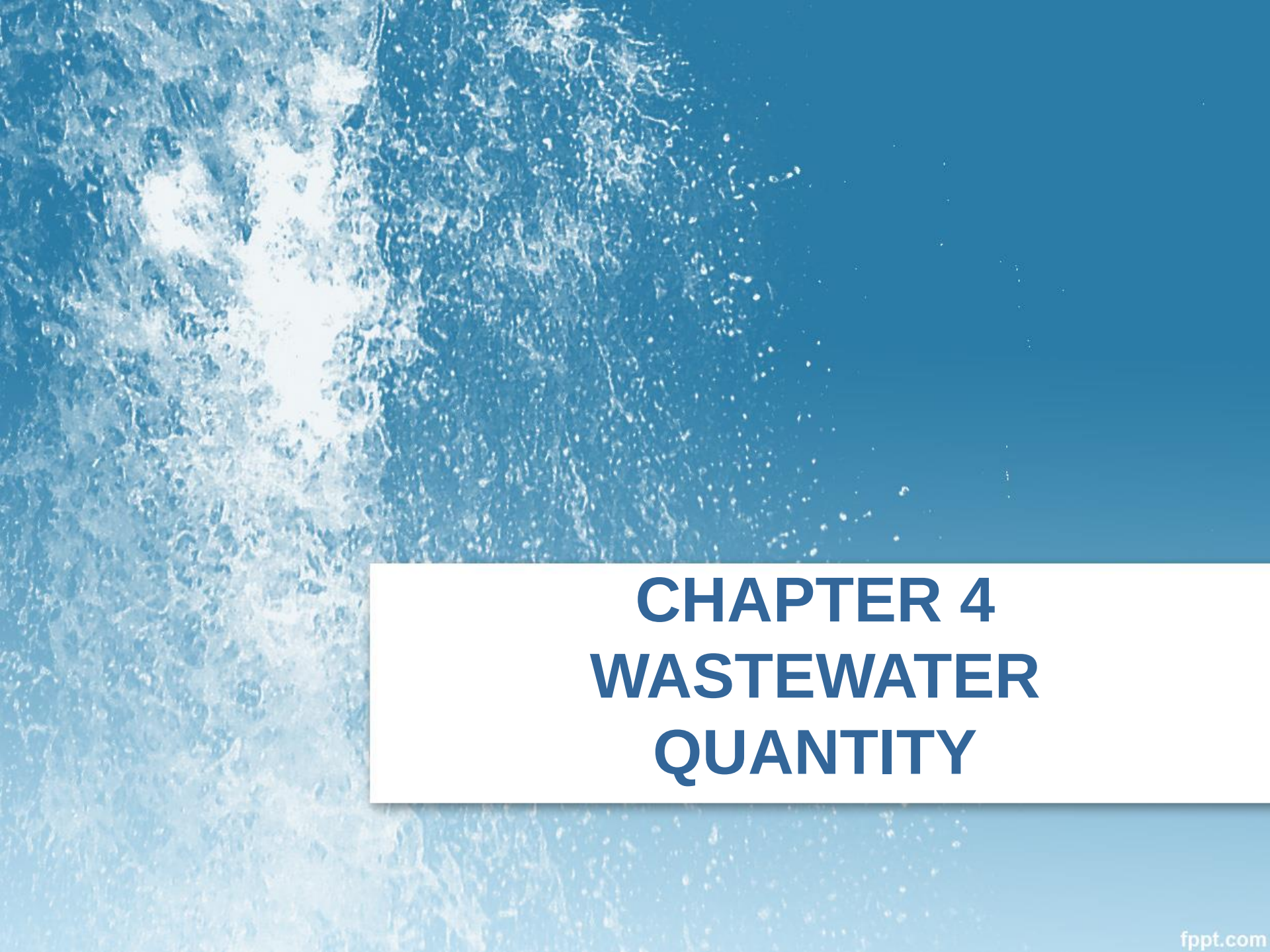
