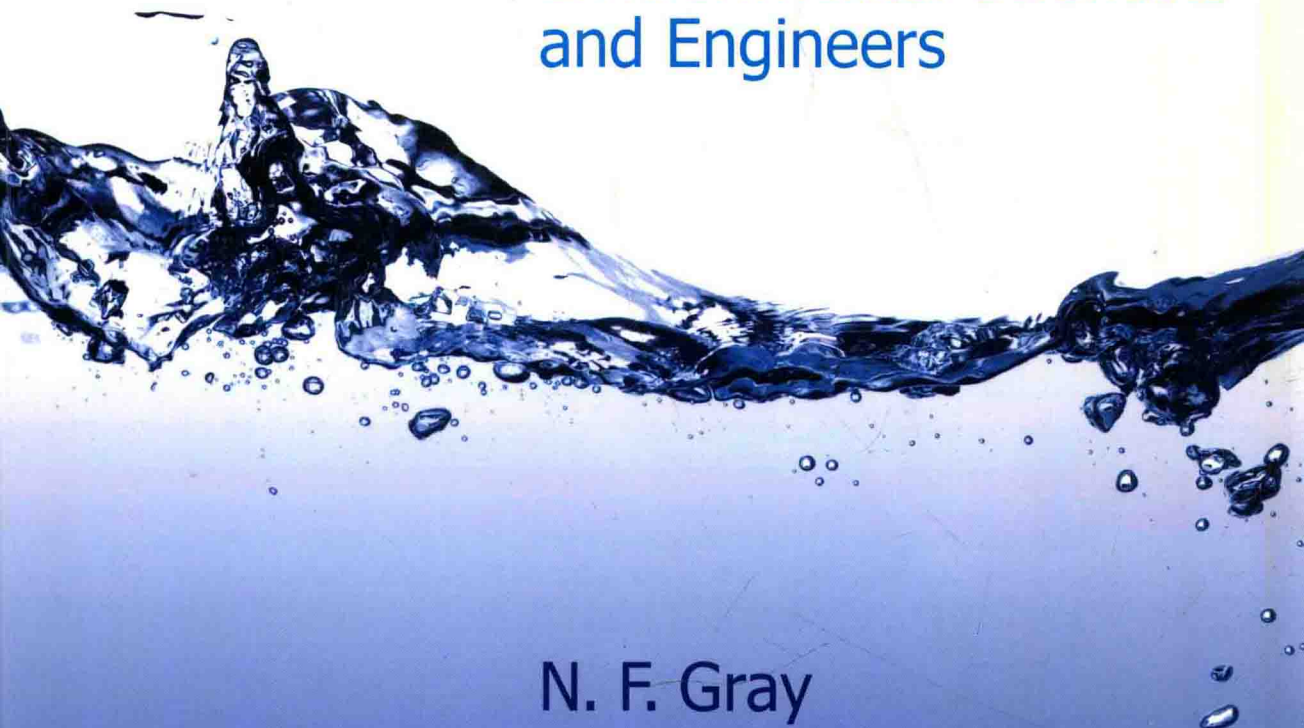


THIRD EDITION

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Publishing

# Water Technology

An Introduction for  
Environmental Scientists  
and Engineers



N. F. Gray

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# Water Technology

## An Introduction for Environmental Scientists and Engineers

Third Edition

N. F. Gray Ph.D., Sc.D.

Centre for the Environment, School of Natural Sciences,  
Trinity College, University of Dublin



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This book is dedicated to:

**Lucy, Catriona and Rebecca**

(My best friends)

**Pat Smythe**

International show jumper

(My hero)

**Ginger Rogers**

Actress and dancer

Who did everything Fred Astaire did, only backwards and on high heels

(A fellow sucker)

# Preface

Traditionally the water industry has relied on specialist engineers, biologists, chemists and microbiologists. However, with new and challenging legislation it has become increasingly necessary for such specialists to develop a broader understanding of the concepts of each other's disciplines. Environmental engineering and environmental science are new hybrids of civil engineering and science, respectively, which require a thorough knowledge of the physico-chemical and biological nature of the aquatic environment, in order to identify and assess impacts, as well as being able to select, design and operate the most appropriate technology to protect both the environment and the health of the general public. Water technology is a rapidly developing area that is truly interdisciplinary in nature.

The European Union has been developing and implementing legislation to protect the aquatic environment for over 30 years. The Water Framework Directive (2000/60/EC) is the final piece of that legislative jigsaw puzzle that puts in place the management structure to ensure that the water quality of lakes, rivers, groundwaters, estuaries, wetlands and coastal waters is protected, and enhanced through proper cooperation and management. The Directive makes this bold statement at the outset:

*Water is not a commercial product like any other but, rather, a heritage which must be protected, defended and treated as such.*

The Water Framework Directive is a powerful enabling piece of legislation that provides an integrated management base for water resource protection and management including water supply treatment and wastewater treatment. This new edition of *Water Technology* acknowledges the importance of this legislation and uses the concept of River Basin Management throughout. At the end of 2009 the first River Basin Management Plans were published with just five years to achieve the environmental objective of good quality status in all surface and groundwaters. The period 2010 to 2015 will be extremely challenging for water scientists and engineers with new innovation and technologies needed. It is going to be an exciting and rewarding time in which I hope you will be able to play a part.

It must be stressed that *Water Technology* is an introductory textbook that covers the areas of freshwater quality, pollution and management; the treatment, quality and distribution of drinking water; and the treatment and disposal of wastewater. Hydraulics has been largely excluded as it would simply make the text too large, although several excellent introductory and specialist books are recommended

in the text. However, where required in relation to water monitoring and process design, basic hydraulics have been included. The text is aimed at pure and applied scientists as well as civil and chemical engineers who require an interdisciplinary transitional text to the most important areas of water technology and science. The text, while easily accessible to all disciplines, is particularly designed for students interested in water science and technology who require a sound understanding of the basic concepts that make up this subject, providing the reader with a concise and self-explanatory course. The emphasis of the text is on practical application and the understanding of the processes involved. Special attention has been paid to those areas where an interdisciplinary approach will be advantageous. The text is supplemented by links given at the end of each chapter. These provide access to a wide range of governmental and NGO websites, including important reports and manuals. Links do change and so where these no longer can be accessed you can find the new link at the text website along with updates on critical areas, including case studies, more worked examples and self-assessment questions ([www.irelandswater.com](http://www.irelandswater.com)). This new edition has been fully updated and expanded with many new sections such as sustainable urban drainage systems and microbial source tracking. It also has a series of process selection algorithms to help you select the most appropriate unit processes for the treatment of wastewaters.

The Brundtland Report and, subsequently, Agenda 21 (the 1992 Rio Earth Summit) both identified sustainable development as a critical goal. However, while there appears to be broad agreement for the idea, we still have no consensus as to its precise meaning or its practical application. Environmental scientists, technologists and engineers are going to have to aggressively take hold of the concept of sustainability and develop it into a practical reality in order to comply with the demands of new carbon dioxide reduction targets agreed in Copenhagen. This can only be achieved by different disciplines working together with mutual respect. The ability of the engineer to understand the constraints and limitations imposed by the scientist and vice versa is the key to a safer and cleaner environment. Together almost anything is possible.

Nick Gray  
Trinity College, Dublin  
May 2010

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