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# DESIGN OF MUNICIPAL WASTEWATER TREATMENT PLANTS

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# DESIGN OF MUNICIPAL WASTEWATER TREATMENT PLANTS

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## WEF Manual of Practice No. 8 ASCE Manuals and Reports on Engineering Practice No. 76 Fifth Edition

*Prepared by the Design of Municipal Wastewater Treatment Plants  
Task Force of the Water Environment Federation and the American Society  
of Civil Engineers/Environmental and Water Resources Institute*

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### Design of Municipal Wastewater Treatment Plants

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**Technical Practice Committee**

2009

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February 1962 (and revised in April 1982) the Board of Direction voted to establish a series entitled “Manuals and Reports on Engineering Practice,” to include the Manuals published and authorized to date, future Manuals of Professional Practice, and Reports on Engineering Practice.

All such Manual or Report material of the Society would have been refereed in a manner approved by the Board Committee on Publications and would be bound, with applicable discussion, in books similar to past Manuals. Numbering would be consecutive and would be a continuation of present Manual numbers. In some cases of reports of joint committees, bypassing of Journal publications may be authorized.

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# Preface

This manual, updated from the 4th edition, continues its goal to be one of the principal references of contemporary practice for the design of municipal wastewater treatment plants (WWTPs). The manual was written for design professionals familiar with wastewater treatment concepts, the design process, and the regulatory basis of water pollution control. It is not intended to be a primer for the inexperienced or the generalist. The manual is intended to reflect current plant design practices of wastewater engineering professionals, augmented by performance information from operating facilities. The design approaches and practices presented in the manual reflect the experiences of more than 300 authors and reviewers from around the world.

This three-volume manual consists of 27 chapters, with each chapter focusing on a particular subject or treatment objective. The successful design of a municipal WWTP is based on consideration of each unit process and the upstream and downstream effects of that unit's place and performance in the overall scheme of the treatment works. The chapters that compose Volume 1 generally cover design concepts and principles that apply to the overall WWTP. Volume 2 contains those chapters that discuss liquid-train-treatment operations or processes. Volume 3 contains the chapters that deal with the management of solids generated during wastewater treatment.

In the 11 years since the publication of the 4th edition of this manual, key technical advances in wastewater treatment have included the following:

- Membrane bioreactors replaced conventional secondary treatment processes in a smaller footprint;
- Advancements within integrated fixed-film/activated sludge (IFAS) systems and moving-bed biological-reactors systems;
- Disinfection alternatives to chlorine;
- Biotrickling filtration for odor control;
- Increased use of ballasted flocculation;
- Sidestream nutrient removal to reduce the loading on the main nutrient-removal process; and
- Use and application of modeling wastewater treatment processes for the basis of design and evaluations of alternatives.

In response to these advancements, this edition includes some significant changes from the 4th edition. As with prior editions, technologies that are no longer

considered current industry practice have been deleted, such as vacuum filters for sludge dewatering. While not intended to be all-inclusive, the following list describes some of the other pertinent processes and newer processes or concepts:

- Concept of sustainability,
- Energy management,
- Odor control and air emissions,
- Chemically assisted/ballast flocculation clarification,
- Membrane bioreactors,
- IFAS processes,
- Enhanced nutrient-control systems,
- Sidestream treatment, and
- Approaches to minimizing biosolids production.

Additionally, the focus of the manual has been sharpened. Like earlier editions, this manual presents current design guidelines and practices of municipal wastewater engineering professionals. Design examples also are provided, in some instances, to show how the guidelines and practice can be applied. However, information on process fundamentals, case histories, operations, and other related topics is covered to a lesser extent than in the previous edition. Readers are referred to other publications for information on those topics.

This 5th edition of this manual was produced under the direction of Terry L. Krause, P.E., BCEE, *Chair*; Roderick D. Reardon, Jr., P.E., BCEE, *Volume 1 Leader*; Albert B. Pincince, Ph.D., P.E., BCEE, *Volume 2 Leader*; and Thomas W. Sigmund, P.E., *Volume 3 Leader*.

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## Preface

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