

Session- 2018-19

SEWER APPURTENANCES



PUBLIC HEALTH ENGINEERING

Definition

Sewer appurtenances are such devices of the sewerage system which are necessary to assist in the efficient operation of the system (OR) Those structures which are constructed at suitable intervals along a sewerage system, and help in its efficient operation and maintenance. These includes:

- Manholes and drop manholes
- Lamp holes
- Clean-outs
- Street inlets called Gullies
- Catch basins
- Flushing tanks
- Grease and oil traps
- Inverted Siphons
- Storm regulators

Manholes

- > Manholes are masonry or R.C.C. chambers, constructed on lines of sewers or drains in order to enable men to enter or leave the sewers. The objectives are: inspection, cleaning and other maintenance-operation in connection with sewers. The openings are fitted with suitable covers called manhole-covers. If the manhole covers are perforated, they may also assist in ventilating the sewers.
- > Location: The manholes are provided at every bend, junction, change of gradient, or change of sewer diameter.
- > The sewer line between two manholes is generally laid straight with even gradient. Even when the sewer line runs straight, the man holes are provided at regular intervals.
- > The larger is the diameter of the sewer, the greater will be the spacing between the manholes.

Size of the sewer	Recommended Spacing of Manholes on straight reaches of Sewer lines as per IS 1742-1960
Diameter up to 0.3m	45m
Diameter up to 0.6m	75m
Diameter up to 0.9m	90m
Diameter up to 1.2m	120m
Diameter up to 1.5m	250m
Diameter greater than 1.5m	300m

Classification of manholes

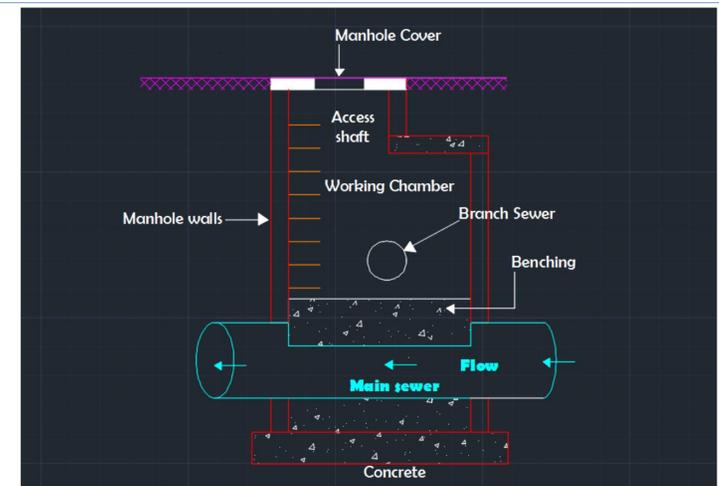
Depending on their depth, the manholes may be classified as:

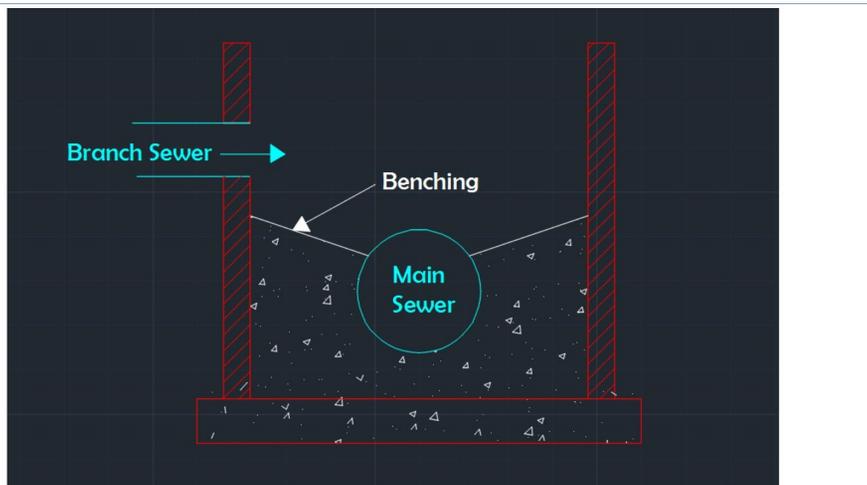
1. Shallow manholes
2. Normal manholes
3. Deep manholes

Shallow manholes: it is about 0.7 to 0.9 m in depth, and its constructed at the start of a branch of a sewer or at places, which are not subjected to heavy traffic. Such a manhole is provided with a light cover at its top, and is called an inspection chamber.

