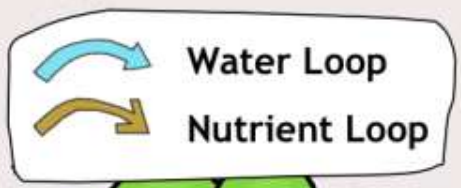


sanitation



Content

- Sanitation , System of sanitation
- Sewage , sewer , sewerage
- Collection and conveyance of waste water
- Classification of sewerage systems
- Estimation of sewage flow and storm water drainage



Sanitation (Definition)

“Sanitation” may be defined as the science and practice ***of affecting healthful and hygienic conditions***, and involves the study and use of hygienic measures, such as:

- Safe and reliable water supply
- Proper disposal of all “human waste”
- Proper drainage of wastewater
- Prompt removal of all refuse (solid waste)

WHO includes food sanitation, rainwater drainage, solid waste disposal and atmospheric pollution under sanitation.

However, the term “sanitation” commonly refers to disposal of “human waste/ wastewater”.



Definition of Sanitation System

A sanitation system involves all arrangements necessary to store, collect, process and deliver human waste or other forms of waste back to nature in a safe manner. Sanitation system with respect to human waste management may be considered to have the following functions:

- Excretion and storage
- Collection and Transportation
- Process/ Treatment
- Disposal/ Recycle

sewage

5. Sewage : Sewage indicates the liquid waste from the community. It includes sullage, discharge from laterines, urinals, stables industrial waste and also the ground surface and storm water that may be admitted into the sewer. It is extremely putrescible ; its decomposition produces large quantities of malodorous gases, and it may contain numerous pathogenic or disease producing bacteria.

sewer

12. Sewer : It is an under-ground conduit or drain through which sewage is carried to a point of discharge or disposal. *Separate sewers* are those which carry the house hold and industrial wastes only. *Storm water drains* are those which carry rain water from the roofs and street surfaces. *Combined sewers* are those which carry both sewage and storm water. *House sewer (or drain)* is a pipe carrying away the sewage from a building to a street sewer. *Main sewer or trunk sewer* is a sewer that receives sewage from many tributary branches and sewers, serving as an outlet for a large territory. *Branch sewer or submain sewer* is a sewer which receives sewage from a relatively small area, usually a few laterals, and discharge into a main sewer. *Lateral sewer* is a sewer which collects sewage directly from the houses. It indicates the first stage of sewage collection.

sewerage

13. **Sewerage** : The term *sewerage*, as a noun, means the structures, device, equipment and appurtenances intended for the collection, transportation and pumping of sewage and liquid wastes, but excluding works for the treatment of sewage. The term sewerage also includes the entire science of collecting and carrying sewage by water carriage system through sewers.

Collection & Conveyance of Systems of Sanitation.

Methods of Collection

- The sanitation of town or city is done by two methods.
- Conservancy System
- Water-Carriage System

Water carriage system

The system requires large initial cost of installation and it requires large quantity of water also to create efficient flow conditions. If the financial conditions of people are poor, it may be difficult to adopt this system. However, this is the most efficient and hygienic system of sewage disposal, and may be adopted in stages if sufficient funds are not available in the beginning.

Conservancy system

2.2. CONSERVANCY SYSTEM

This is an old system in which various types of wastes, such as night soil, garbage etc. are collected separately in vessels or deposited in pools or pits and then removed periodically atleast once in 24 hours. On account of this method of handling independently the different types of refuse from a place, the term conservancy system has been derived. The system is also known as the *dry system*. The following are the methods of collection of various types of wastes in the system.

Collection & Conveyance of Systems of Sanitation.

