# **CHAPTER 1**

# WASTEWATER SOURCES AND FLOWRATES

Domestic, industrial and infiltration/inflow are the sources of wastewater.

### **Domestic Wastewater Sources and Rates**

Sources of domestic wastewater can be listed as residential, commercial, institutional and recreational.

#### Residential districts:

- For small ones: based on population density and average per capita (Table 3.1, [1])
- For large ones: based on land use areas and anticipated population densities.
- If actual data are not present, about 70% of domestic-water withdrawal can be taken.

#### Commercial districts:

- Usually expressed as m<sup>3</sup>/ha.d and based on existing or anticipated future development or comparable data from other areas.
- Unit flows may vary from 14 to more than 1500 m<sup>3</sup>/ha.d (Table 3.3, [1]).
- Airport, bar, hotel, office, restaurant, shopping center are some examples for commercial districts.

### Institutional facilities:

- Actual records of institutions are the best sources of data for design purposes (Table 3.4, [1]).
- Hospital, prison, school, etc are some examples for institutional facilities.

#### Recreational facilities:

- Flows from recreational facilities are highly seasonal (Table 3.5, [1]).
- Cafeteria, resort apartment, country club, dormitory, swimming pool, theater are some examples for recreational facilities.

### **Industrial Wastewater Sources and Rates**

Industrial wastewater flows vary with the type and size of the industry, the degree of water use and the on-site wastewater treatment methods used, if any. Peak flows may be reduced by the use of detention tank and equalization basins.

#### Typical values:

- Industries that have no wet-process: 30 m<sup>3</sup>/ha.d
- For the industries without internal reuse programs: 85 95% of the water used become wastewater.
- Average domestic wastewater from industries: 30 95 LCD.

### Infiltration / Inflow

<u>Infiltration</u>: The water entering a sewer system including service connections, defective pipes, pipe joints or manhole walls. It is not included to inflow.

<u>Inflow:</u> The water discharged into a sewer system from roof leaders, cellar, yard and area drains, foundation drains, cooling water discharges, drains from springs and swampy areas, manhole covers, cross connections from storm and combined sewers.

<u>I/I:</u> The total quantity of water from both infiltration & inflow without distinguishing the source.

## Infiltration

- It is a function of pipe diameter, workmanship in construction, height of groundwater table.
- Judgement is required for infiltration allowance. Two different approaches:
  - Infiltration rate is expressed as a percentage of domestic sewage flow from 20 to 100%.
    20% if an AC pipe and rubber ring joints are used.
    - 100% if concrete pipe and concrete joints are used.
  - 2. Infiltration rate is determined and added to peak domestic sewage flow from a table (p.16 of notes).

## Exfiltration

It is the leakage from the sewer. Exfiltration will attract the roots of plants and clogging and destruction of sewers occur.

### Inflow

It may exceed domestic wastewater flow. It can reach up to 400 L/d/manhole if construction quality is low.

### References:

[1] Metcalf and Eddy, 1981. Wastewater Engineering: Collection and pumping of Wastewater. McGraw Hill Inc., New York.