Normal or medium manholes: it is about 1.5 m in depth and is constructed either square or rectangular in cross-section. Such a manhole is provided with a heavy cover at its top.

Deep manhole: it is having a depth more than 1.5m. Steps, etc. are provided in such a manhole for facilitating descending into the manhole, and to enable the workers to go up to its bottom. Such a manhole is provided with heavy cover at its top.





Lamp Holes

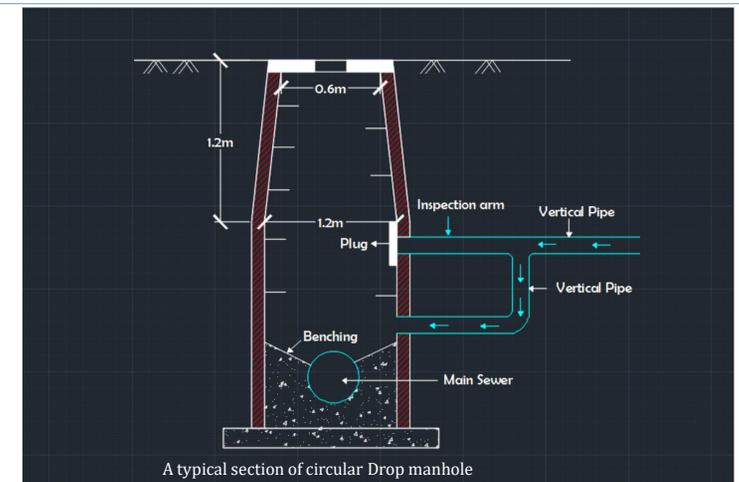
Lamp holes are the small openings on sewers to permit the insertion of lamp into the sewer. The lamp light is then viewed from the upstream as well as the downstream manholes. The obstructed light confirms the obstructions in the sewer. But however, lamp holes are rarely used these days and have become obsolete.

Lampholes are found suitable for use under the following situations

1. Where it becomes necessary to insert bends in sewer
2. Where manholes can be constructed with difficulty
3. Where the straight length between manholes is to be considerably more than the usual spacing of manholes.

