



Abdelhafid Boussouf University Center - Mila

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Water distribution and collection: PART II: Sanitation

– Course 3 –

Chapter 03 : *Urban sanitation works.*



Teaching staff

Name	Grade Institute	E-mail address
Boumesseneh Amel	MCB Sciences and Technology	a.boumesseneh@centre-univ-mila.dz

Students concerned

Institute	Department	Year	Speciality
Science and Technology	GC and hydraulic	2nd year master	Urban hydraulics

Course objective

At the end of this chapter, the student should be able to:

- Define the main urban sanitation works and their roles in management wastewater and rainwater.
- Identify the different types of structures (networks, collectors, pumping stations, retention basins, treatment plants, etc.).
- Understand the principles of design, sizing and operation of works.
- Analyze the importance of these infrastructures in preserving public health and the environment.

Introduction

Increasing urbanization leads to considerable production of domestic wastewater, industrial and rainwater. Without an effective sanitation system, these discharges constitute a major source of pollution and health risks.

Urban sanitation works therefore constitute an essential link in the management integrated water management. They ensure the collection, transport, treatment and discharge of water into the natural environment, while limiting environmental impacts.

This chapter aims to present the main types of works used in the systems urban sanitation, their technical characteristics, as well as their conditions operation and maintenance.

III.1 Ancillary works

The ancillary works have considerable importance in the operation rational sewer networks. They are numerous and obey a hierarchy of function very diversified: effluent collection function, windows open on the network for facilitate the maintenance of the system due to their economic role in acting on the oversizing and enabling cost optimization.

The ancillary works are considered according to two groups: Normal works and Special Works.

III.1.1 Normal works

Normal works are the essential current works upstream or on the course of the networks. They generally provide the function of receiving effluents or access to the network.

III.1.1.1 Connections

Their role is to collect wastewater and rainwater from buildings. connection includes three essential parts:

- A facade inspection window which must be placed at the edge of the public highway and at most near the front of the property connected to allow easy access to personnel responsible for operation and monitoring of proper functioning.
- Branch pipes which are preferably connected according to an oblique inclined at 45° or 60° relative to the general axis of the public network.
- The connection devices of the branch pipe are linked to the nature and dimensions of the public network.

V.1.1.2 Surface works

This type of structure is intended for the collection of rainwater. There are two types: categories: Collection and transport works.

I. The collection works themselves at the head and on the course of the main network.

- **The ditches**

The ditches are intended to collect water from the roads. They are subject to periodic maintenance. (see figure 01).



Figure 01: Storm drainage ditch.

- **The gutters**

The gutters are intended for the collection of rainwater running off the profile transverse of the roadway and sidewalks and the transport of these waters to the mouths sewer (see figure 02).

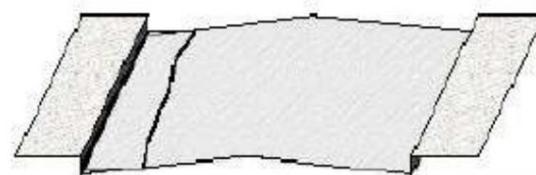


Figure 02. Grate channel for rainwater drainage

- **Manholes**

Manholes are intended to collect surface water (rainwater and washing of the roads) They are generally placed at the low point of the gutters, either on the sidewalk. The distance between two manholes is on average 50m, the entrance section is a function of the distance between the two vents in order to absorb the storm flow coming

from upstream (see figure 03).

They can be classified according to two criteria: the way of collecting water and the way in which waste is retained.

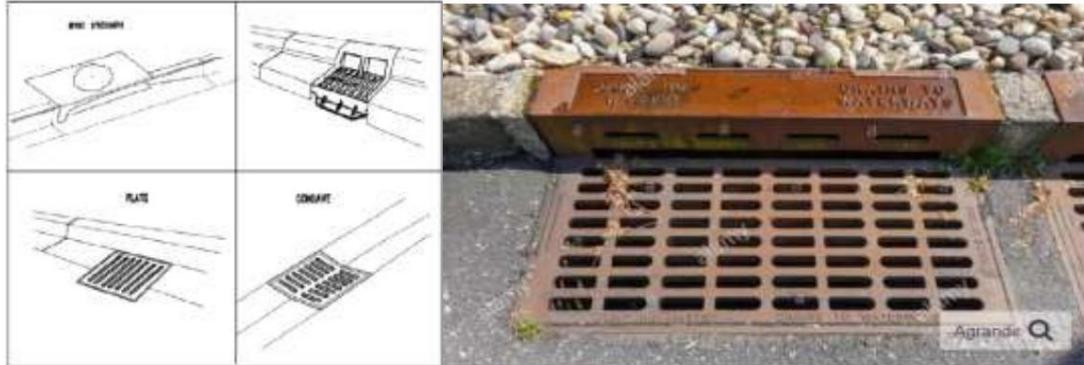


Figure 03: Manholes (Seddiki, 2019)

III.1.1.3. Network access works

1- the looks

These are reinforced concrete structures, they are watered on the ground equipped with a frame and a cover, designed to withstand the thrust of the earth and that generated by the passage of rolling loads.