Merits & Demerits of Water Carriage System

Merits

- It is hygienic method, because all the excremental matters are collected and conveyed by water only and no human agency is employed for it.
- There is no nuisance in the street of the town due to offensive matters, because all the sewage goes in closed sewers under the ground. The risk of epidemic is reduced.
- As only one sewer is laid, therefore it occupies less space in crowded lane.
- Due to more quantity of sewage, self-cleansing velocity can be obtained even at less gradients.
- Buildings can be designed as compact one unit.
- The land required for the disposal work is less as compared with conservancy system in which more area is required.
- The usual water supply is sufficient and no additional water is required in water carriage system.
- This system does not depend on the manual labours
- Sewage after proper treatment can be used for various purposes.

TABLE 2.1 COMPARISON BETWEEN CONSERVANCY AND WATER CARRIAGE SYSTEM

<i>S.N.</i>	<i>Conservancy System</i>	<i>Water Carriage System</i>
1.	The system is unhygienic since every thing is visible.	The system is hygienic. Sewers are laid below the ground and hence excreta etc. is not visible.
2.	Due to putrefication, there is a lot of foul smell.	No chances of putrefication, and hence no foul smell
3.	Compact house design is not possible	Compact design is possible
4.	Large labour force is required	Labour force is negligibly small
5.	Water consumption is small	Requires high water consumption
6.	Initial cost is small, though the running costs are high	High initial cost. Running costs small
7.	No technical persons required	Technical persons required for operation and maintenance
8.	Acute pollution problems	Pollution problems are rare.
9.	Risk of spread of epidemic	No such risk
10.	Large land required for the disposal of untreated sewage.	Small land required for the disposal of treated sludge
11.	Final disposal into streams etc not free from risks	Final disposal easier because of treatment works.
12.	Good quality manure available from the end products	The sludge has small manure value. However, treated waste water can be used for irrigation etc.
13.	The system is more suitable for rural conditions	The system is better suited for urban conditions.

TYPES OF SEWERAGE SYSTEM

- ***Combined system*** : In combined system along with domestic sewage, the run-off resulting from storms is carried through the same conduit of sewerage system.
- ***Separate System*** : In separate system, separate conduits are used; one carrying sewage and other carrying storm water run-off.
- ***Partially separate system*** : In separate system, separate conduits are used; one carrying sewage and other carrying storm water run-off.

