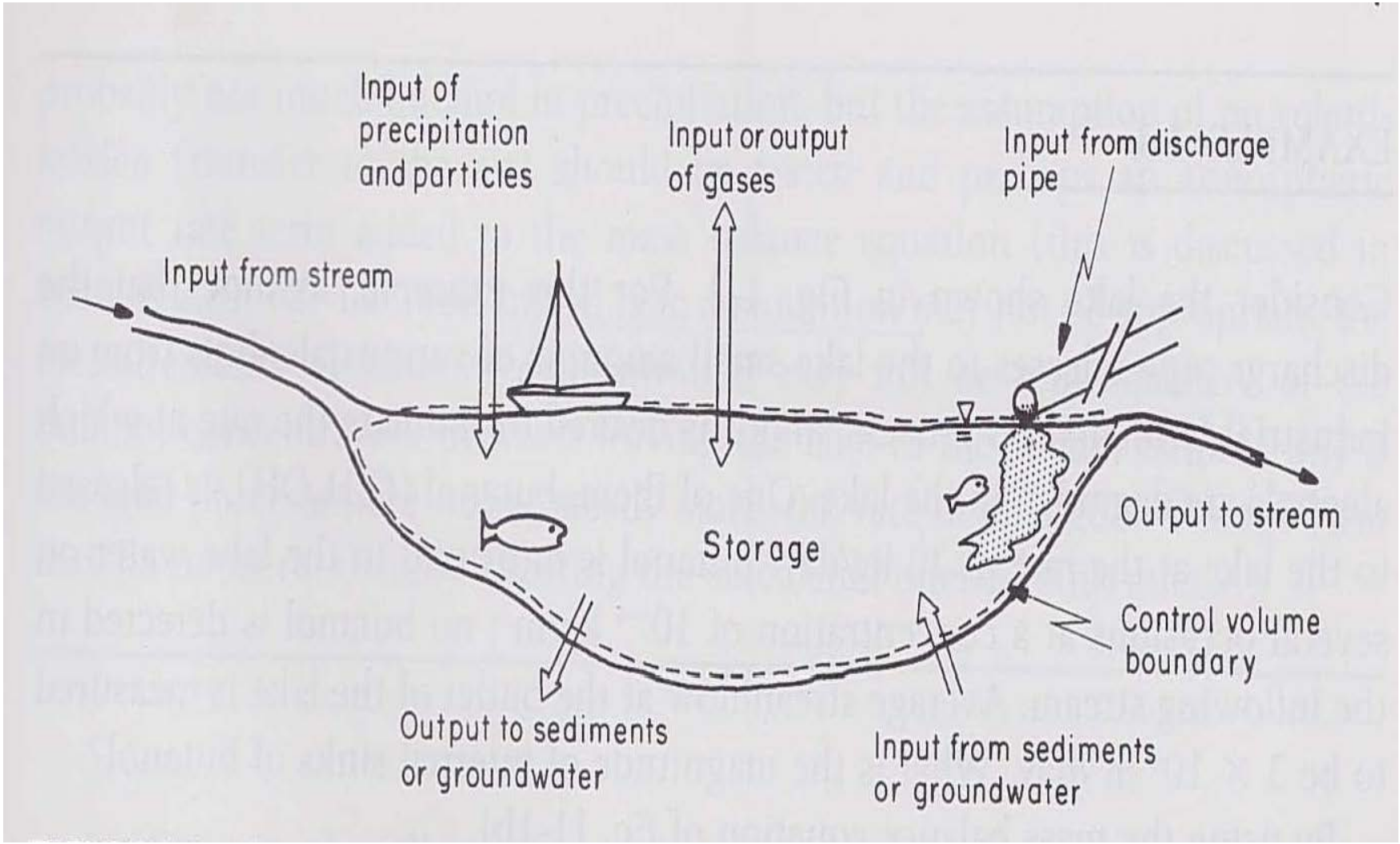
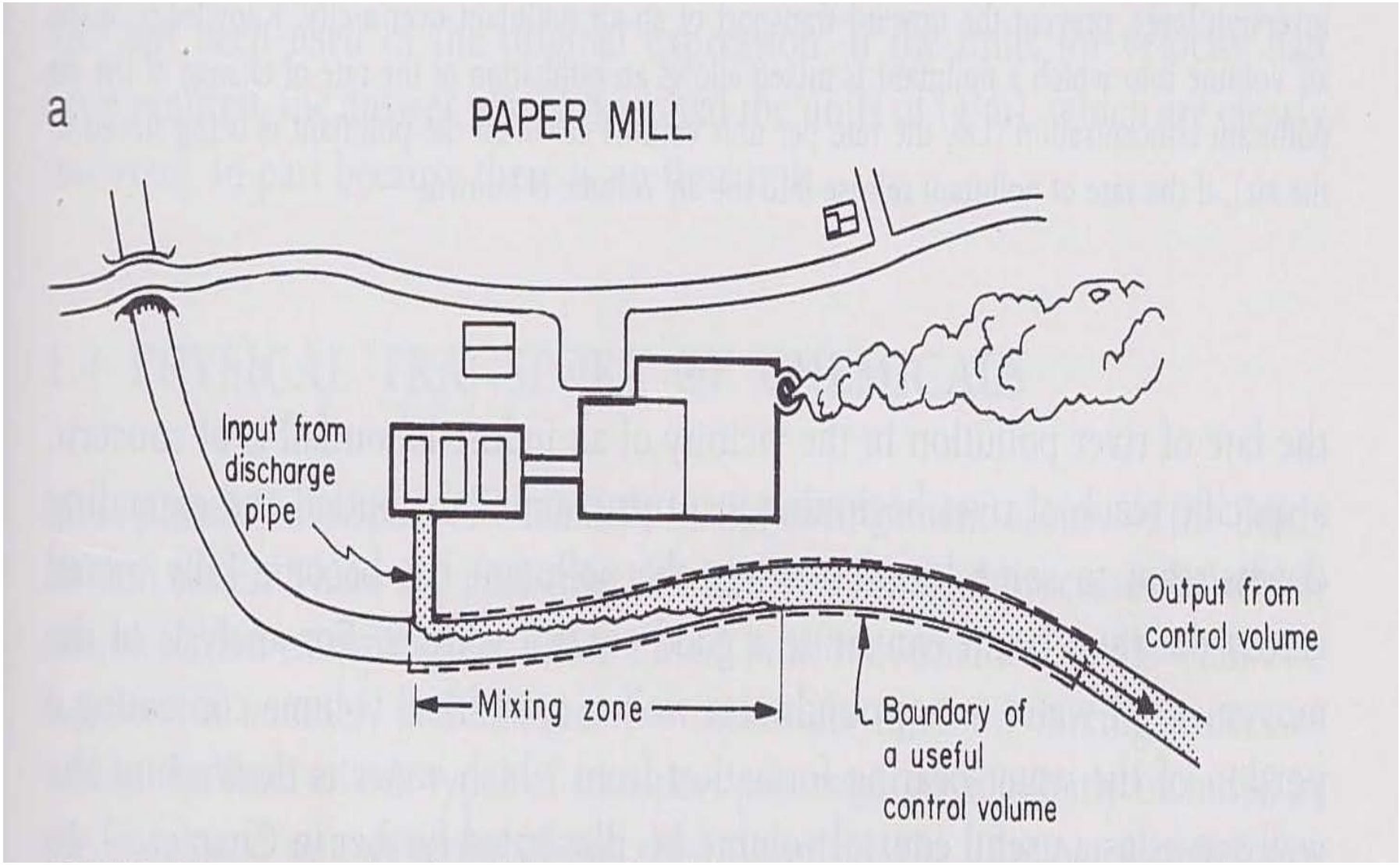
Control Volume for a Lake