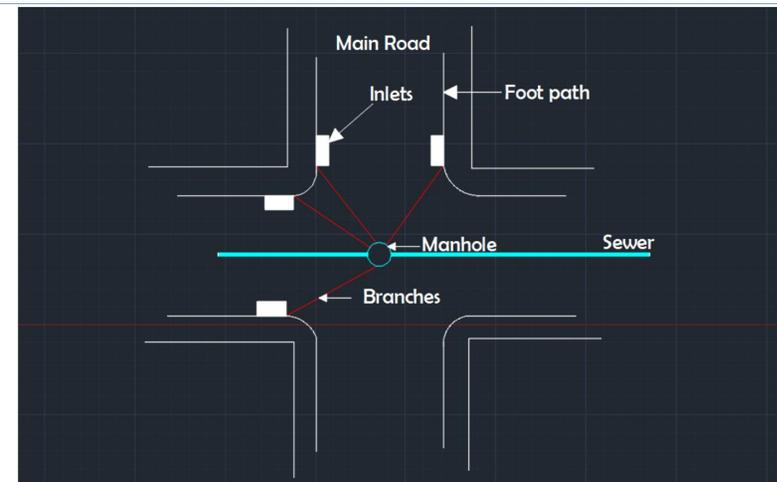
Drop manholes

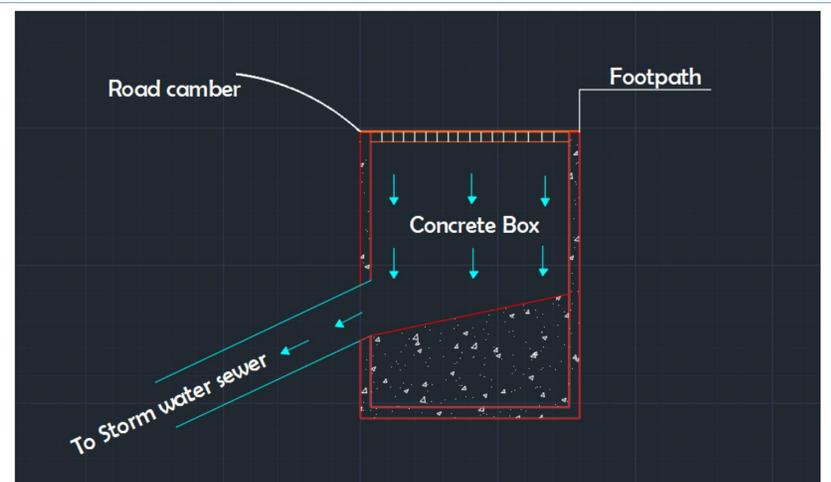
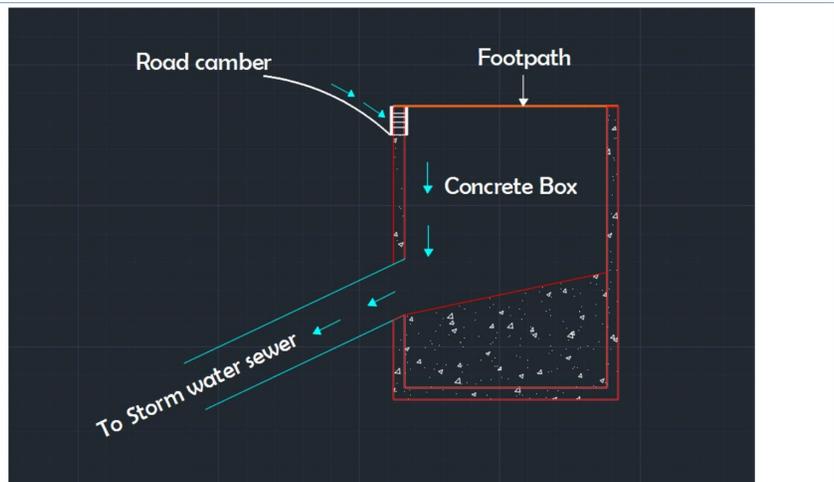
- When the branch sewers enters a manhole by more than 0.5 to 0.6m above the main sewers.
- The sewage is not allowed to fall directly into the manhole, but its brought into it through a down pipe taken from the branch sewer to the bottom of the manhole.
- This is done to avoid chances of sewage splashing on a man working inside the manhole chamber.
- The manhole in which a vertical pipe is used is called a drop manhole, whereas the one using an inclined pipe is called a ramp.
- A plug is provided at the point where branch sewer, if taken straight, intersects the wall of the manhole.
- The length of the branch sewer between the vertical pipe and the plug is known as inspection arm and can be used for inspecting and cleaning the branch sewer after opening the plug.



Street Inlets, called Gullies

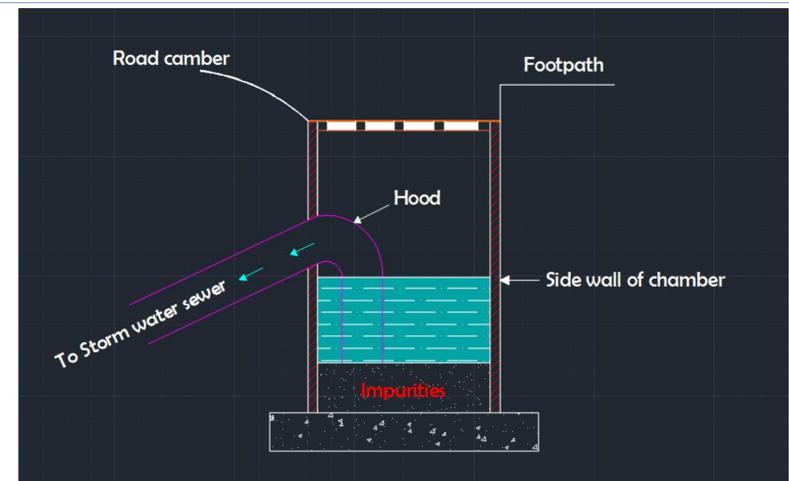
- Inlets are gullies or openings on the road surface at the lowest point for draining rain water from roads, and admitting it into the underground storm sewer.
- These inlets are located along the road side on straight roads at an interval of 30m to 60m.
- The inlets are connected to the nearby manholes by pipe lines (branches).
- Inlets are located usually at street intersection near low places so as not to flood the cross-walks or cause interference to the traffic.
- Street inlet is a simple concrete box having gratings or openings in vertical or horizontal direction.
- The inlets having vertical opening is known as the vertical inlet or the curb inlet, and the inlet having the horizontal openings is known as the horizontal inlet.





Catch Basins or Catch Pits

- Catch basins are the street inlets provided with additional small settling basins.
- Grit, sand, debris, etc., gets settled in these basins, and their entry into the sewer is prevented.
- In addition to this, a hood is also provided which prevents the escape of foul gases, which may find its way through the sewer line.
- Catch basins need periodical cleaning, as otherwise the settled organic matter may decompose, producing foul odours, and may also become a breeding place for mosquitoes.