1.1-Type of look

a- Inspection window

The role of the inspection chamber is to ensure:

- sewer ventilation
- network access for cleaning equipment (See figure 04).



Figure 04. Inspection window

They are installed at:

- each change of direction
- each change in diameter
- distance between two successive views is 30 to 50 m, except in special cases.

b- Drop manholes: this type of manhole is very necessary in the case of very uneven terrain, they have the role of lowering steep slopes. (See figure 05).

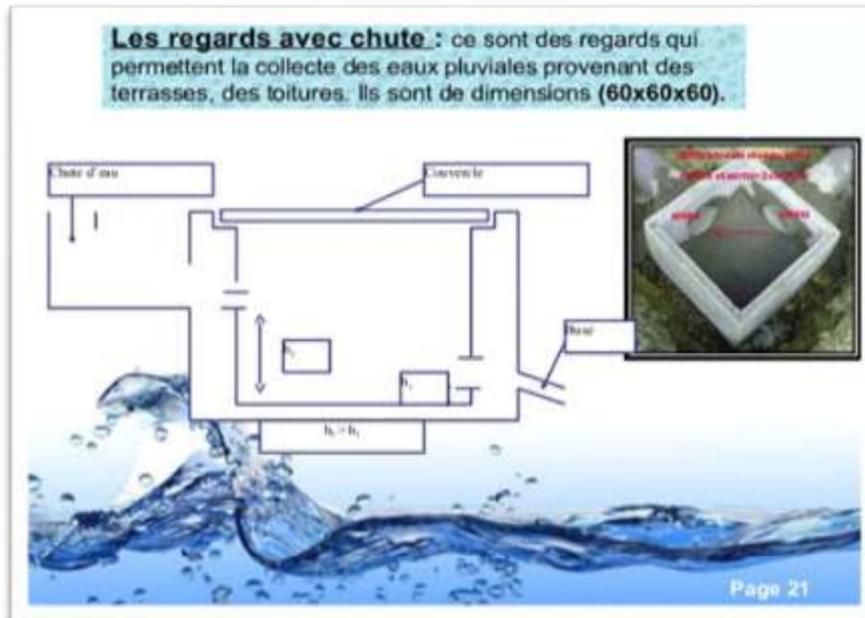


Figure 05. Drop manhole

c- Flush manhole: this type of manhole is installed at the network head to deal with waste, if the self-cleaning conditions are not verified.

d- the outlet: this is the last work delivered by the projector on plan. (See figure 06).



Figure 06. Water drainage in rural areas.

e- Connection inspection chamber: it provides a connection between the buildings' sanitary network and the network external sanitation. (See figure 07).

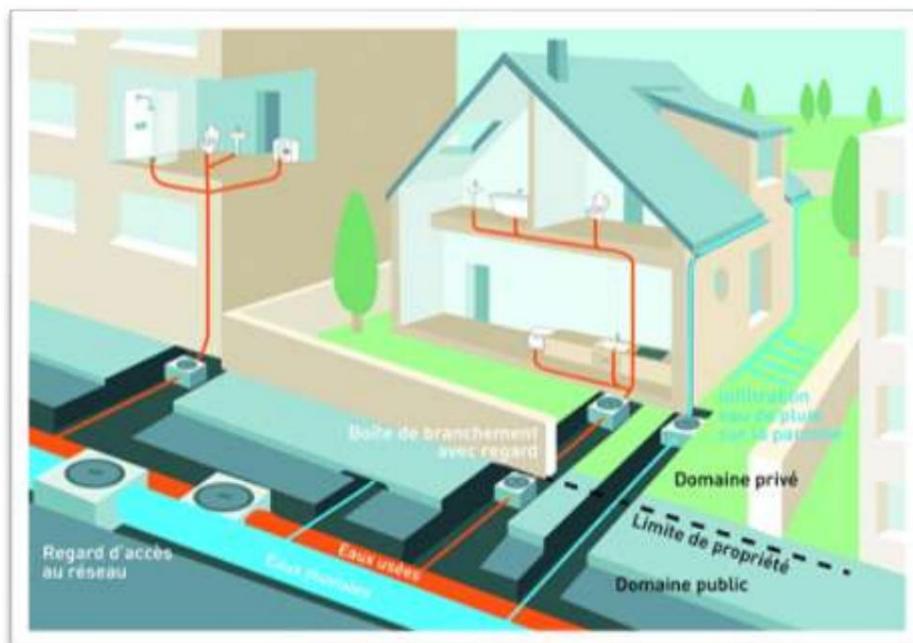


Figure 07. Connection view

f- Drainage manhole (sewer inlet): these are ancillary structures intended to collect water from surface runoff (rain, washing of roads, parking lots, sidewalks, etc.) and to channel them to the sewer through a pipe, they are installed laterally, it is essential to clean them after each storm, they can be: grid – selective – filtering. (See figure 08).



