

# Introduction to Infrastructural Engineering

## Waste Water

by

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# Waste Water

## Sewage

- Liquid waste from toilets, baths and showers, kitchens, that is disposed via sewers, trucking, or on site treatment systems

## Industrial Waste Water

- Waste water from industries of mines. Generally involves some on site processing



# Treatment Stages

- **Primary**: Mechanical treatment to reduce coarse solids, sand and dirt, oils and grease

Note: Ideal as pre-treatment or for treating “surface” water (e.g. street water)

Note: Involves screening, sedimentation, skimming



# Treatment Stages

- **Secondary**: Treatments designed to degrade biological content of sewage (e.g. human waste, food waste) through aerobic biological processes

Note: Require aeration for bacterial and protozoan activities to degrade organic compounds

Note: Effluent water and sludge are by-products



# Treatment Stages

- **Tertiary**: Advanced stages of treatment to raise the effluent quality to the standard required before it is discharged to the receiving environment

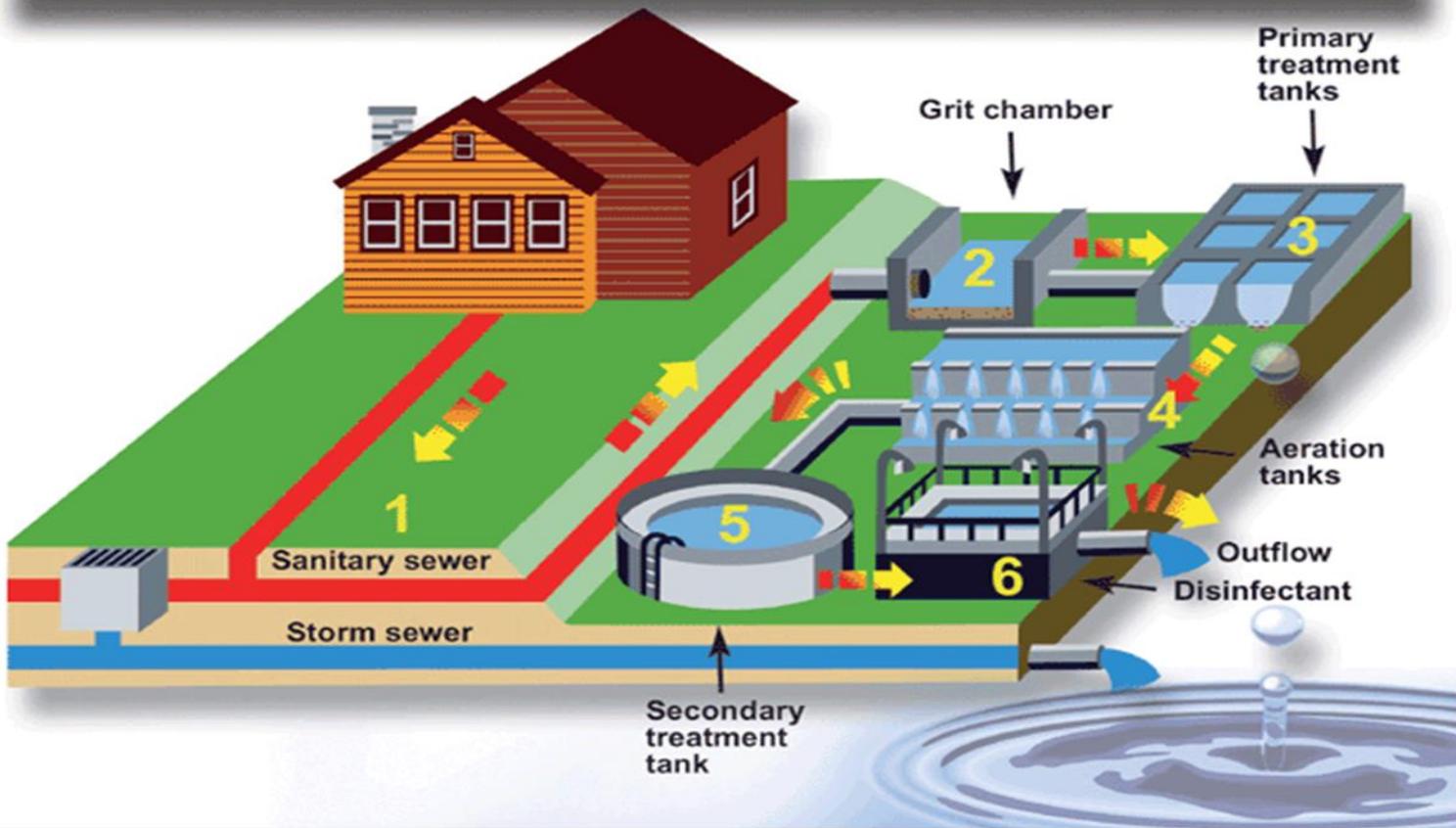
Potential steps: Filtration, polishing, ponding (lagoons, wetlands), nutrient removal, disinfection.

