Sewage

Introduction to Sewage

Sewage refers to wastewater generated from homes, industries, agricultural fields, and various human activities. It also includes rainwater that runs off streets during storms or heavy rainfall. Essentially, sewage is liquid waste, with a significant portion containing dissolved and suspended impurities known as contaminants.

Why Sewage Treatment is Important

- Prevents pollution of natural water bodies.
- Stops the spread of waterborne diseases like cholera and typhoid.
- Protects aquatic ecosystems from harmful pollutants.
- Allows for the reuse of treated water, conserving water resources.

Historical Background of Sewage Systems

3000 BCE: The Indus Valley Civilization (Mohenjo-Daro and Harappa) had advanced covered drains and centralized sewage systems.

Ancient Babylonian and Mesopotamian Civilizations: Developed rudimentary drainage systems for wastewater management.

19th Century London: Joseph Bazalgette designed an extensive underground sewer system to address the "Great Stink" of 1858.

2005 — 2015: The United Nations declared the International Decade for Action on Water for Life to reduce the number of people without access to clean drinking water.

Composition of Sewage

Sewage consists of various components categorized into organic impurities, inorganic impurities, nutrients, and microorganisms.

i. Organic Impurities

Animal Waste: Manure and urine, often from agricultural areas, can carry harmful microorganisms.

Oil and Grease: From industrial facilities, road runoff, and household kitchens, negatively affecting water quality.

Fruit and Vegetable Waste: Decomposes in water, increasing its Biological Oxygen Demand (BOD) and harming aquatic life.

Pesticides and Herbicides: Agricultural chemicals that contaminate water, disrupt ecosystems, and accumulate in the food chain.

ii. Inorganic Impurities

Phosphates: Found in detergents and fertilizers, causing excessive algae growth and oxygen depletion in water bodies.

Nitrates: Runoff from agriculture, can contaminate drinking water and cause health risks like "blue baby syndrome."

Heavy Metals: Lead, mercury, and cadmium from industrial waste can accumulate in organisms, leading to toxicity.

iii. Nutrients

Nitrogen and Phosphorus: Essential for plants but harmful in excess as they cause eutrophication in water bodies.

iv. Microorganisms

Bacteria: Some are harmful, causing diseases like cholera and typhoid.

Protozoa: Microorganisms such as those causing dysentery, contributing to the spread of infections.

The Sewage System

A well-structured sewage system is essential for efficient wastewater management. It comprises interconnected components transporting wastewater from its sources to treatment facilities.

i. How Sewage is Transported

- Wastewater from toilets, sinks, and washing machines flows through household drains.
- These drains connect to larger sewer mains, covered by manhole covers for maintenance.
- Sewer mains carry the wastewater to wastewater treatment plants (WWTPs).

ii. Location and Flow Design

- Wastewater treatment plants are built in low-lying areas to use gravity for efficient sewage transport.
- Sewer mains are strategically placed along natural streambeds to improve flow efficiency.

Sewage Treatment Process

Once sewage reaches a treatment plant, it undergoes several purification stages to remove contaminants before being discharged into natural water bodies.

i. Primary Treatment

- Large debris, sand, and grit are removed using screens and grit chambers.
- Settling tanks allow heavier solids to settle, forming sludge.

ii. Secondary Treatment

- Biological treatment using bacteria to break down organic matter.
- Aeration tanks supply oxygen to encourage microbial activity.
- Secondary settling tanks remove the biological mass formed.

iii. Tertiary Treatment

- Advanced filtration and chemical treatment to remove residual impurities.
- Disinfection using chlorine or UV radiation before releasing treated water into water bodies.

Infrastructure of Sewage Systems

Modern sewage systems include various components working together for effective wastewater management.

i. Household Drains

- Collect wastewater from individual homes and buildings.
- Act as the starting point of the sewage system.

ii. Sewers

- Underground pipelines transport wastewater to treatment plants.
- Can range from small household pipes to large tunnels carrying massive volumes.

iii. Pumping Stations

- Used in low-lying areas to pump wastewater to higher elevations.
- Ensure continuous flow to treatment facilities.

iv. Manholes

- Vertical openings in roads or pavements providing access to underground sewers.
- Installed at regular intervals (50-60 meters) for maintenance and cleaning purposes.