Flushing Tanks

- Devices that hold/store sewage/water and throw out or discharge into the sewer at intervals for the sewer flushing.
- Provided in the sewer sections where flow is never sufficient to generate self-cleansing velocity.
- These devices store water temporarily and throw it into the sewer for the purpose of flushing and cleaning the sewer. Such devices are called flushing tanks.
- Two types of flushing operations are normally used
 - Flushing operations using automatic flushing tank.
 - Hand operated flushing operation
- The automatic type of flushing tanks are being used more commonly in modern days.

Automatic Flushing Tanks:

- The flushing operation is carried out automatically at regular interval.
- The entry of water is so regulated as to fill the tank upto the discharge point in a period equal to the flushing interval.
- An overflow pipe is also provided to drain away water in case the tank fails to discharge and thereby overflows.

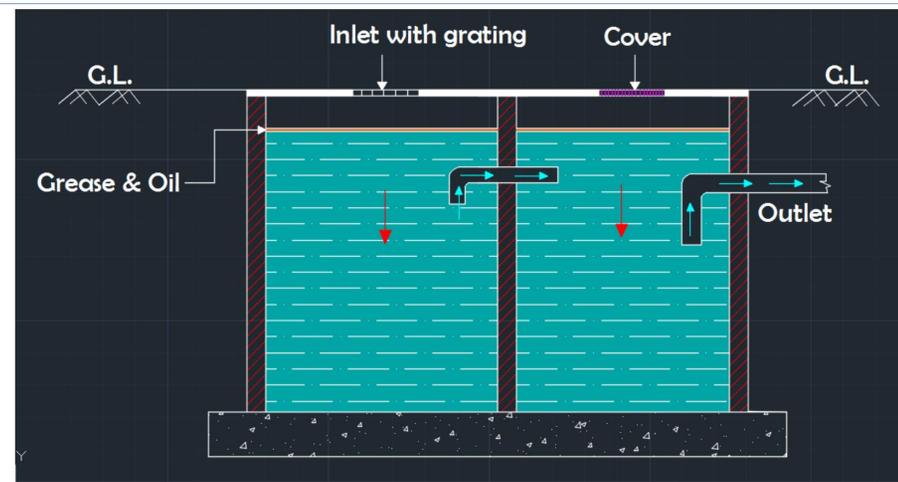
Hand Operated Flushing Operations:

- The flushing and cleaning of sewers can be carried out at suitable intervals by means of manual labour. It may be carried out in the following ways:
 - a. In one method, the outlet end of the manhole is closed by a sluice valve, etc. The sewage entering the manhole from the inlet end will then start collecting in the manhole. When sufficient quantity of sewage gets accumulate the outlet end of the manhole is suddenly opened, and the sewage is thus allowed to enter the sewer, causing flushing operation.
 - b. In other method, the inlet end as well as the outlet end of the manhole are closed by sluice valves, etc. The water from outside is now made to enter into the manhole. The flushing of sewer can then be carried out by opening the outlet and the inlet ends.

Grease and Oil Traps

- Grease and oil traps are those trap chambers which are constructed in a sewerage system to remove oil and grease from the sewage before it enters into the sewer line.
- Such traps are located near the sources contributing grease and oil to the sewage such as workshops, garages, kitchens of hotels, oil and grease industries, etc.
- The grease and oil should be removed from the sewage because:
 - The grease and oil, if allowed to enter the sewer will stick to the sewer sides thereby reducing the sewer capacity.
 - Due to the sticky nature of the grease and oil, the suspended matter will also stick to the sides of the sewer.
 - The presence of oil and grease in sewage adds to the possibilities of explosions in the sewers.
 - The presence of oil and grease makes the sewage treatment difficult.

