Handbook of Wastewater Collection and Treatment:

principles and practice

Garland water management series

By M. Anis Al-Layla, Shamim Ahmad, and E. Joe Middlebrooks

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PRINCIPLES AND PRACTICE

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Preface

Many books on wastewater collection and treatment have been written in the past twenty years, but none of these has effectively coordinated European, Middle Eastern, and United States practices. The material presented in this book is a compendium of the practices used throughout the world. The problems of developing nations are given consideration and many of the examples relate to actual problems in developing nations.

This book was written to serve as a guide for practicing engineers. All segments of the pollution control industry should find the volume useful. All principles and practices are illustrated with detailed solutions to practical problems. Adequate theory is presented so that the basic concepts are clear, but the major emphasis of the book is on the practical engineering aspects of wastewater collection and treatment.

An attempt has been made to incorporate drawings of the most common equipment in Europe and the United States that is employed in the wastewater field. Because of space limitations many desirable drawings have been omitted, but enough information is provided to allow one to initiate a search for manufacturers not specifically illustrated.

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Introduction

Water is used in homes, public places, commercial establishments, industries, and agriculture. During these multiple uses, water acquires impurities and microorganisms which impair its usefulness. Polluted and contaminated waters are referred to as wastewater, which may be hazardous, a source of nuisance, and aesthetically offensive. Therefore, provisions should be made to collect, transport, treat, and dispose of wastewaters in a safe and aesthetic manner.

Even today in many parts of the world the public is exposed to untreated wastewaters which flow in open gutters and cause unhygienic conditions. Wastewaters are frequently discharged untreated into water bodies serving as a source of culinary water (Figure 1–1). These wastewaters adversely affect the quality of water and cause problems to the communities downstream. Such practices must be controlled to improve sanitation and abate pollution.

Developed and highly industrialized countries of the world have faced the problems of pollution for many years, but the developing nations face a particularly acute situation because of the absence of or poor drainage and sewerage systems. With the population explosion, the concentration of population in urban areas, and the tempo of industrial and agricultural developments, the problems created by wastewater have been compounded. Therefore, suitable steps must be taken to solve these problems.

To protect the well-being of a municipality or community, solid waste disposal and air pollution control must be practiced in addition to the control of wastewaters. Solid waste encourages the breeding of flies, mosquitoes, other insects, and worms, causing a nuisance and health hazards. Air pollution contributes to respiratory diseases and is particularly hard on the elderly or infirm.

The following steps should be taken to maintain a safe, healthy, and aesthetically acceptable environment:

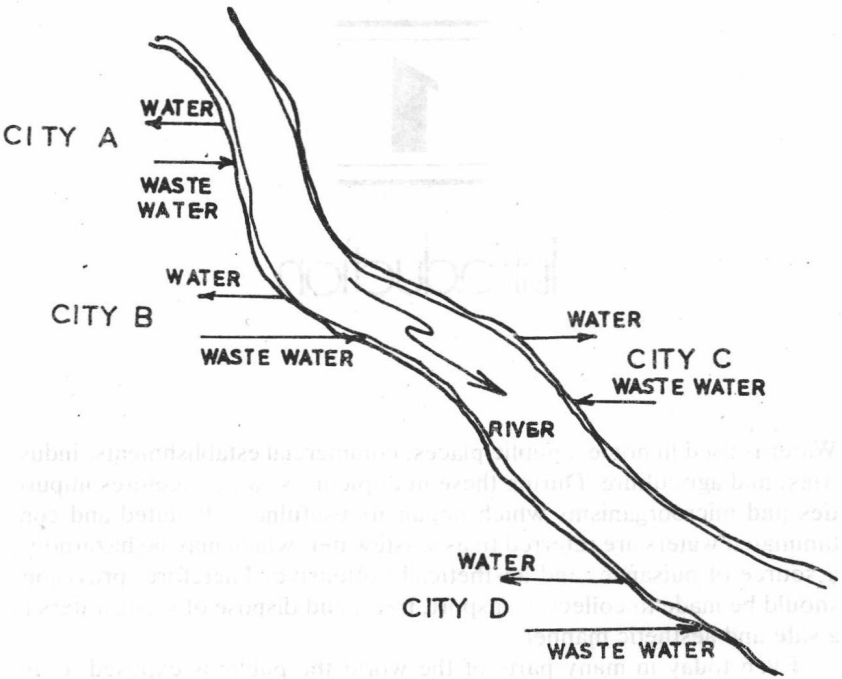

Figure 1–1 / River used as a source of water and a point of discharge for wastewater.

1. Install sewerage systems for the collection and transportation of wastewater for safe disposal to a body of water or application to the land.
2. Implement either partial or complete treatment of wastewater prior to disposal to protect the quality of surface and ground waters.
3. Collect, transport, and dispose of solid waste in a suitable manner.
4. Control industrial air pollution sources and require more efficient combustion and low emission of pollutants from automobiles.

The excuse generally given to explain why pollution abatement plans are not implemented is the shortage of funds; however, on a national basis pollution abatement actually saves money (Sebastian, 1972). It is known that the cost of water purification increases rapidly with the deterioration in the raw water quality (Figure 1–2; Gandenberger, 1956, p. 504). A high degree of wastewater treatment costs less than treating a poor quality raw water for culinary uses (Figure 1–3; Bohnke and Meyer, 1975, p. 173).

A substance is said to be polluted when it contains impurities in excess of the permissible limits. Pollution causes changes in the physical, chemi-