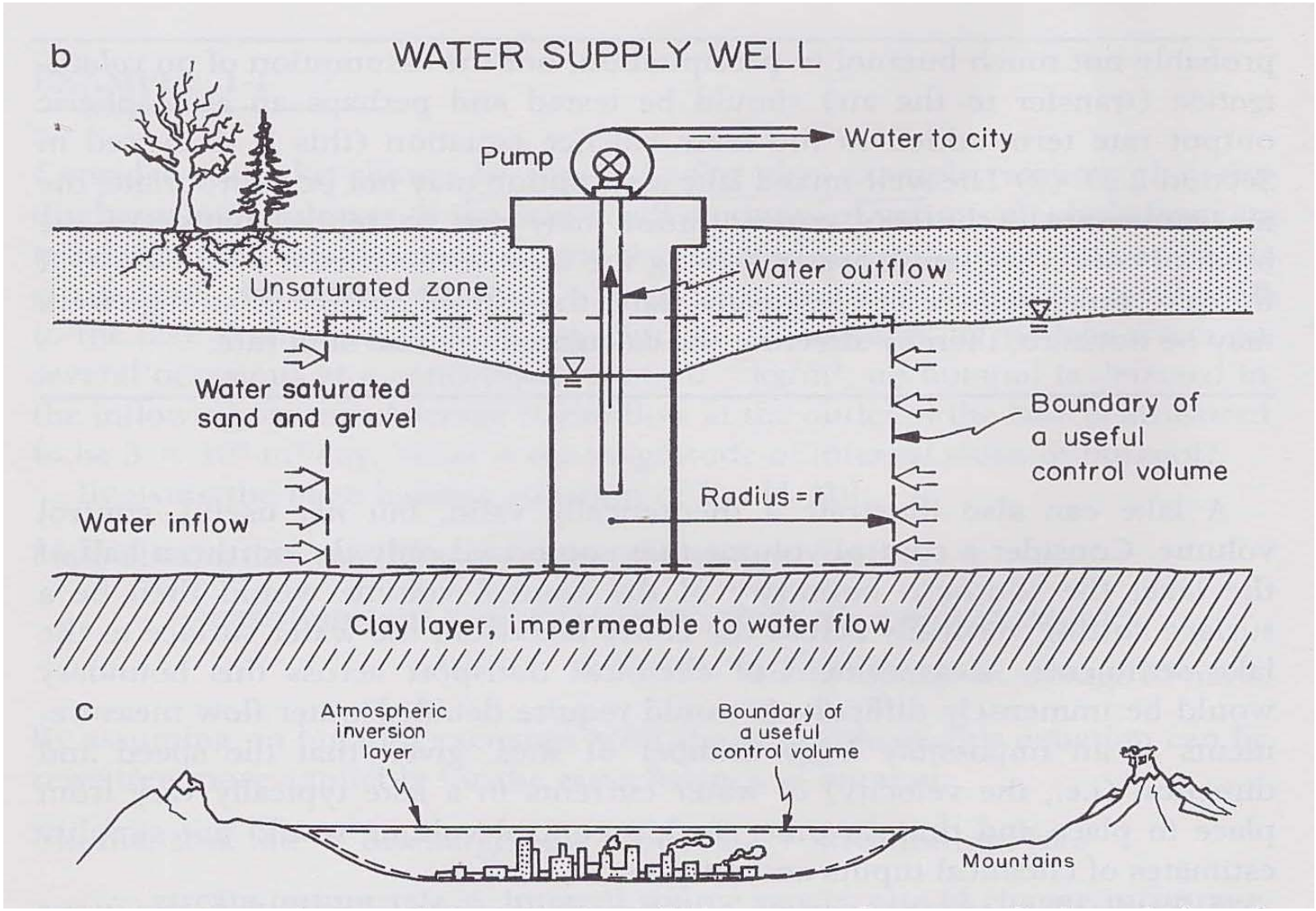
Source: *Chemical Fate and Transport in the Environment*, 2nd Ed., Hemond, H.F. and Fechner-Levy, E.J. (2000).