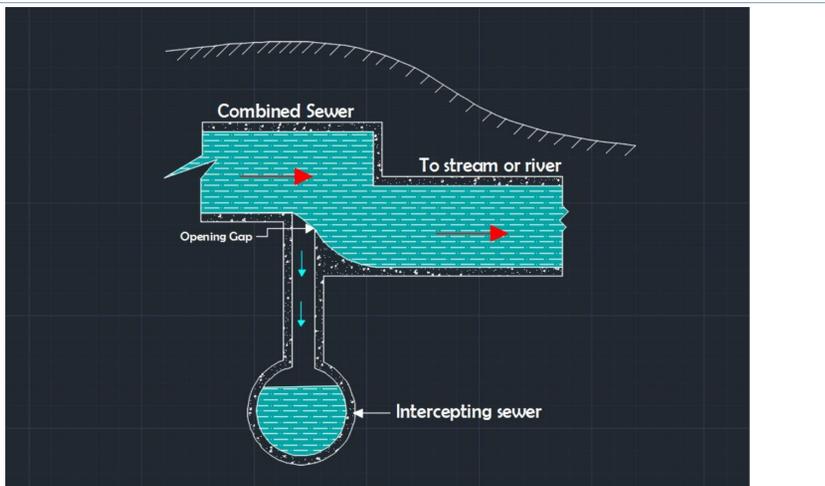
- Principle: The grease and oil being lighter in weight, float on the top surface of the sewage.
- If an outlet draws the sewage from lower level, grease and oil will get excluded.
- Based on this principle, the grease and oil trap chambers are designed in such a way that the outlet level is located near the bottom of the chamber, and the inlet level is kept near the top of the chamber.
- If sand is desired to be excluded from the sewage, dead space should be also kept at the bottom of the chamber for sand to be deposited.
- These traps should be cleaned periodically, as they would not function properly and sewage will not flow freely.



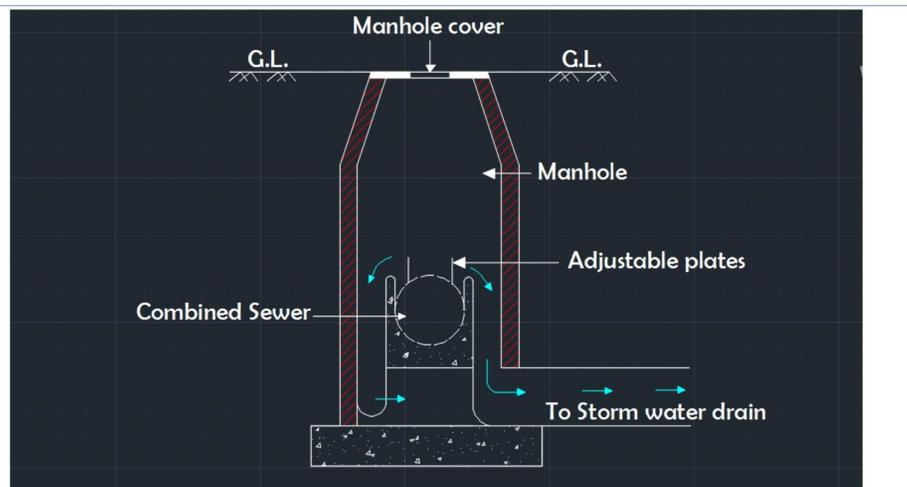
Storm Water Regulators

- Storm water regulators are constructed in the combined sewerage systems and permit the diversion of excess storm water into nearby stream.
- Storm regulators may be of the following types:
 - Leaping weir.
 - Overflow weir.
 - Siphon spillway

- **Leaping weir:** The leaping weir arrangement consists of an opening in the invert of the storm drain through which the normal storm flow is diverted into the intercepting sewer, and the excess flow leaps over the combined sewer to flow into the nearby stream.
- When the sewage discharge is small, the sewage will fall directly into the intercepting sewer through the opening.
- However, when the discharge exceeds a certain limit, the excess sewage leaps or jumps across the weir and it is carried to the natural stream.
- The leaping weir is a good regulator but in heavy storms most of the flow may leap over the combined sewer, and only small quantity may be left in the sewer, which may result in low velocity and thus creating silting problems.