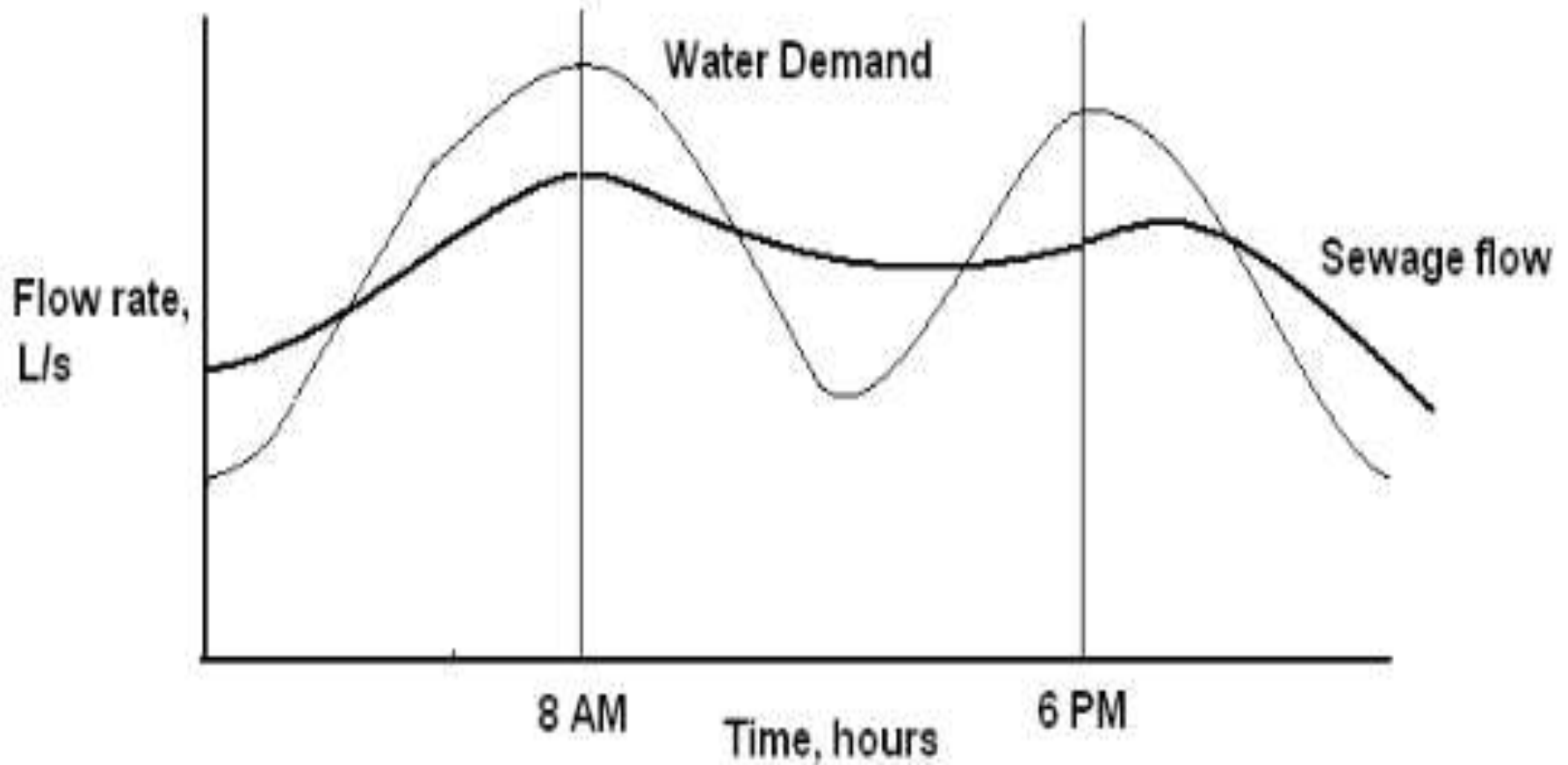
Estimation of sewage flow

- Correct estimation of sewage discharge is necessary otherwise sewers may prove inadequate resulting in overflow or may prove too large in diameter, which may make the system uneconomical and hydraulically inefficient.
- Hence, before designing the sewerage system it is important to know the discharge / quantity of the sewage, which will flow in it after completion of the project and at the end of design period.

Fluctuations

- Variation occurs in the flow of sewage over annual average daily flow. Fluctuation in flow occurs from hour to hour and from season to season.
- The typical hourly variation in the sewage flow is shown in the Figure.
- As sewage flow in sewer lines, more and more sewage is mixed in it due to continuous increase in the area being served by the sewer line.
- This leads to reduction in the fluctuations in the sewage flow and the lag period goes on increasing.

Typical hourly variations in sewage flow



Waste water flow rates

- In order to determine the section of the sewer it is essential to know the total quantity of wastewater or sewage that would flow through the sewer. The total waste water flow can be divided into two components.
- Dry weather flow : Domestic sewage , industrial sewage
- Storm water flow: runoff from roofs , streets

Storm water Runoff



Stormwater Flows over surfaces such as roads, driveways and parking lots.

- Water falls as rain, snow, or ice. Most seeps into ground.
- If ground is saturated, frozen, or has paved surfaces, water flows & is called stormwater runoff.

Where does Stormwater Go?



Stormwater goes into storm drains and pollutants flow untreated into local streams, rivers & lakes.

- Stormwater flows to storm drains along streets.
- It may carry soil, pet waste, oil, pesticides, & other pollutants with it.
- This polluted runoff goes to streams & lakes untreated.