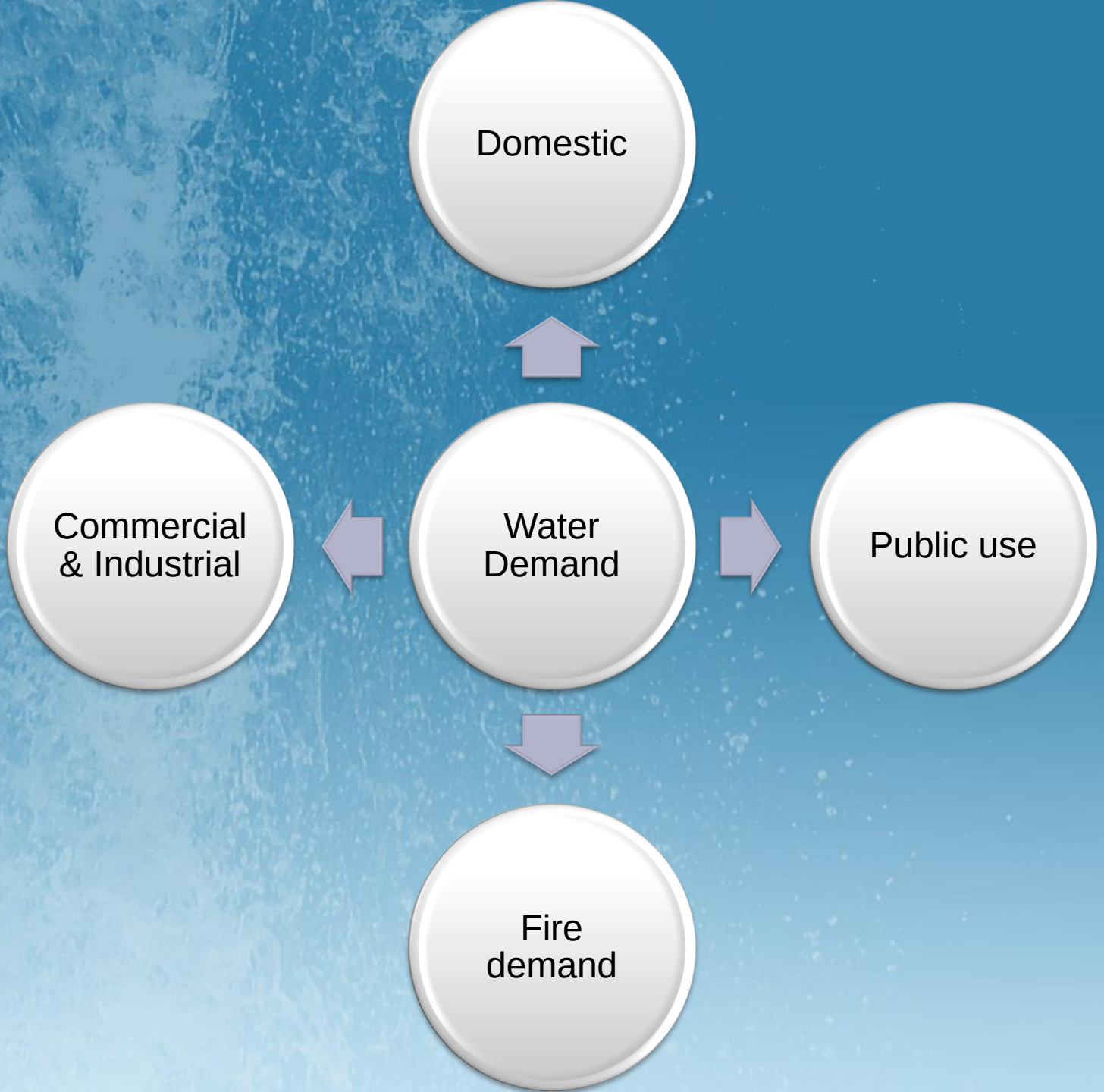