Choosing Useful Control Volume…1



Source: *Chemical Fate and Transport in the Environment*, 2nd Ed., Hemond, H.F. and Fechner-Levy, E.J. (2000).

Choosing Useful Control Volume…2



Source: *Chemical Fate and Transport in the Environment*, 2nd Ed., Hemond, H.F. and Fechner-Levy, E.J. (2000).

Class Problem

On a piece of paper provided to you, please answer the following question. Write your name and roll number before submitting the sheet today.

- A stream flowing at 10 m^3/s has a tributary feeding into it with a flow of 5 m^3/s. The stream's concentration of chloride upstream of the junction is 20.0 mg/L, and the tributary chloride concentration is 40.0 mg/L.

  Treating chloride as a conservative substance and assuming complete mixing of the two streams, find the downstream chloride concentration.

Contaminant vs Pollutant

Contaminants: Impurities in fresh water, either dissolved or suspended

- Naturally available fresh water is always impure, i.e., it contains contaminants.
- Presence of contaminants is not harmful to the health of human beings and other organisms.

Pollutants: Contaminants present at concentrations high enough to adversely impact health of human beings and other organisms

Types of Contaminants in Fresh Water

1. Dissolved / particulate
2. Organic / inorganic

Factors Determining Concentration of Contaminants

1. Loading

   How much of the contaminant is added to water

2. Physical, Chemical and Biological Transformation

   Reactions in water leading to formation/destruction of contaminants

3. Physical Transport, i.e., Mass Transport

   How the contaminant is spread in the water

4. Mass Transfer

   Transfer of contaminant from water to soil and air

Processes Undergone by Contaminants in Water

1. **Biological / chemical processes involving dissolved contaminants**

Acid-Base Reaction	**organic / inorganic**
Complexation Reaction	**organic / inorganic**
Precipitation Reaction	**inorganic**
Oxidation-Reduction	**organic / inorganic**
Hydrolysis	mostly organic (will be briefly discussed)
Photolysis	mostly organic (will be briefly discussed)
Biodegradation	mostly organic (will not be discussed)

2. **Physical processes involving particulate contaminants**
   - **Sedimentation**
   - **Coagulation / flocculation**
   - **Filtration**

3. **Mass transport of dissolved / particulate contaminants**
   - **Advection**
   - **Diffusion / Dispersion**

4. **Mass transfer of dissolved contaminants**

Solid-liquid mass transfer	**adsorption / desorption**
Gas-liquid mass transfer	**absorption / stripping**