Storm Water Inlets

- These are the openings through which the surface runoff and storm water is admitted and conveyed to the storm water sewer or combined sewer.
- The inlet is a box of concrete or brick masonry with the clear opening not more than 25mm.
- Maximum spacing depends on road surface, it varies between 30 to 60 m.



Storm Water Inlets

- Storm water inlets may be categorised into 3 types:
 - Curb inlets
 - Gutter inlets
 - Composite inlets
- Curb inlet – These are vertical openings in the road curbs through which the storm water flows.
- They are preferred where heavy traffic is anticipated.

anticipated (Fig. 21.1).

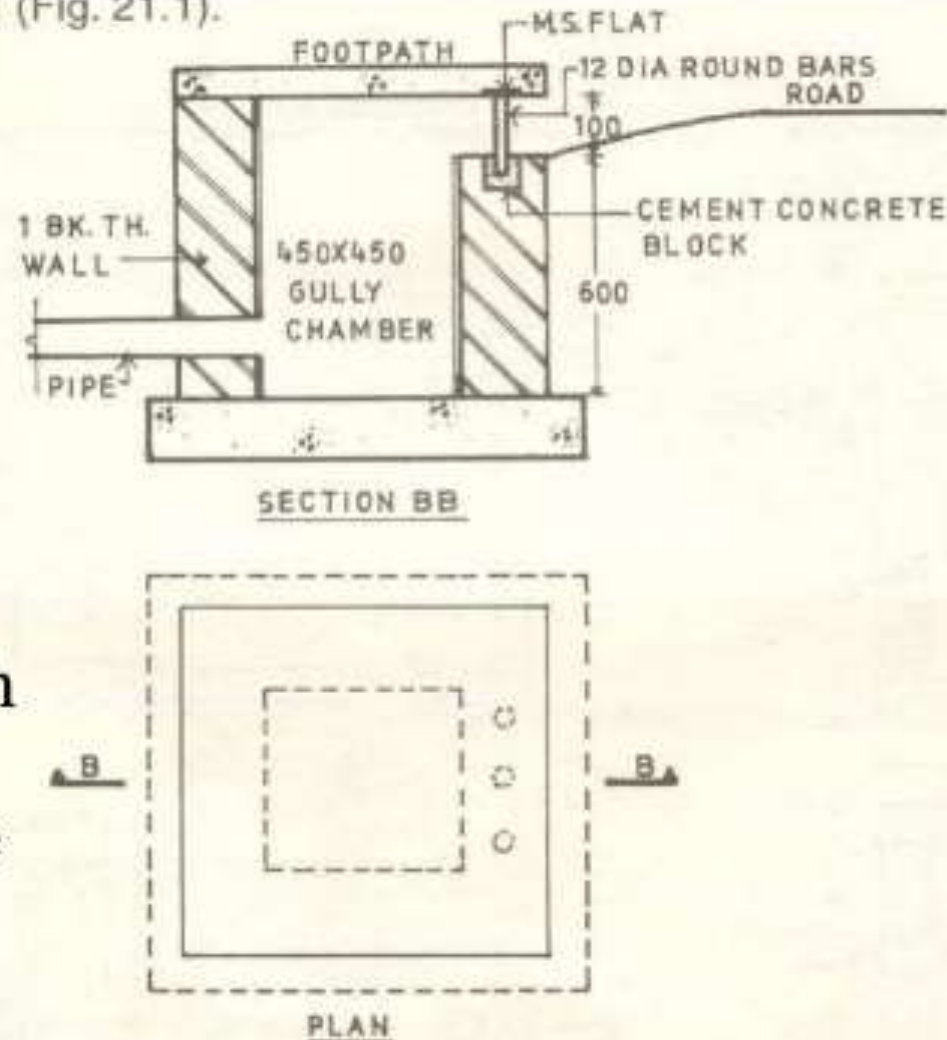


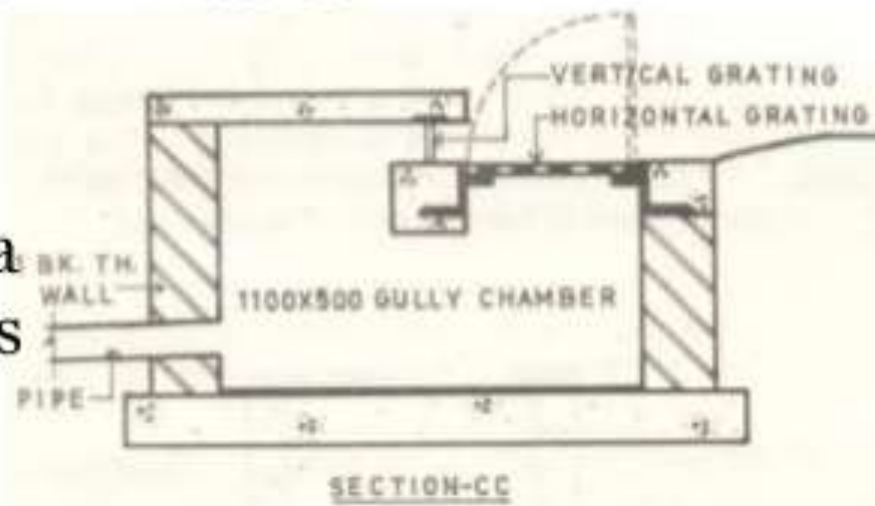
Fig. 21.1 Curb inlets for surface runoff and storm water drainage.



Storm Water Inlets



- Gutter inlet – Horizontal openings in the gutter



- Composite inlet – Combination of both curb & gutter inlet.

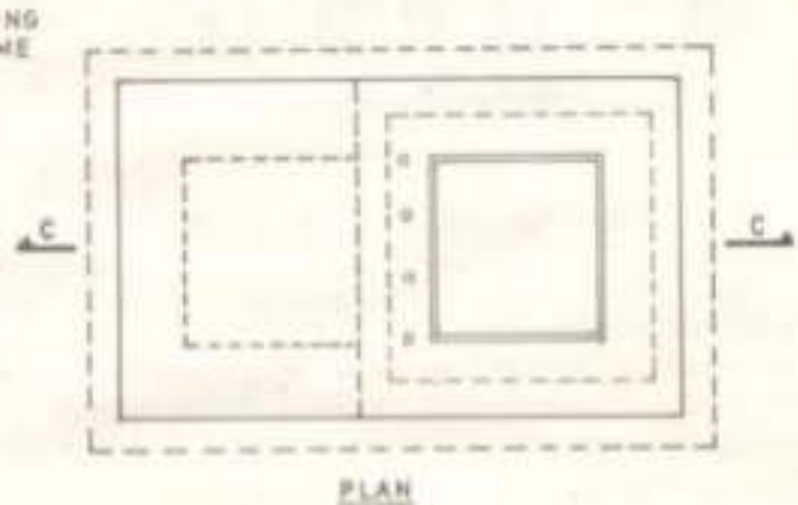
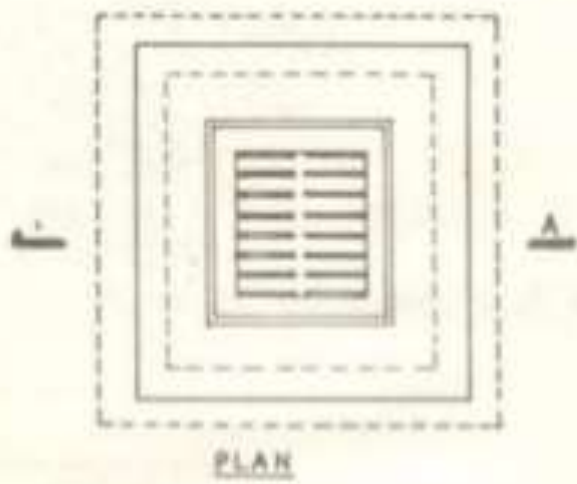


Fig. 21.2 Gutter inlet.