CHAPTER 4
WASTEWATER QUANTITY

WATER CONSUMPTION RATE

City (> 10 000 persons)	Suburban	Heavy Industries	Light Industries
• 230 – 320 litre/person/day	• 130 – 230 litre/person/day	• 45 000 litre/ha/day	• 22 000 litre/ha/day


Domestic
Commercial & Industrial
Water Demand
Public use
Fire demand

Demand…..

Wastewater production…..

Wastewater quantity varies hourly, daily and weekly.

Peak flow occurs at maximum flow for the day.

DEFINITIONS

Sewage	Sewer	Sewage Treatment Plant (STP)	Sewerage system
• any liquid discharge normally from domestic sources	• any line of pipes or channels used to convey sewage and effluents	• a site designed to treat sewage	• a system incorporating sewers intended for the collection, transportation, pumping, treatment and disposal of sewage

POPULATION EQUIVALENT (PE)

- The equivalent, in terms of fixed population of a varying or transient population or other activity eg. industrial or commercial contributing flow to the sewerage system.
- PE depends on type of premise and activity


5
PE per UNIT

3 PE

per 100 m^2
of
FLOOR
AREA

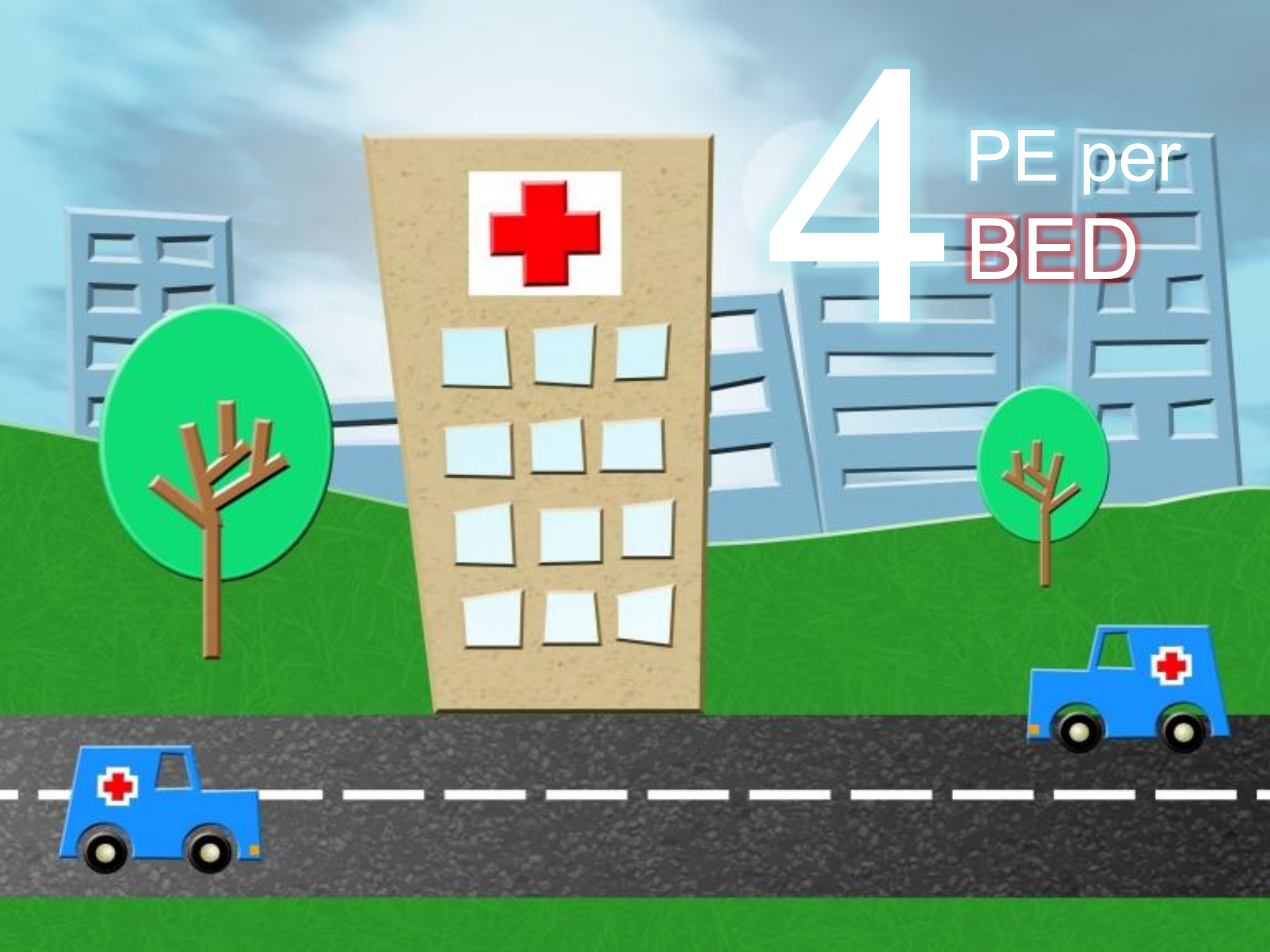
0.2

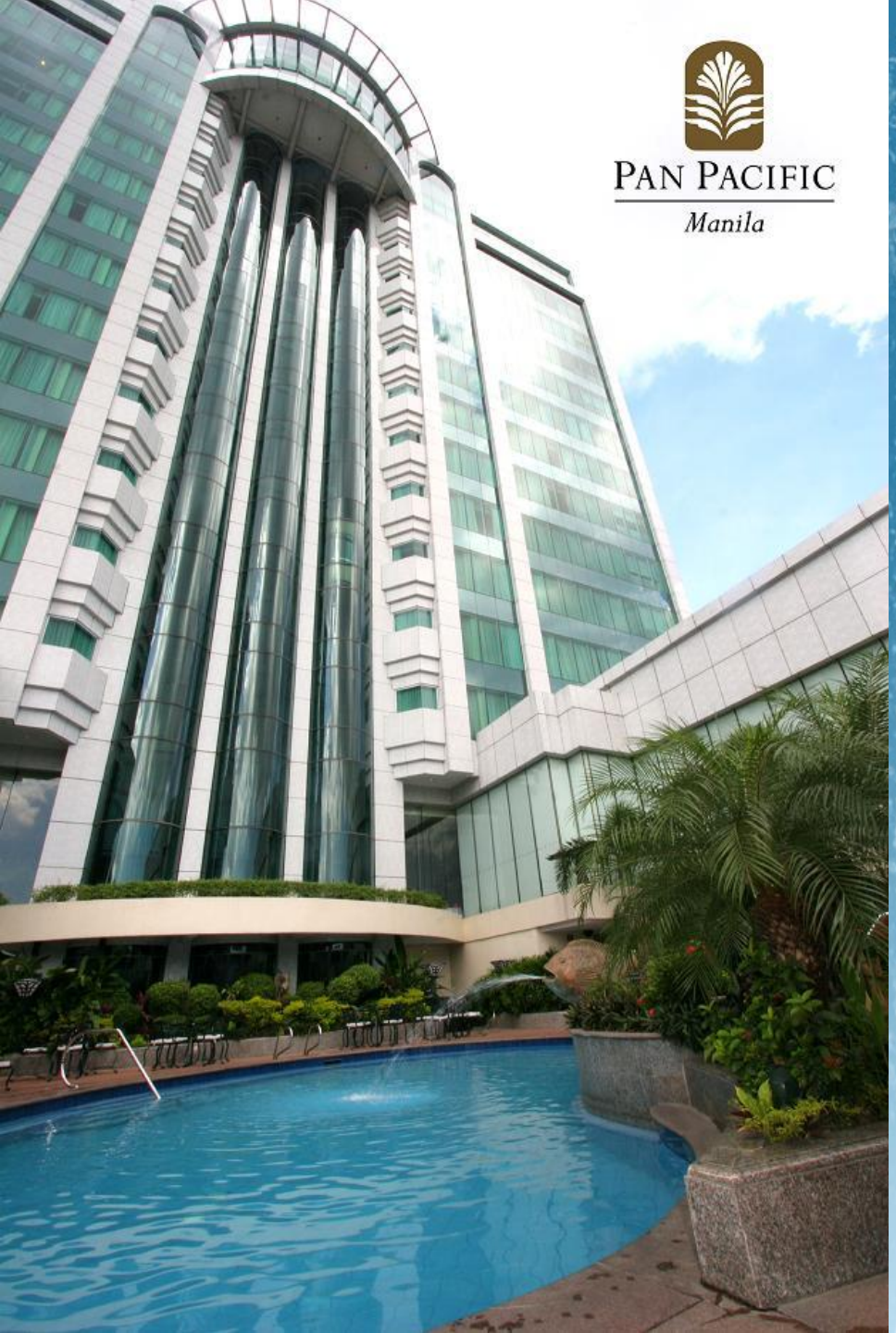
PE per STUDENT

Day school

1 PE per STUDENT

Residential school


4
PE per
BED



4 PE
per ROOM


0.3
PE per
STAFF


0.5
PE per
PERSON

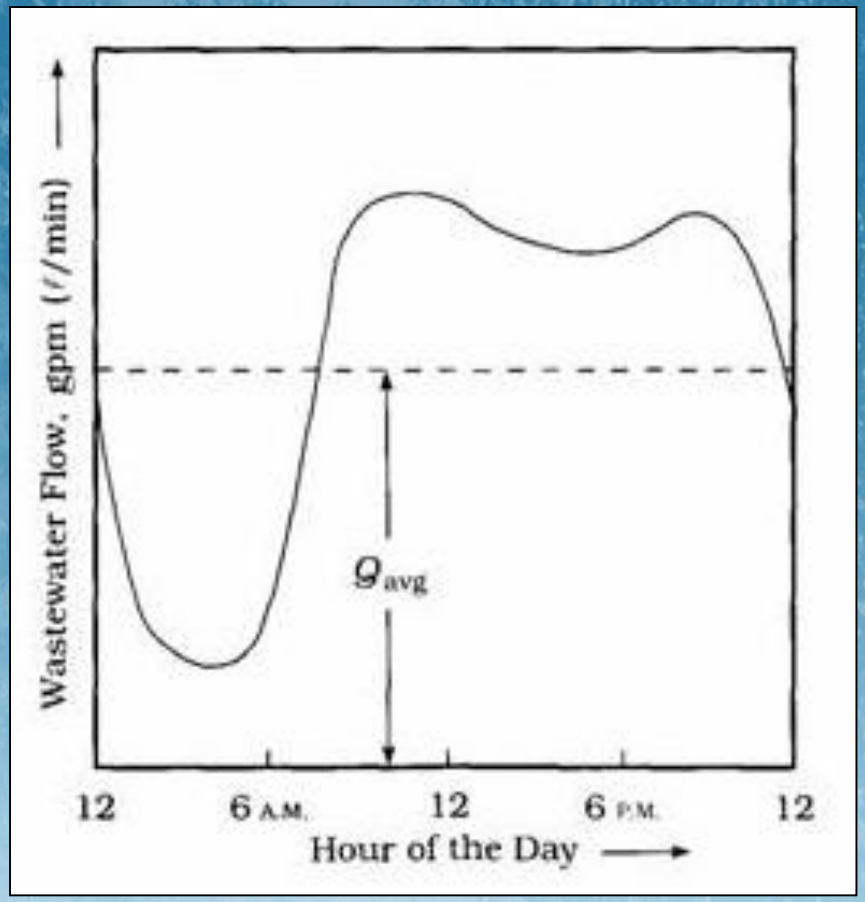
0.2 PE

per PERSON

Type of Establishment/Premise	Population Equivalent (PE)
Residential	5 per house
Commercial	3 per 100m^2 area
Educational Institutions - Day Schools - Residential Schools	 0.2 per student 1 per student (residential)
Hospitals	4 per bed
Hotels	4 per room
Factories	0.3 per employee
Market (Wet Type)	3 per stall
Market (Dry Type)	1 per stall
Petrol Stations	18 per service bay
Bus Terminal	4 per bus bay
Taxi Terminal	4 per taxi bay
Mosque	0.5 per person

Type of Establishment/Premise	Population Equivalent (PE)
Church or Temple	0.2 per person
Stadium	0.2 per person
Swimming Pool or Sports Complex	0.5 per person
Public Toilet	16 per WC (water closet)
Airport	0.2 per passenger/day
Airport	0.3 per employee
Laundry	10 per machine
Prison	1 per person
Golf Course	20 per hole

FLOW RATE (L/min)



- Varies hourly, daily and weekly
- Peak flow occurs at maximum flow for the day

Design flow rate

225

Litres/capita/day (lpcd)

Average daily flow = Design flow rate x PE

Peak Flow Factor (PFF) = $4.7\ p^{-0.11}$

[where p is population equivalent (PE) in thousand]

Peak Flow = PFF x average daily flow

EXAMPLE

A new residential area consists of the following premises:

Premise	Unit / Area
Residential house	3200 units
Commercial building	10000 m^2
Primary school	800 students
Private hospital	120 beds

Calculate the average daily flow of sewage and the peak flow rate from the residential area.

SOLUTION

Determine the total PE:

Premise	Unit / Area	PE
Residential house	3200 units	3200 x 5 = 16000
Commercial building	10 000 m^2	10000 x 0.03 = 300
Primary school	800 students	800 x 0.2 = 160
Private hospital	120 beds	120 x 4 = 480
		Total PE = 16940

Average daily flow = 16940 x 225 lpcd

= 3811.5 m^3/day

Peak Flow Factor = $4.7\ (16.940)^{-0.11}$

= 4.7 x 0.733

= 3.445

Peak flow rate = 3.445 x 3811.5 m^3/day

= 13131 m^3/day