swampy area suitable for mosquito breeding, or where it may contaminate drinking water or the environment.

11.2 LAGOON MAINTENANCE

Lagoons which are not working properly or are poorly maintained or damaged may be dangerous to health.

Signs of a lagoon which is not working properly are heavy overflow, mosquito breeding or a bad smell.

Signs of a lagoon which is poorly maintained or damaged include broken fences and gates, trees, shrubs or grass on the banks, grass growing and other objects in the water causing still patches.

Fig. 2.42: Unsafe sewage lagoon.

To be properly maintained the lagoon should be checked frequently and any problems reported to the authority responsible for providing the maintenance.
It is important to report any of the following:

- eroded or broken lagoon banks
- lagoon banks which are not angled at 15-20 degrees
- trees and/or other vegetation growing in the lagoon, on its banks or in the area around the lagoon
- bad smells given off by the lagoon
- water which is not a light, flecked green colour
- still areas on the surface of the lagoon
- signs of mosquitoes breeding in the water
- damaged fences or gates that cannot be locked properly to keep out animals and children
- rubbish in the water
- a swampy situation near the lagoon (possibly caused by the overflow) which could provide mosquito breeding areas
- grass on the banks of lagoons, particularly growing at the edge of water, which can provide ideal mosquito breeding areas.

Fig. 2.43: Properly maintained lagoon.
12 Communities without a sewage disposal system

Some communities may not have sewage systems with pipes, septic tanks/leach drains or lagoons. This may be because they are new communities or the people are staying in a place which is not used all the time.

The sewage and effluent has to be disposed of properly in some other way. If this does not happen the sewage and effluent may cause disease.

Wastewater from people washing themselves and their clothes and bedding, and from cooking must not be tipped onto the ground. This wastewater can contain disease-causing germs. The wastewater can lie in pools allowing germs to breed and causing bad smells. It attracts flies and mosquitoes, and can also be harmful to children and family pets who like to play in water.

The methods of sewage disposal outlined below can be used as temporary (short-term) solutions, but they will never be as good as a proper sewage system.

Combination of a grease trap and soakage pit

This pit can be used for disposing of cooking and washing wastewater in temporary camps and in new communities for a short period of time until proper disposal systems are installed. It cannot be used for toilet waste.

Fig. 2.44: Grease trap and soakage pit.
The **grease trap** collects any food scraps and solids and prevents any grease or fat from entering the **soakage pit**.

The grease trap is a 20 L (4 gallon) drum with a tight fitting removable lid. It has holes in the bottom and in the sides.

The grease trap is set into a large hole called the soakage pit. This is filled with stones and sand. The hole should be carefully packed with sand at the bottom and layered with stones of different sizes—small stones (gravel) at the bottom to large stones at the top.

Soakage pits should be about 1200 mm square and the same distance (1200 mm) deep. If one pit is not big enough more of the same size can be dug. These can be individual pits or connected by pipes.

It may be necessary to clean out the grease trap every day depending on how much use the pit is getting. The waste from the grease trap should be buried at the place where other rubbish (solid waste) is being buried.

Grease traps and soakage pits should be covered to keep out flies. Flywire can be used to cover the soakage pit around the grease trap.

**Pit toilets**

Where there are temporary camps or where the community is newly established and there is not yet a water supply which will allow the use of flush toilets, the following types of pit toilets can be used:

- bore-hole latrines
- VIP latrines
- shallow trench latrines.

Shallow trench latrines can be built where there are large numbers of people who are going to live in a place for a short time only. There is a latrine for each sex and each time a person goes to the toilet he/she should cover any faeces with soil.

When a trench is nearly full, it should be filled with soil.

Chemical toilets may be considered, but are rarely practical in these situations because of the need for supplies of chemical and pump-out equipment. Also, it is sometimes difficult transporting these toilets to remote places.