Fig. 21.3 Composite inlet.

Surface Drains

- Cheap arrangement for collecting storm water.

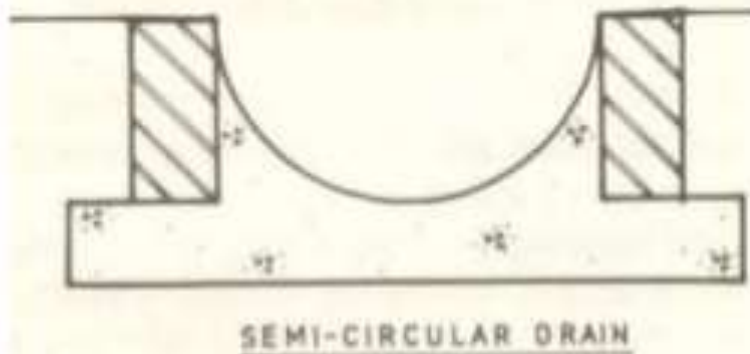
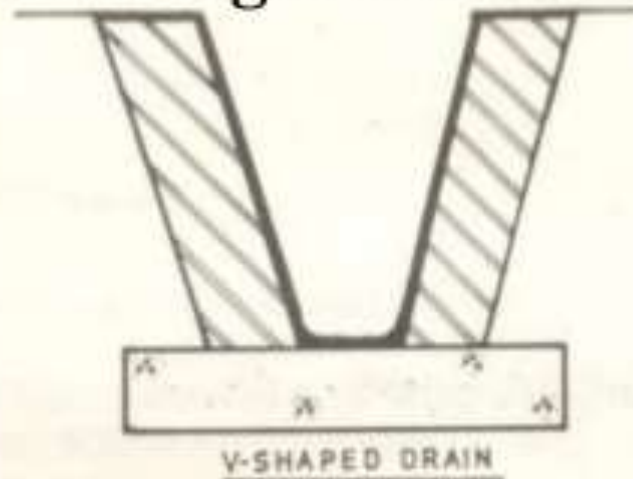
