# HIGHER TECHNICAL INSTITUTE
# CIVIL ENGINEERING DEPARTMENT
# NICOSIA-CYPRUS

**DIPLOMA PROJECT**

**DESIGN OF A WASTEWATER TREATMENT UNIT**
**C/968**

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# 1.0 Introduction

## 1.1 Historical overview wastewater treatment

With the need to protect the humanity and furthermore the environment and also the demand by the people for better quality of life, the construction and efficient operation of wastewater treatment plants has received more attention in recent years than ever before.

The Industrial Revolution of the last century resulted in rapid increased in urban populations throughout Europe and North America. Traditional methods of human waste disposal involving land spreading and the use of watercourses resulted in soon became necessary to develop intensive treatment processes to ensure the safe disposal of waterborne wastes.

In recent years a large number of processes and variation on existing ones, have been proposed to improve wastewater and sludge treatment. The application of chemical engineering techniques within the water industry has led to the rapid intensification and optimization of treatment processes.

## 1.2 Hydrological Considerations

The total mass of water associated with our planet is fixed and exists in various phases and locations, collectively referred to as the hydrological or water cycle. The world's supply of fresh water is extremely limited and results almost entirely from precipitation due to the evaporation of seawater. The major stages of the water cycle are as follows: precipitation, percolation, runoff, and evaporation.

The water, which falls to earth as precipitation, falls directly on water surfaces and is returned directly to the atmosphere by evaporation. Of the minor fraction, which falls onto landmasses, part is lost to the atmosphere by evaporation and transpiration from vegetation, part flows overland to receiving waters as surface runoff, and part enters the soil. The rainwater infiltrating the soil flows downward under the influence of gravity until it reaches the groundwater table to join the subterranean reservoir within the earth's crust. Most of the groundwater is eventually discharge at the ground surface through springs and outcrops, or it passes at or below the water level into streams and standing bodies of water. Ultimately, all the fresh water is discharged to the ocean where it is contaminated with salt and can no longer be used for most purposes.

## 1.3 Wastewater engineering

Wastewater engineering is that branch of engineering in which the basic principles of science and engineering are applied to the problems of water pollution control.

Practicing wastewater engineers are involved in the conception planning, evaluation, design, construction, and operation and maintenance of the systems that are needed to meet wastewater management objectives.

## 1.4 Domestic Wastewater

Domestic wastewater is the water that is spent from all aspects of water usage in houses and any other small-scale residential areas. For example it is the water flowing, after being used, from the bathroom, the kitchen, the laboratories, sinks, garbage-grinders, dishwashers or washing machines.

The principal sources of domestic wastewater in a commonly are the residential areas and commercial districts. Other important sources include institutional and recreational facilities.

For many residential areas, wastewater flow rates are commonly determined on the basis of population density and the average per capita contribution of wastewater. In addition, the fluctuations normally experienced on an hourly, daily and monthly basis must be taken into account in any consideration of domestic wastewater characteristics. These factors are most significant for the designer faced with the problem of establishing a design basis for collection and treatment facilities. The domestic wastewater composition depends on the quantities of physical, chemical and biological constituents that are present.

## 1.5 Wastewater treatment

Wastewater collected from communities must be returned to receiving water or to the land. Contaminants in wastewater must be removed to protect the environment.

In the late 1800 and early 1900 the systematic treatment of wastewater was started.

Methods of treatment in which the application of physical forces predominates are known as unit operations. Methods of treatment in which the removal of contaminants is brought about by chemical or biological reactions are know as unit processes.

Unit operations and process are grouped together to provide what is know as primary, secondary and tertiary treatment. In primary treatment, physical operation such as screening and sedimentation are used to remove the floating and settle able solids found in wastewater. In secondary treatment biological and chemical process are used to remove most of the organic matter. Finally in tertiary treatment, additional combinations of unit operations and process are used to remove other constituents, such as nitrogen and phosphorus.

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