# HIGHER TECHNICAL INSTITUDE CIVIL ENGINEERING DEPARTMENT

# **DIPLOMA PROJECT**

# WASTEWATER TREATMENT AND REUSE

BY:
HADJIAGAPIOY MARIOS

**JUNE 2004** 

HIGHER TECHNICAL INSTITUTE PROJECT NO

# INTRODUCTION

For the last quarter century, a repeated thesis has been that the treatment of municipal and industrial wastewater provides a water of such quality that it should not be wasted but put to beneficial use. This conviction, coupled with the increasing frequency of water shortages and the high costs of water development and environment protection, has provided an impetus for considering wastewater reclamation, recycling and reuse in many parts of the world. A few examples of the nonpotable water reuse applications are agricultural and landscape irrigation, industrial cooling, toilet flushing in large office buildings, groundwater recharge and water for aesthetics and environmental purposes.

Today, technically proven wastewater treatment or water purification processes exist to provide water of almost any quality desired. Wastewater reclamation and reuse have a rightful place in the integrated management of water resources and play an important role in optimal planning and more efficient management and use of water resources, now and in the future.

## **TABLE OF CONTENTS**

## INTRODUCTION

## **CHAPTER 1**

## **WASTEWATER CHARACTERISTICS**

1	1	WASTE	NΔ	TER
- 4	7 B			/ I I I I I I I I I I I I I I I I I I I

- 1.2 WASTEWATER CHARACTERISTICS
- 1.3 PHYSICAL CHARACTERISTICS
- 1.3.1 TASTE AND ODOR
- 1.3.2 TEMPERATURE
- 1.3.3 TURBIDITY
- 1.3.4 COLOR
- 1.3.5 SUSPENDED SOLIDS

## 1.4 CHEMICAL CHARACTERISTICS

- 1.4.1 T.D.S
- 1.4.2 ALKALINITY
- 1.4.3 HARDNESS
- 1.4.4 FLUORIDE
- 1.4.5 METALS
- 1.4.6 ORGANICS
- 1.4.7 NUTRIENTS

## 1.5 BIOLOGICAL CHARACTERISTICS

- 1.5.1 PATHOGENS
- 1.5.2 PATHOGEN INDICATORS

# **CHAPTER 2**

## **WASTEWATER TREATMENT**

# 2.1 WASTEWATER TREATMENT TECHNOLOGY

- 2.2 PRIMARY TREATMENT
- 2.2.1 SCREENING
- 2.2.2 COMMINUTING
- 2.2.3 GRIT REMOVAL
- 2.2.4 FLOW MEASUREMENT
- 2.2.5 PRIMARY SEDIMENTATION

#### **2.3 SECONDARY TREATMENT**

- 2.3.1 GROWTH AND FOOD UTILIZATION
- 2.3.2 SUSPENDED-CULTURE SYSTEMS
- 2.3.3 ACTIVATED SLUDGE
- 2.3.4 PONDS AND LAGOONS
- 2.3.5 ATTACHED-CULTURE SYSTEMS
- 2.3.6 SECONDARY CLARIFICATION
- 2.3.7 DISINFECTION OF EFFLUENTS
- 2.3.8 SLUDGE THICKENING
- 2.3.9 ANAEROBIC SLUDGE DIGESTION
- 2.3.10 AEROBIC SLUDGE DIGESTION
- 2.3.11 SLUDGE DISPOSAL

#### 2.4 TERTIARY TREATMENT

2.4.1 NUTRIENT REMOVAL

## **CHAPTER 3**

# **WASTEWATER REUSE**

- 3.1 INTRODUCTION
- **3.2 WASTEWATER REUSE TERMINOLOGY**
- 3.3 WASTEWATER REUSE APPLICATIONS
- 3.3.1 OVERLAND-FLOW
- 3.3.2 IRRIGATION
- 3.3.3 HIGH-RATE IRRIGATION
- 3.3.4 INFILTRATION PERCOLATION

## **CHAPTER 4**

# **WASTE STABILIZATION PONDS**

- **4.1 INTRODUCTION**
- **4.2 TYPES OF PONDS**
- 4.2.1 ANAEROBIC PONDS
- **4.2.2 FACULTATIVE PONDS**
- **4.2.3 MATURATION PONDS**
- **4.3 ADVANTAGES-DISADVANTAGES**

# **CHAPTER 5**

# **GENERAL INFORMATION**

- **5.1 WASTEWATER TREATMENT PLANTS**
- **5.2 ANTHOUPOLIS WWTP**
- **5.3 DESCRIPTION OF THE PLANT**
- 5.4 DISPOSAL

## **CHAPTER 6**

# **CUMULATIVE DATA (ANTHOUPOLIS WWTP)**

- **6.1 CHARACTERIZATION OF THE ANTHOUPOLIS WWTP**
- **6.2 CONCLUSIONS CONCERNING ANTHOUPOLIS WWTP**

## **CONCLUSIONS**