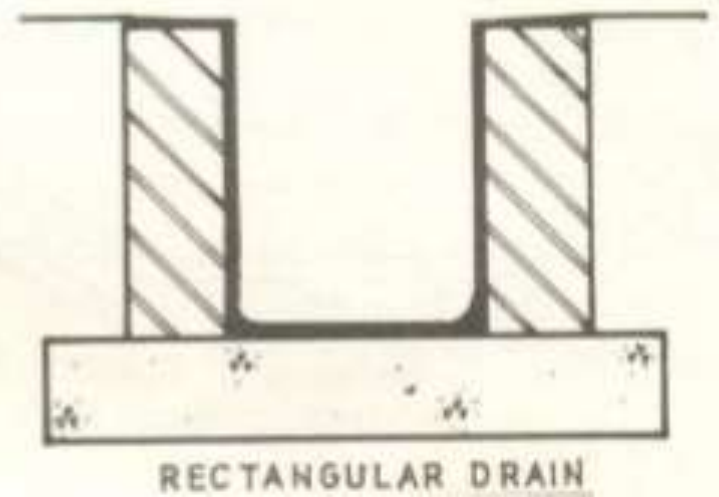
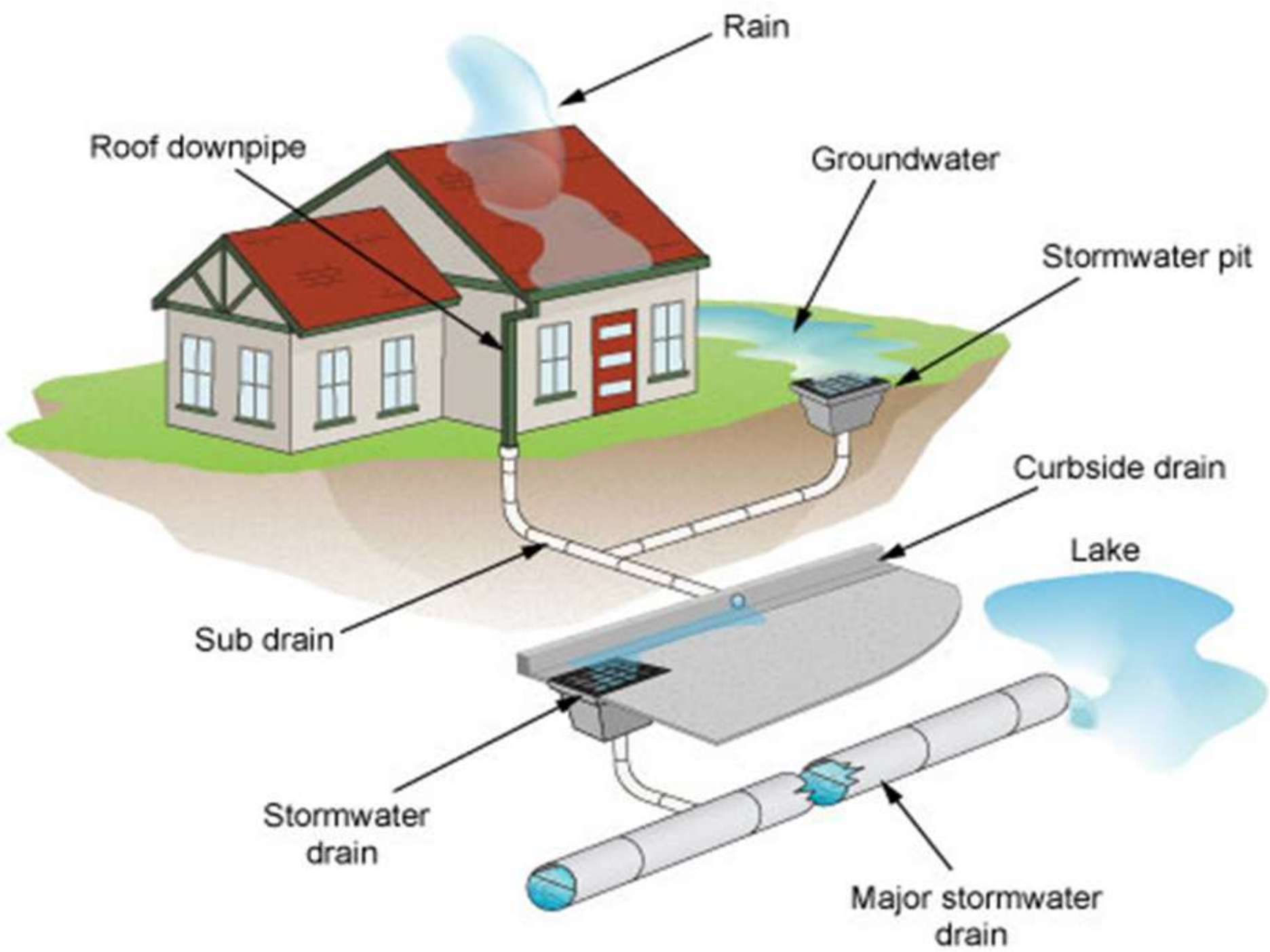
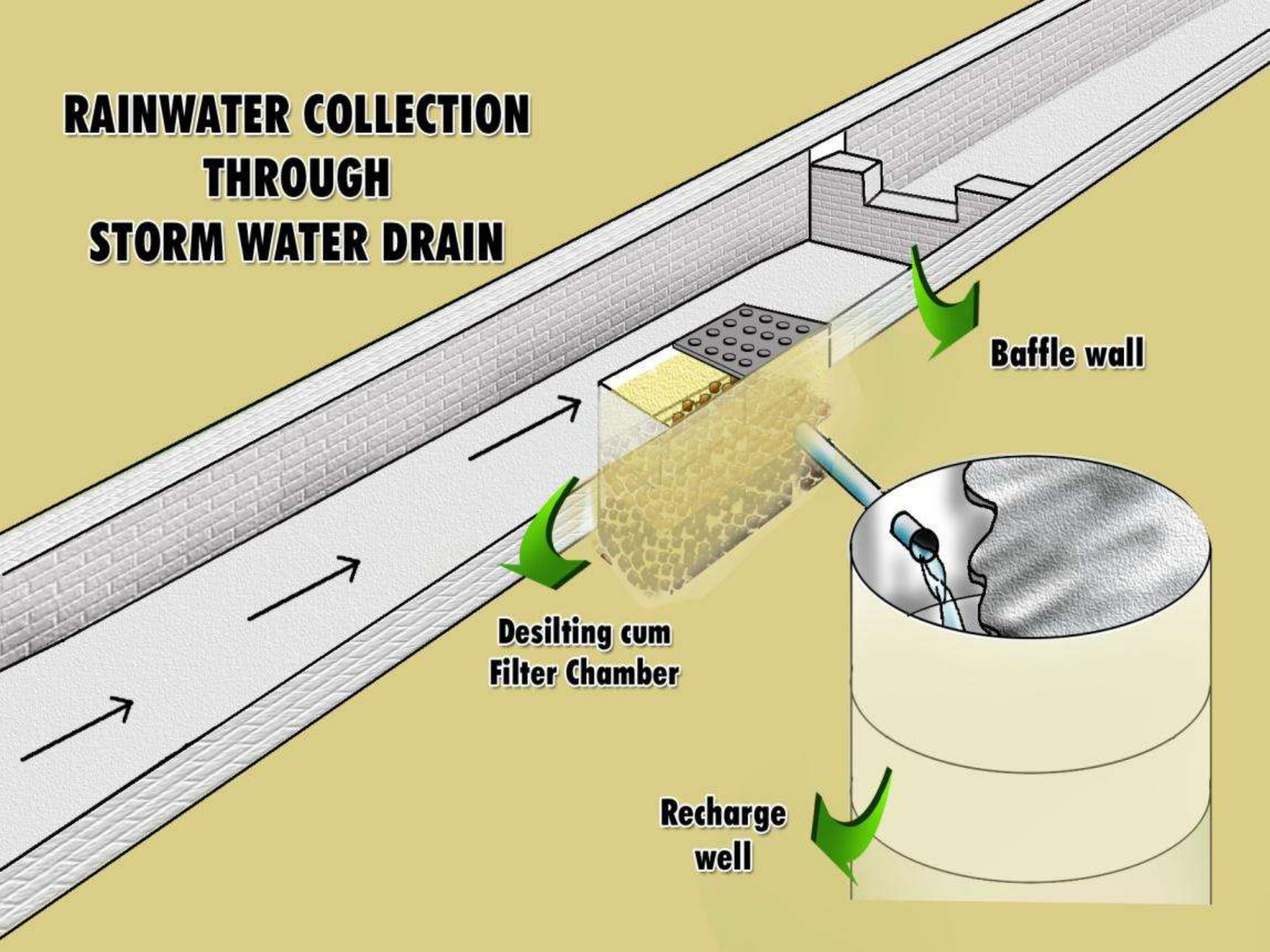


Fig. 21.4 Shapes of surface drains.





RAINWATER COLLECTION THROUGH STORM WATER DRAIN



Baffle wall

**Desilting cum
Filter Chamber**

**Recharge
well**

THANK YOU
FOR YOUR
TIME



THE DAY - DINNER
I WILL BE ARRIVING DEPART
10:00 MEET
11:30 MEET
10:30 AM
ARRIVE
FOR

5
14
1000