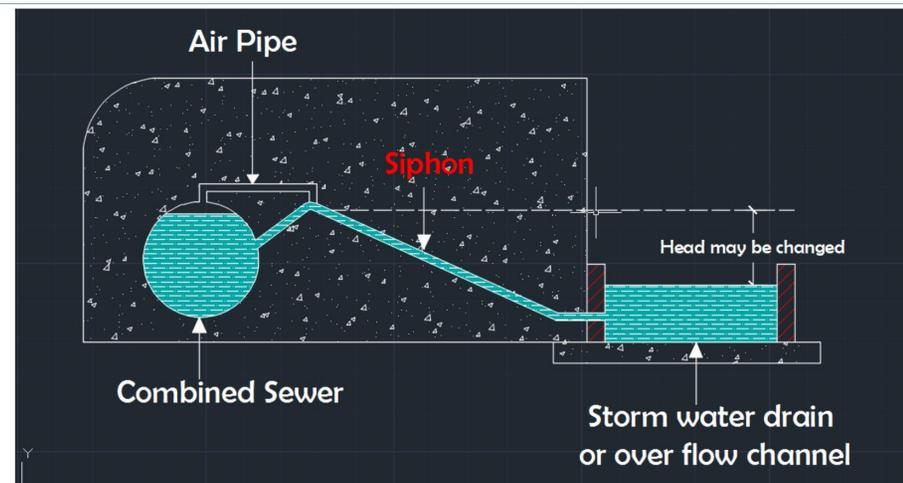


- **Overflow weir:** The excess sewage is allowed to overflow the combined sewer in the manhole, from where it enters into a channel carrying it into a storm water drain.
- In order to prevent the escape of the floating matter from the combined sewer, adjustable plates may be used.



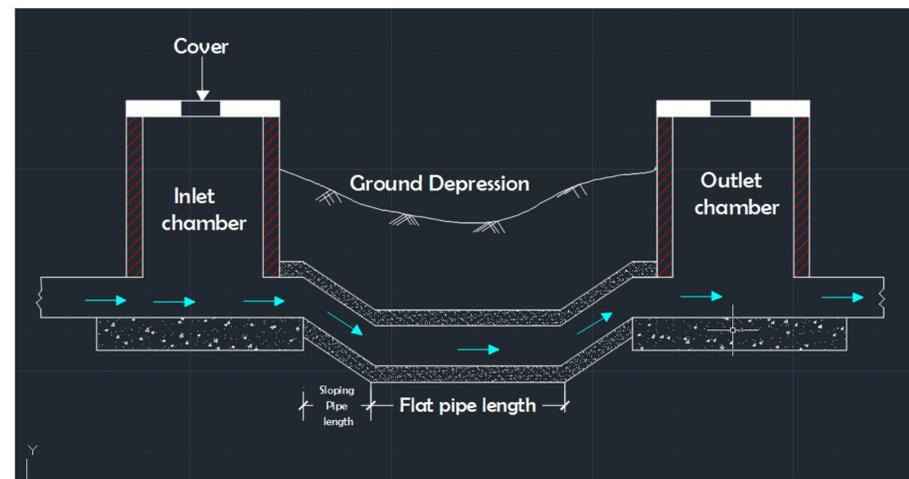
- **Siphon Spillway:** It is used for diverting excess sewage discharge from the combined sewer. This method provides the most effective type of storm relief work.
- It is an automatic process and works on the principle action. The siphonic action starts when the sewage in the combined sewer rises above a fixed level and stops as soon as the sewage falls below this level.
- The level of the crest of the siphon is generally kept at the level reached by the flow in the combined sewer during the period of maximum dry weather flow.
- The siphonic action does not start so long as the level of the sewage in the combined sewer remains lower than this crest level of the siphon.
- However, where the sewage level in the combined sewer goes beyond the crest level, the mouth of the air pipe sealed, and the air contained in the siphon is suddenly removed by the flow.
- The suction thus developed starts the siphonic action, and the full flow through the siphon pipe into the storm water drain, immediately gets established.

- The siphonic action continues till the mouth of the air pipe remains submerged in the sewage flowing in the combined sewer.
- When the excess sewage is discharged, the level of sewage in the combined sewer falls down and the mouth of the air pipe gets exposed.
- The air, now enters the siphon pipe, thus breaking the siphonic action and the consequent overflow through the siphon pipe. The process goes on repeating.



Inverted Siphons

- Generally provided when the sewer pipe needs to be dropped beneath a valley, a road, a railway, a stream, etc.
- The sewage through such pipe line will not flow under gravity, but will be flowing under pressure.
- An inverted siphon is thus a sewer section constructed lower than the adjacent sewer section, and it runs full under gravity with pressure greater than the atmosphere.
- An inverted siphon is usually made of siphon tubers or pipes made of cast iron or concrete.



Necessity of pumping sewage

Sewage is required to be lifted up from a lower level to a higher level at various places in a sewerage system. Sewage may have to be lifted by pumps under the following circumstances.

In order to drain off a low-lying area, when the rest of the sewerage system being drained gravitationally cannot be lowered to facilitate the drainage of the low lying area.

When the land is flat and laying sewers at their proper grades could mean expensive excavation. In such a case, sewage may be lifted at intervals and subsequent sewers laid at reasonable depth below the surface.

When the outfall sewer is lower than the entrance to the treatment works or the body of water into which sewage is discharged for dilution.

Thank You