Figure 08. Inlet manhole.

III.1.2 Main works

The main works include:

1. The pipes

In sanitation, pipes are intended to carry flows to free surface up to the main collector, we notice the existence of two most common types used.

a- **circular pipes:** these are the most used, given their simplicity of manufacture and execution. (See figure 09).



Figure 09. Circular conduit.

b- **Ovoid pipes:** prefabricated concrete ovoids, their useful length is at least 1 m, they are joined with a mid-thickness interlock, it facilitates the flow of large flows. (See Figure 10).



Figure 10. Ovoid conduits.

c- **Nature of the pipes:** the choice of materials depends on:

- the nature of the ground
- the chemical nature of the fluid to be evacuated
- its availability on the market and the cost
- resistance under the effect of external loads

2. the joints

They constitute the weak points of the network, they must necessarily and imperatively meet the technical requirements:

- waterproofness and flexibility
- resistance to hydraulic pressure and effluent attacks
- be protected from attack by plant roots.

For this, we chose cement mortar to make the joints so that they adapt to the cement nozzle and for its ease of production and availability.

III.1.2 Special works

1. The spillways

According to the encyclopedia of sanitation, a Storm Overflow (DO) is a "structure allowing the direct discharge of part of the effluent into the natural environment, when the upstream flow

exceeds a certain value. Storm overflows are generally installed on networks unitary, with the aim of limiting inputs to the downstream network, and in particular the stations purification, in case of rain."

Storm overflows help reduce the load on treatment plants, but on the other hand, they discharge a large quantity of polluting materials from the waters worn in the natural environment during rainy weather.

The calculation of storm overflows relates to:

- At the gallery itself
- At the spill threshold, the level of which determines the operation of the structure.

The gallery must be calculated to be able to carry all of the upstream flows. (See figure 11).

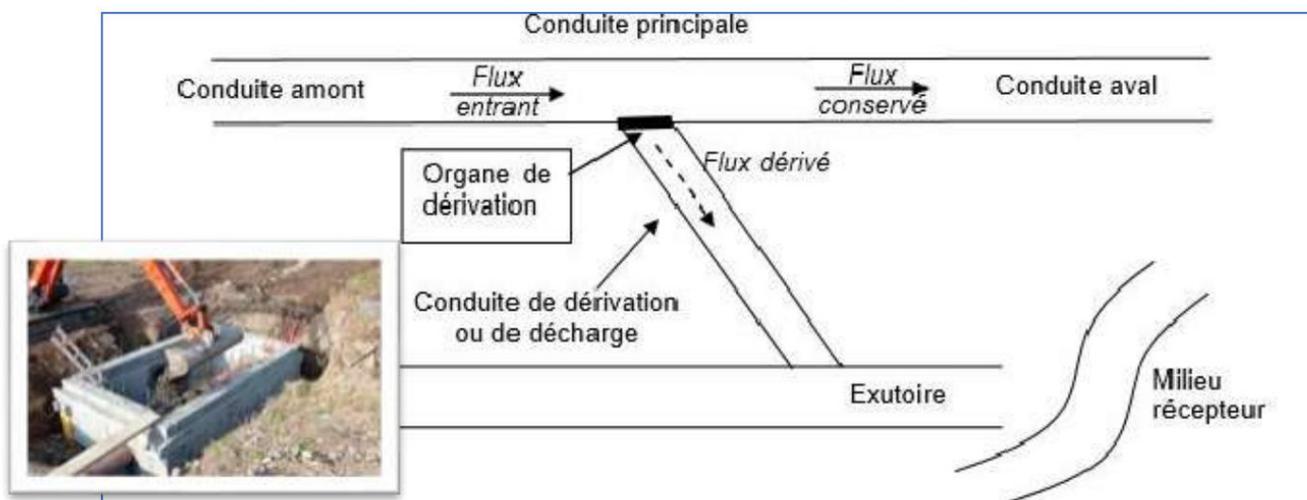


Figure 11. Storm overflow.

2. Retention basins

Retention basins are used when the aim is to reduce the dimensions of the collectors projected downstream by spreading the peak flows over a time imposed by the conditions downstream flow. (See Figure 12).

Natural depressions can be used as retention basins, if they are re-lined with sewerage network for the evacuation of runoff flows stored for a certain period time in depression.