Note: Industrial contaminants remain an issue.



# Treatment Process example

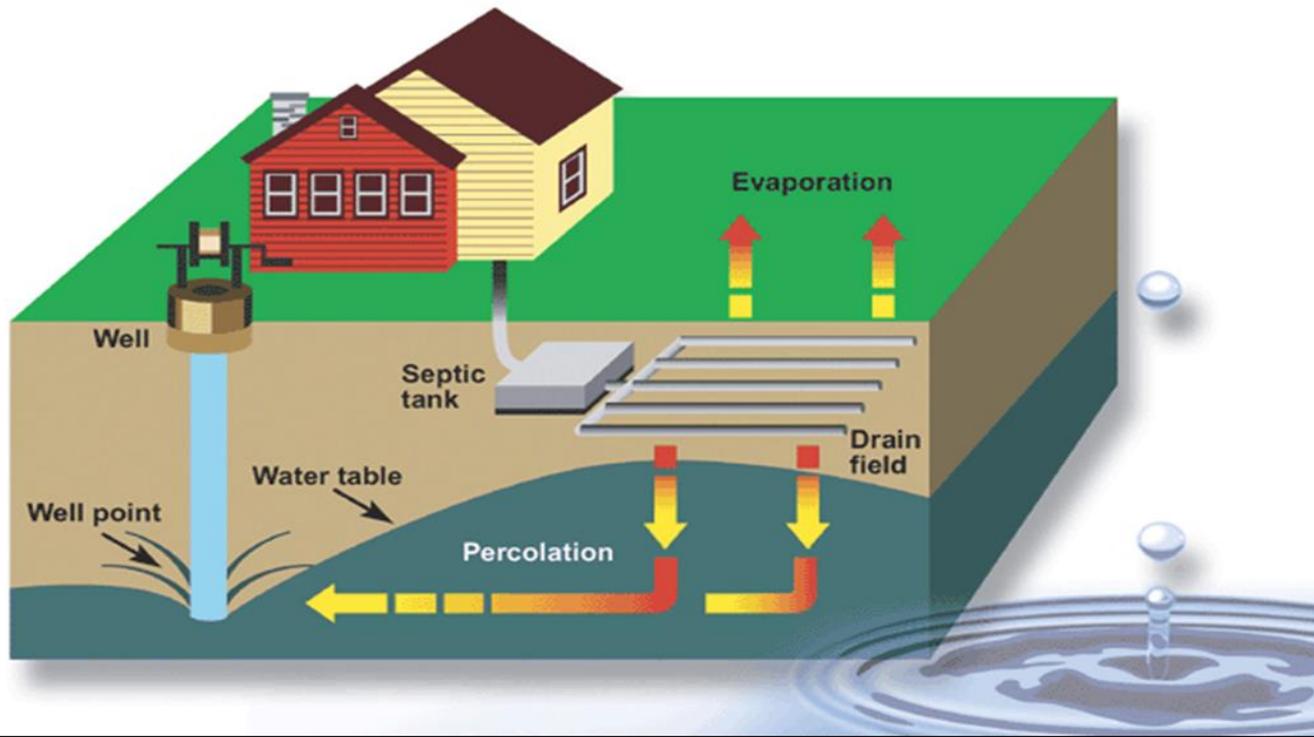
## Typical sewage treatment process in Canadian municipalities



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# Primary Sewage Treatment

Septic effluent percolates to the water table



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# Common Options for Secondary Sewage Treatment

Treatment Process	Description	Key Features
<b>Activated Sludge Process (ASP)</b>	Oxygen is mechanically supplied to bacteria which feed on organic material and provide treatment	Sophisticated process – many mechanical & electrical parts, needs careful control of operator; provides high degree of treatment.
<b>Aerated lagoons</b>	Like lagoons but with mechanical aeration	Not very common; oxygen requirement mostly from aeration and hence more complicated and higher operational and maintenance costs.
<b>Land Treatment (soil –aquifer treatment – SAT)</b>	Sewage is supplied in controlled conditions to the soil	Soil matrix has quite a high capacity for treatment of normal domestic sewage, as long as capacity is not exceeded. Some pollutants, such as P, are not easily removed.



# Anaerobic Digestion

Anaerobic digestion (AD) is a suitable and efficient technology for organic materials management, and it is also predicted to play a vital role in the future of renewable energy production. However, AD is a very complicated and sensitive process involving numerous microorganisms with ultimate operational environmental conditions.



## Anaerobic (Cont)

The type and structure of substrates also affect the efficiency of biogas production. The organic materials are mainly composite of carbohydrates, proteins, lipids which can be degraded to simpler compounds by microorganisms in an oxygen-free environment with the following process stages: hydrolysis stage, acidogenesis stage, acetogenesis stage and methanogenesis stage.



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