These basins are made up of a basin body and a downstream structure made up of a threshold discharge which can be an overflow or an orifice.



Figure 12. Retention basins.

3. Low-point siphons

Their role is to overcome an obstacle at a level higher or lower than that of the main collector. An obstacle can be a watercourse, a canal, a road, a tunnel, a railway track, trench or large pipe. (See Figure 13).



Figure 13. Low point siphons.

4. Grids and screens

Their role is to retain the largest bodies transported by the effluents rainwater or wastewater effluents as they flow into the network.

These works are very effective upstream of the sand removal basins, the storm overflows and pumping stations.

The grids are used to retain coarse materials carried by the water which could harm the effectiveness of the treatment. They consist of grids with bars placed at an angle in the channel and are made of simple or profiled flat iron or round iron.

To avoid flooding when the grid is clogged by rain sudden or careful handling, each grid is equipped with a bypass.

The grids can be fixed or mobile, with cleaning installed at depths weak. We distinguish between vertical and inclined grids. The spacing (e) between the bars of the grid depends on the fineness of sieving that one wishes to obtain.

5. Sand removal basins

These are structures which must be placed downstream of the secondary collectors so as not to not let the sand flow into the main collectors, so as not to erode the walls and to prevent fermentation of plant elements.

Sand traps are structures that allow materials to be easily removed. decantables which are carried by wastewater and rainwater (most often sand).

The sand traps are always placed downstream of the grids and upstream of the decanters. primary in the treatment plants, at the level of the siphon has no low point; and upstream of the storm overflows.

It may nevertheless be necessary to place them on the sanitation network to the protection of works against:

• Friction at the collectors and pumps.

• Losses in usable volume due to deposits that form quickly.

The different types of sand traps

The sand traps are always placed downstream of the grids and upstream of the decanters. primary in the treatment plants, at the level of the low point siphon; and upstream storm overflows.

• **Corridor sand trap:** This is a channel with a widened part. The entrance must be built so that the speed is reduced with a speed distribution at this level widened part as regular as possible or a speed of 0.3 m/s can be maintained.

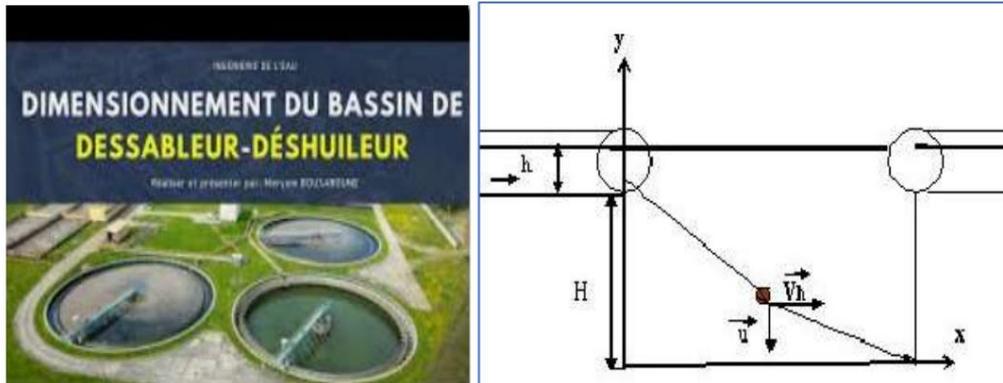


Figure 14: Diagram of a corridor sand trap.

III.3 Execution of the trench and laying of the pipeline

The width of the trench must be at least equal to the outside diameter of the pipe with over-widths of 0.3 m on one side and on the other, if the nature of the joints makes it necessary, their operation must be facilitated by the construction of niches in the bottom and in the walls of the trenches.

The bottom of the trench is normally watered at least 0.1 m above the planned level for the wire water, the laying bed must be made of fine sand.

The pipes must be laid from downstream, the socket, if any, being directed upstream, the temporary wedging of the pipes is carried out using sieved clods of earth at least 0.4 m above of the pipeline, then backfilling is done using the rough run.



Figure 15. Diagram of laying and backfilling a sewerage pipe

Conclusion

Urban sanitation works represent a fundamental component of basic infrastructure of a modern city. Their design and management must meet of the requirements techniques, sanitary facilities And environmental strict.

Proper sizing and appropriate operation allow:

- To protect public health,
- To preserve receiving environments,
- And to contribute to the sustainable development of urban spaces.

Thus, the control of sanitation works constitutes a skill essential for engineers and professionals in the water and energy sectors the environment.

Useful links

<https://youtu.be/rliC3kmNkXg>

<https://youtu.be/qd-Pmiiza9A>

<https://youtu.be/zdC97wQXrq4>

<https://youtu.be/qf6GzzhB0PQ>

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Standards and technical guides

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